ITE

SID
SOCIETY FOR INFORMATION DISPLAY

IDW '07

THE 14TH INTERNATIONAL DISPLAY WORKSHOPS

Workshops on

- LC Science and Technologies
- Active Matrix Displays
- FPD Manufacturing, Materials and Components
- CRTs
- Plasma Displays
- EL Displays and Phosphors
- Field Emission Display
- Organic LED Displays
- 3D/Hyper-Realistic Displays and Systems
- Applied Vision and Human Factors
- Projection and Large-Area Displays, and Their Components
- Electronic Paper
- MEMS for Future Displays and Related Electron Devices
- Display Electronic Systems

Topical Session on

- Imaging and Photonic Devices

Final Program

Sapporo Convention Center
Sapporo, Japan
December 5(Wed) –7(Fri), 2007

CONTENTS

Workshop on FPD Manufacturing, Materials and Components

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Workshop on Plasma Displays

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Workshop on 3D/Hyper-Realistic Displays and Systems

Workshop on Applied Vision and Human Factors

Workshop on Projection and Large-Area Displays, and Their Components

Workshop on Electronic Paper

Workshop on MEMS for Future Displays and Related Electron Devices

Workshop on Display Electronic Systems

Topical Session on Imaging and Photonic Devices

EXHIBITION

13:00–17:00 Wednesday, Dec. 5
9:00–17:00 Thursday, Dec. 6
9:00–14:00 Friday, Dec. 7

Main Hall C
Sapporo Convention Center

Free admission with your registration name tag.

BANQUET

Wednesday, December 5
19:30–21:30
Palace Ballroom (3F)
Sheraton Sapporo Hotel

See page 10 for details

IDW Best Paper Award

This new award will go to the most outstanding paper selected from those presented at IDW '07. The 2007 award winners will be announced on the IDW web site:
http://www.idw.ne.jp/award.html

IDRC '08

November 3-6, 2008
Orlando, FL, U.S.A

PROGRAM HIGHLIGHTS

Scientific and technological advances in research and development on information displays will be found at the 14th International Display Workshops (IDW '07). IDW '07 will present "IDW Best Paper" awards starting this year in addition to the existing IDW outstanding poster paper award. A feature of the IDW '07 is an integration of the following fourteen workshops and one topical session.

Workshops on
- LC Science and Technologies
- Active Matrix Displays
- FPD Manufacturing, Materials and Components
- CRTs
- Plasma Displays
- EL Displays and Phosphors
- Field Emission Display
- Organic LED Displays
- 3D/Hyper-Realistic Displays and Systems
- Applied Vision and Human Factors
- Projection and Large-Area Displays, and Their Components
- Electronic Paper
- MEMS for Future Displays and Related Electron Devices
- Display Electronic Systems

Topical Session on
- Imaging and Photonic Devices

The three-day conference will feature 633 papers, including 2 keynote addresses, 2 invited addresses, 84 invited papers, 206 oral and 339 poster presentations including 91 late-news papers. Following keynote and invited addresses in the Wednesday morning, presentations will begin and continue in six parallel sessions through Friday. Poster sessions and author interviews will enable participants to discuss presented issues in detail. Exhibitions from display and related industries will also be featured from Wednesday to Friday in parallel with workshops and topical session. The IDW '07 should be of interest not only to researchers and engineers, but also to those who manage companies and institutions in the display community.

Workshop on LC Science and Technologies (LCT)
Recent advances in LC materials and device technologies are presented. The sessions cover from fundamental studies to recent development in LCD technologies. New LC materials & modes, LC alignment processes, display measurement, transflective LCDs, fast response LCDs, high performance LCDs and new applications are discussed.

Workshop on Active Matrix Displays (AMD)
Now, we open the door to a new era. We serve fruitful opportunities to develop your intellectual curiosity with interesting invited talks and contributed papers. This workshop covers various applications: LCD and OLED for TV, novel applications, etc. Moreover, this workshop includes TFT technologies: organic TFT, poly-Si TFT, crystallization, SOG, μc-Si TFT, oxide-semiconductor TFT, etc. Let's discuss latest progress in active matrix displays and TFT technologies.

Workshop on FPD Manufacturing, Materials and Components (FMC)
This workshop includes 9 invited papers dealing with the overview of technical trends and the new related technologies on FPDs. In the techni-

cal sessions, papers deal with optical components such as optical films and color filters, backlight systems, manufacturing technologies, measurement systems for FPDs. This year, special topics of nano- and environment-friendly technologies for FPDs will be also presented.

Workshop on CRTs (CRT)
This year, the Workshop of CRTs is planning an exhibition of the CRT history including the replica of the world's first television, designed by Prof. Takayanagi 81 years ago, next to the latest products. In the sessions, also the future of the CRT, especially Super Slim CRTs, will be discussed.

Workshop on Plasma Displays (PDP)
About 50 papers pursue these aims from the viewpoints of discharge cell and driving technology, PDP-TV and electron emissive layer about MgO physics, process and alternative materials. The "highest-light" of the workshop would be an invited talk given by Panasonic (Matsushita), who will introduce the $2.8B factory which will start producing 1M sets/mo (42"-equivalent) in May 2009. The factory substantially reduces the fixed manufacturing cost. General trends on new materials and technologies will also be discussed. Pioneer will be presenting another spotlighted paper, in which a new priming electron source will be revealed. Together with the crystal emissive layer introduced previously, the Pioneer PDP is now able to express appealing low luminance images in dark background. The progress of PDP phosphor will be presented in PH workshop.

Workshop on EL Displays and Phosphors (PH)
This workshop covers the latest R&D achievement in inorganic ELDs, phosphors for emissive displays and solid-state illumination as well as LEDs. Invited talks present phosphors for LEDs, EL TV, Flexible ELD, new FED-blue phosphor, nanophosphors and computational approach for phosphors. Contributed papers also include interesting topics such as luminescent mechanism, synthesis techniques for phosphors, thin-film phosphors and new phosphor materials for ELDs, FEDs, LEDs and PDPs.

Workshop on Field Emission Display (FED)
Recent progresses in various field emission displays equipped with carbon nanotube (CNT) field emitter arrays are presented. Field emission characteristics of high-efficiency electron device (HEED) equipped with active-matrix driving circuits, and various field emitter materials, such as CNTs, ZnO, transition metal nitride and nanocrystalline silicon, are also discussed.

Workshop on Organic LED Displays (OLED)
This workshop includes recent developments in OLED materials, devices and display systems. OLED technologies based on new full-color patterning methods are reported, which facilitates AM-OLED to mobile and TV applications. Device architectures to achieve highly efficient emission and novel materials supporting these device technologies are presented.

Workshop on 3D/Hyper-Realistic Displays and Systems (3D)
This workshop focuses on recent progress in 3D, holography and related visual science. It also covers 3D, hyper-realistic image progressing such as 3D acquisition and high-fidelity color reproduction. Invited talks in this workshop include the topics from forefront of 3D/holographic technologies and the recent researches into advanced display systems.

Workshop on Applied Vision and Human Factors (VHF)
This workshop provides a forum for discussion of the latest industrial and academic R&D in the field of applied vision and human factors associated with display technology, including methods for improved color reproduction and the assessment and improvement of the perceived quality of still and, increasingly, moving images. The workshop constitutes a unique opportunity to interact and discuss the latest advances with world-renowned experts in the field.

Workshop on Projection and Large-Area Displays, and Their Components (LAD)
The worldwide hottest technologies for projection displays will make this workshop exciting. Invited talks will cover advancing technologies of solid state light sources including semipolar-oriented InGaN semiconductor devices and green laser for mobile projectors. In the general talks, light source, light valve, screen and optical systems for enhancing display performance will be discussed.

Workshop on Electronic Paper (EP)
This workshop focuses on current topics on electronic paper, including rewritable paper, paper-like display, and flexible display. Various novel technologies on electrophoretic, liquid crystal, and toner display systems will be reported. Systems, devices, materials, and applications in this field are expected to be discussed.

Workshop on MEMS for Future Displays and Related Electron Devices (MEMS)
The workshop is unique in covering all aspects of MEMS and nanotechnologies for future displays, imaging devices, and related electron devices. It seeks to broaden the horizon of display technologies into MEMS technologies. Among MEMS and display conferences in the world, this is the only opportunity where MEMS researchers gather to discuss on such devices. Research areas such as, materials, basic physics and fabrication process are included. Authorities of this field are invited from top research institutions around the world. Invited speakers are from Fraunhofer IPMS, KAIST, Kochi Univ. of Tech., MIT, Tohoku Univ., Toyota Tech. Inst., Univ. of Cambridge, and Univ. of Tokyo (in alphabetical order). Together with excellent contributed papers, this workshop invites attendants who wish to cut open a new field of display and imaging devices.

Workshop on Display Electronic Systems (DES)
This workshop will cover all aspects of display systems in relation to electronics: video data processing, interface technologies, cooperative operations between display components such as cells and backlights, combinations with other input/output devices, applications to the new areas, system performance, or power consumption. We will have interesting speeches on the recent hot topics such as high dynamic range display systems, high-quality video processing and mobile display technologies.

Topical Session on Imaging and Photonic Devices (IPD)
The topical session of this year intends to discuss the recently broadening area of imaging and photonic devices, which covers the design, fabrication and characteristics of optical communication devices, novel imaging devices, nanostructures, ultra short laser pulse and nonlinear optical phenomena. Several new fundamental and practical achievements will be presented, of which the topics are nonlinear magneto-optics, nanostructures by mesoscopic patterning, the polysilane and liquid crystal communication devices, supercontinuum generation by photonic crystal fibers, water-surface ranging by Optical Time Domain

Refletometry (OTDR), electrochromic displays of metal oxides, and other interesting new findings.

IDW Best Paper Award and Outstanding Poster Paper Award

IDW '07 will present "IDW Best Paper" awards starting this year in addition to the existing "IDW Outstanding Poster Paper" award. The awards committee of IDW will select the most outstanding papers from those presented at IDW '07. The award winners will be announced on the IDW website and given a plaque after the conference.

Exhibition

The IDW '07 Exhibition will be held from Dec. 5 through Dec. 7, which covers materials, components, manufacturing and measuring equipment, software systems and related products for display devices. Please join and enjoy discussions at exhibitors' booths.

December 5: 13:00 – 17:00
December 6: 9:00 – 17:00
December 7: 9:00 – 14:00

Special Exhibition of "Fujioka Collection"

IDW '07 will exhibit an historical collection of CRTs that Mr. Fujioka has maintained for over 40 years. You can see live pictures on the very early color and black & white televisions in comparison with the latest Super Slim televisions at the exhibition corner in the main hall C.

EVENING GET-TOGETHER WITH WINE

Tuesday, December 4
18:00–20:00

Restaurant "Sora", Sapporo Convention Center
(Sponsored by Merck Ltd., Japan)

See page 10 for details

IDW '08

The 15th International Display Workshops

December 3-5, 2008

Toki Messe
Niigata Convention Center

Niigata, Japan

GENERAL INFORMATION

SPONSORSHIP
IDW '07 is sponsored by the Institute of Image Information and Television Engineers (ITE) and the Society for Information Display (SID).

CONFERENCE SITE
Sapporo Convention Center
Higashi-Sapporo 6-jo 1-chome 1-1 Shiroishi-ku, Sapporo, 003-0006 Japan

ON-SITE SECRETARIAT
Telephone and fax machines for IDW '07 use will be temporarily set up in the secretariat room (104) at Sapporo Convention Center (December 4-7).
Phone: +81-11-820-1314
Fax: +81-11-820-1324

BANQUET
A buffet-style banquet will be held on December 5 from 19:30 to 21:30 in Palace Ballroom (3F), Sheraton Sapporo Hotel. As the number of tickets is limited, you are urged to make an advance reservation through website or by completing the enclosed registration form.

EVENING GET-TOGETHER WITH WINE
A get-together will be held on December 4 from 18:00 to 20:00 at the restaurant "Sora" in Sapporo Convention Center. Wine (sponsored by Merck Ltd., Japan) will be served to participants with a relaxed atmosphere for informal discussion.

REGISTRATION
Registration is available in advance and also on site. However, proceedings book might not be guaranteed for the on-site registrants in case of the unexpected excess of the on-site registration. Advance registration is strongly recommended.

Registration Fees
The registration fee for IDW '07 includes admission to the conference, a copy of the proceedings (book or USB memory), and CD-ROM. The proceedings in USB memory can be selected only by those who registered and paid by November 8 (Japan Standard Time).

	Paid by Nov. 8	After Nov. 8
Member of SID/ITE/ASO*	¥ 30,000	¥ 40,000
Non-Member	¥ 35,000	¥ 45,000
Student**	¥ 8,000	¥ 10,000
Life Member of SID/ITE	¥ 8,000	¥ 10,000
Banquet	¥ 8,000	¥ 10,000

*ASO: Academic Supporting Organizations
(See p. 12 as well as "Supporting Organizations and Sponsors" at the end of each workshop/topical session section.)
**Student ID is required.

Please note that the reduced registration fee must be paid by November 8. In case of the payment after November 8 or on site, prices after November 8 will be applied even if you sent the registration form by November 8, 2007. Also note that *the number of banquet tickets to register on site is limited*.

For additional sets of the proceedings (book or USB memory*) and CD-ROM

	Book & CD-ROM	USB & CD-ROM*
At the conference site	¥ 8,000	¥ 8,000
Airmail after the conference	¥ 15,000	not available
Domestic mail after the conference	¥ 10,000	not available

*Additional sets of USB memory and CD-ROM can be selected only by the application with payment by November 8.

Payment

Three ways are provided for the registration.

(1) e-Registration

Access the following URL.

http://www.idw.ne.jp/regist.html

The e-Registration is acceptable until November 21, 2007.

(2) Mail or Fax Registration

Complete the registration form (FORM A) at the centerfold and send it to the secretariat together with all necessary payments no later than November 21, 2007.

IDW '07 Secretariat
c/o ABEISM CORPORATION
4-30-12 Kamimeguro, Meguro-ku, Tokyo 153-8571, Japan
Phone: +81-3-5720-7022 Fax: +81-3-6203-8238
E-mail: idw@abegroup.jp

The registration fee should be remitted by one of the following methods.

1. Credit card (only VISA or MasterCard accepted)
2. Bank transfer to:
   Account name: IDW
   Account No.: 4307797 (ordinary account)
   Bank Name: SUMITOMO MITSUI BANKING
   Branch Name: KOFU BRANCH
   Please attach a copy of your bank remittance form with the registration form to avoid possible troubles.

All above payments should be made in **JAPANESE YEN**.
Also, please note that personal and traveler's checks are not accepted.

(3) On-site Registration

Conference registration desk will be open:

December 4 (Tue.)	17:30–20:00
December 5 (Wed.)	8:30–18:00
December 6 (Thu.)	8:30–18:00
December 7 (Fri.)	8:30–15:00

The on-site registration fee will be payable by:

1. Cash (JAPANESE YEN only)
2. Credit card (VISA or MasterCard only)

Bank transfer, bank check, or personal/traveler's checks are not accepted. Payment by cash is recommended.

Cancellation Policy

Refunds for registration, banquet, additional sets of proceedings etc. will be made on written cancellation received by IDW '07 secretariat by **November 8**. For cancellations received after November 8 or no-shows, refunds will not be made. However, after IDW '07 closes, a set of the proceedings book/USB memory and CD-ROM will be sent to the registrants who have paid the registration fees.

INQUIRIES

IDW '07 Secretariat
c/o ABEISM CORPORATION
4-30-12 Kamimeguro, Meguro-ku, Tokyo 153-8571, Japan
Phone: +81-3-5720-7022 Fax: +81-3-6203-8238
E-mail: idw@abegroup.jp

ACADEMIC SUPPORTING ORGANIZATIONS

The Chemical Society of Japan
The Electrochemical Society of Japan (ECSJ)
The Illuminating Engineering Institute of Japan
The Imaging Society of Japan
The Institute of Electrical Engineers of Japan
The Institute of Electronics, Information and Communication Engineers (IEICE)
The Institute of Image Electronics Engineers of Japan
Japan Ergonomics Society (JES)
The Japanese Liquid Crystal Society (JLCS)
The Japan Society of Applied Physics
The Virtual Reality Society of Japan
The Society of Polymer Science, Japan

FUNDS

Funds for the conference are furnished in part by the following organizations:
• Grant-in-Aid for Scientific Research (KAKENHI: 1862004) from MEXT
• Sapporo International Communication Plaza Foundation

Please pay attention to the website (http://www.idw.ne.jp/) for latest information.

HOTEL AND TRAVEL INFORMATION

HOTEL RESERVATIONS

The IDW '07 executive committee has secured enough rooms for the participants. Participants who want to stay in Sapporo during IDW '07 should make reservations directly with the tourist agency "TOPTOUR Corporation" by yourself as follows. Reservation will be made on a first-come, first-served basis.

1. By website, please access the following URL.
   http://www.toptour.co.jp/conv/3917/idw07/
   On-line registration is highly recommended.
2. By fax, please use the enclosed Form B. (The handling charge of 525 yen per person is required in the case of Fax reservation.)
   1) Confirmation will be sent to the applicants directly from the tourist agency in about 10 days after receiving your application.
   2) If your both 1st choice and 2nd choice are fully booked, the tourist agency will send you the confirmation with an alternative.

VISAS

Visitors from countries whose citizens must have visas should apply to a Japanese consular office or diplomatic mission in their respective country. For further details, please contact your travel agent or the local consular office in your country.
Attention: For some countries' citizens, official documents prepared by the secretariat will be needed. Please ask the secretariat for its application at least two months before the conference.

JAPAN RAIL PASS and JR HOKKAIDO RAIL PASS

(1) The JAPAN RAIL PASS is the most economical way to travel throughout Japan by rail and JR buses.
Please be aware, however, that some restrictions apply.
   (i) The pass is not valid for "NOZOMI" trains on the Tokaido and Sanyo Shinkansen lines.
   (ii) The pass cannot be purchased inside Japan.
For details, please access the following URL.
http://www.japanrailpass.net/eng/en001.html

(2) The JR Hokkaido Rail Pass, a convenient, economical pass available only for travelers from abroad, offers unlimited rides on any JR Hokkaido line for 3 or 5 days.
For details, please access the following URL.
http://www2.jrhokkaido.co.jp/global/english/railpass/index.html

Please ask the JR Hokkaido Visitors Information Desk at New Chitose Airport Station or the JR Information Desk at JR Sapporo Station West Gate.

The JR Hokkaido Visitors Information Desk
New Chitose Airport Station (8:30–21:00)
http://www2.jrhokkaido.co.jp/global/english/access/chitose.html

The JR Information Desk
JR Sapporo Station West Gate (8:30–19:00)
http://www2.jrhokkaido.co.jp/global/english/access/sapporo.html

CLIMATE

Sapporo's average temperature is around 0 degree Celsius at the beginning of December. The first snowfall usually occurs in late October. From early December onward, the ground is often covered with snow. Please take care of yourself with wear and shoes.

SAPPORO CITY

Sapporo, the capital of Hokkaido, is the fifth largest city in Japan and primarily known as the host city for the 1972 Winter Olympics. The development of Hokkaido was started on a large scale about 150 years ago, when Sapporo was enlarged according to the advice of foreign specialists. Sapporo was built based on a rectangular street system.

Today, the city is well known for its ramen (a special kind of noodle), beer, and the annual snow festival held in February.

Sapporo's weather is harsh in winter with lots of snowfall, however, may attracts outdoor lovers including skiers and snowboarders.

PLACES to SEE/VISIT

Odori Park is an oasis at the city center, which extends 1.5 km east-west. It is decorated with fountains, sculptures and flower beds. In winter, since the end of November, the park and Ekimae-main street are decorated with illuminations, creating brilliant works that liven up the surrounding areas.

Susukino is the largest entertainment district in the northern part of Japan, with approximately 5,000 restaurants and entertainment facilities in total. The district is popular not only among locals, but also among visitors.

Large shopping malls and department stores are found around JR Sapporo Station and Odori subway station.

JR Tower is located beside the JR Sapporo Station. The night view of downtown Sapporo from its higher floors, with a drink or two, ensures a splendid evening.

A trip to Sapporo Beer Museum and a tour of the brewery give history of brewing in Sapporo. The adjoining brick buildings of the former brewery now house a beer hall, where the local brew is complemented by a variety of Hokkaido delicacies including popular lamb barbeques named after the Mongolian warrior, Genghis Khan.

Sapporo Winter Museum exhibits the valuable legacy of Sapporo Winter Olympic Games as well as historical materials of winter sports. There are two different ski jumping hills near by. One of them, Okura-yama, is designed for large hill jumping and will be opened for visitors to climb up to the observation deck.

A 75- minute bus tour from JR Sapporo station takes you to one of the largest hot springs in Japan, Jouzankei.

Lake Toya is located about 100 kilometers south of Sapporo and is famous for its hot spa, volcanoes and beautiful scenery, where the presidents and the prime ministers will gather to hold a Summit next year. You can visit craters of Volcano Usu that erupted in 2000.

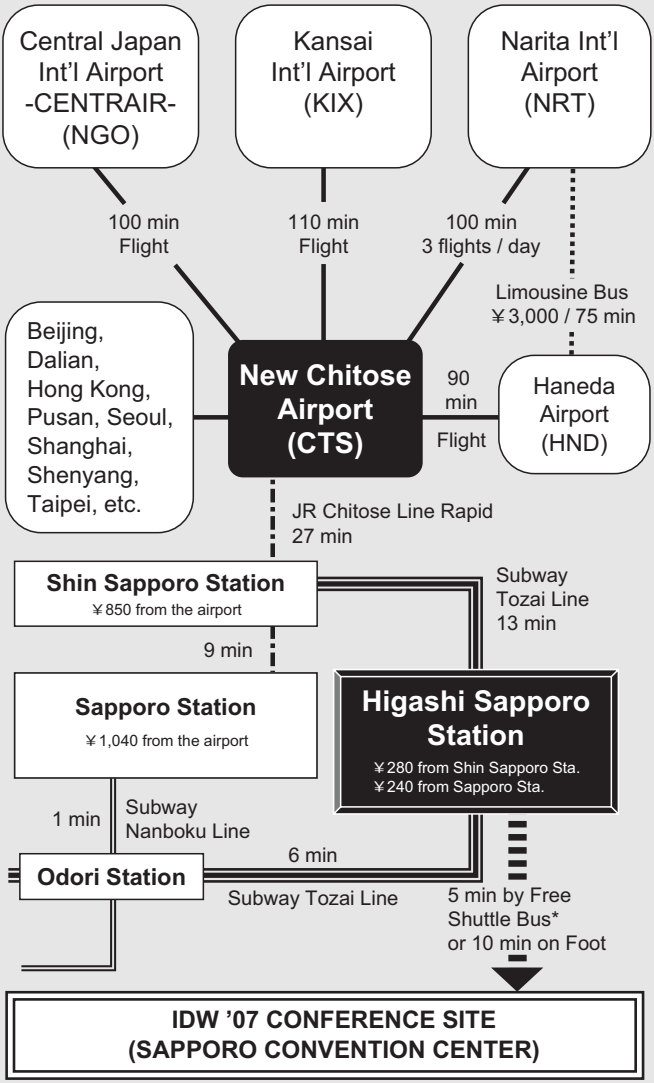
Probably, some ski grounds on the outskirts of the city open at the beginning of December.

Multilingual sightseeing buses are available.

Sapporo's numerous charms make it an ideal convention site for you and your traveling companions.

For more information, visit Sapporo city guide:
http://www.welcome.city.sapporo.jp/english/

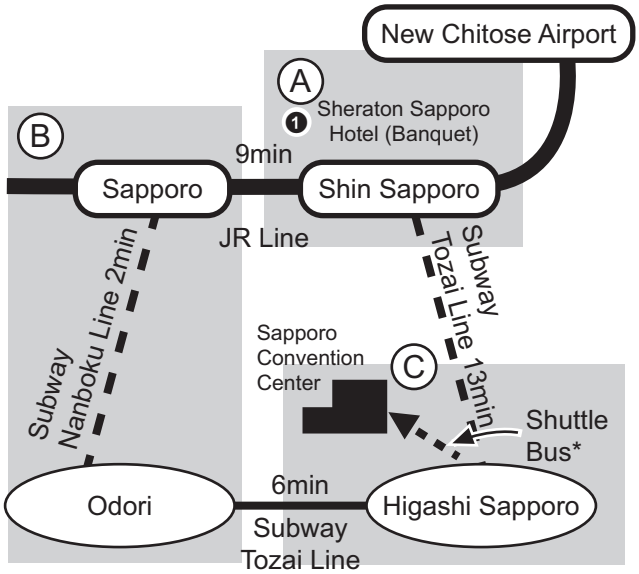
ACCESS TO SAPPORO CONVENTION CENTER



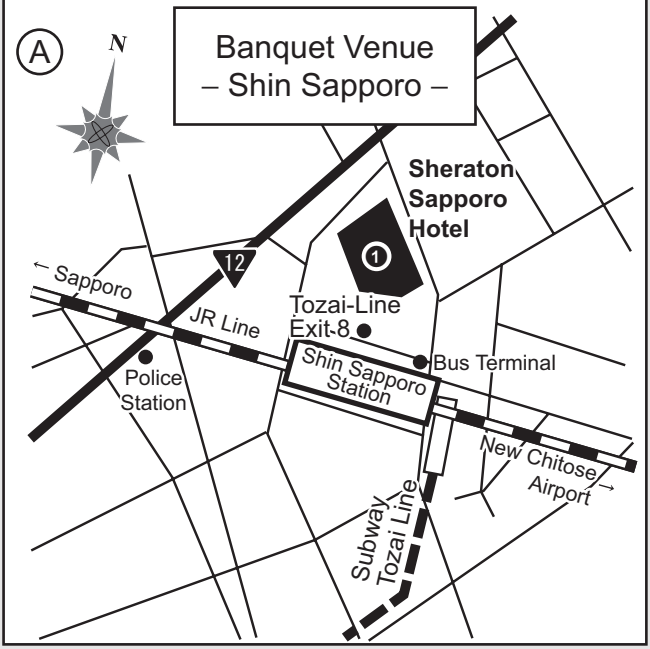
*(See http://www.idw.ne.jp/)

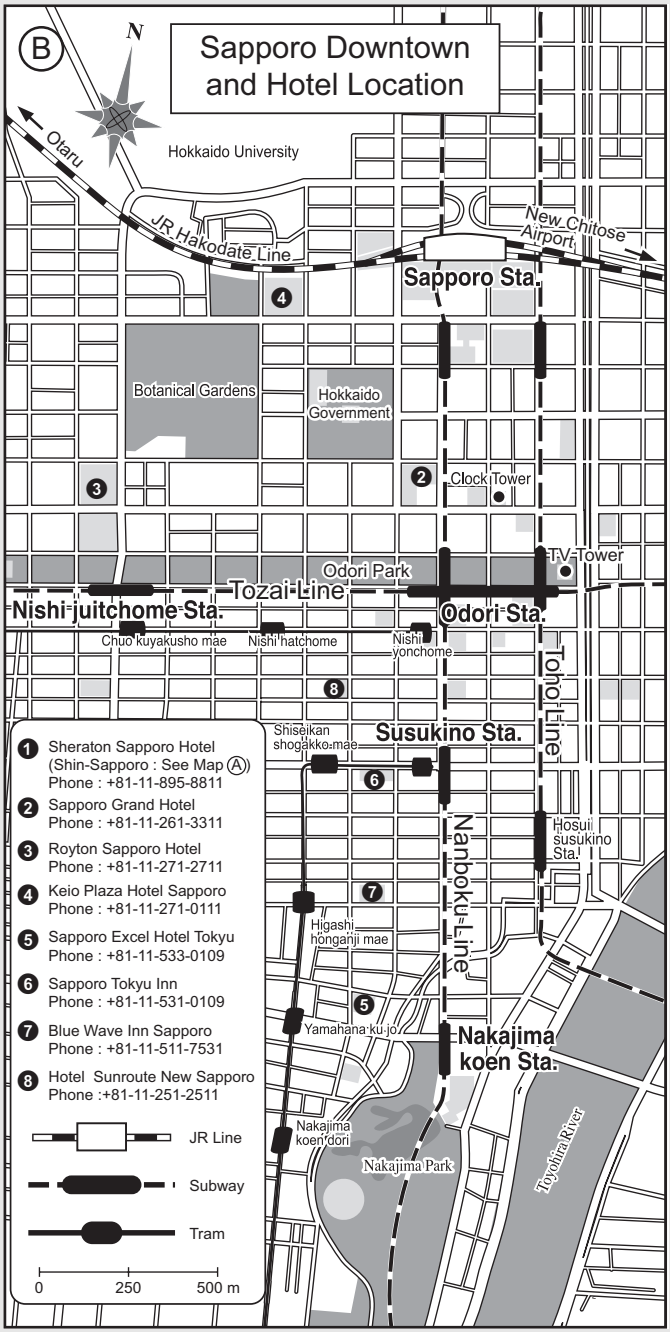
Information of this page may be changed. Please confirm the details in each company.
(as of July, 2007)

Access from New Chitose Airport



*See http://www.idw.ne.jp




B
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Sapporo Downtown and Hotel Location
Otaru
Hokkaido University
JR Hakodate Line
New Chitose Airport
Sapporo Sta.
Botanical Gardens
Hokkaido Government
Clock Tower
TV Tower
Odori Park
Tozai Line
Nishi juitchome Sta.
Odori Sta.
Chuo kuyakusho mae
Nishi hatchome
Nishi yonchome
Toho Line
Shiseikan shogakko mae
Susukino Sta.
Hosui susukino Sta.
Nanboku Line
Higashi honganji mae
Yamahana ku jo
Nakajima koen Sta.
Nakajima koen dori
Nakajima Park
Toyohira River
1 Sheraton Sapporo Hotel (Shin-Sapporo : See Map Ⓐ) Phone : +81-11-895-8811
2 Sapporo Grand Hotel Phone : +81-11-261-3311
3 Royton Sapporo Hotel Phone : +81-11-271-2711
4 Keio Plaza Hotel Sapporo Phone : +81-11-271-0111
5 Sapporo Excel Hotel Tokyu Phone : +81-11-533-0109
6 Sapporo Tokyu Inn Phone : +81-11-531-0109
7 Blue Wave Inn Sapporo Phone : +81-11-511-7531
8 Hotel Sunroute New Sapporo Phone :+81-11-251-2511
JR Line
Subway
Tram
0
250
500 m

Sapporo Convention Center Map

IDW Outstanding Poster Paper Award

The 2007 award winners will be announced on the IDW web site:
http://www.idw.ne.jp/award.html

SID 2008

International Symposium, Seminar, and Exhibition

May 18–23, 2008

Los Angeles Convention Center
Los Angeles, California, USA

BANQUET

Wednesday, December 5
19:30–21:30
Palace Ballroom (3F)
Sheraton Sapporo Hotel

See page 10 for details

EXHIBITION

13:00–17:00 Wednesday, Dec. 5
9:00–17:00 Thursday, Dec. 6
9:00–14:00 Friday, Dec. 7

Main Hall C
Sapporo Convention Center

Free admission with your registration name tag.

IDW '07

Wednesday, December 5

9:00 - 9:10 **Conference Hall**

Opening

Master of Ceremony: T. Sugawara, Executive Chair

Opening Remarks
9:00

Y. Nagae, General Chair, Hitachi Displays, Japan
H. Seki, Program Chair, Hachinohe Inst. of Tech., Japan

9:10 - 10:30 **Conference Hall**

Keynote Address

Co-Chairs: H. Seki, Program Chair, Hachinohe Inst. of Tech., Japan
Y. Nagae, General Chair, Hitachi Displays, Japan

Keynote Address - 1 **Innovation in Molecular Electronics,**
9:10 **Displays and Culture**

K. Matsushige
Kyoto Univ., Japan

For the next-generation electronics and displays, several innovations should be made. Functional organic materials and recent nanotechnology will play essential roles to create molecular-base devices, future molecular computer, and flexible EL displays. Also, the combination of such cutting-edge technologies and traditional culture will bring us a new 21C culture.

Keynote Address - 2 **Creation of Innovative Concept for New**
9:50 **Business**

K. Mori
Tokyo Univ. of Sci., Japan

Companies in the innovation age need to develop new businesses which have the top market share in the world. In this keynote speech, I would like to present an innovative concept creation method that led to successful R&D for new businesses, such as Japanese Word Processor, Note PC and DVD.

----- Break -----

10:40 - 11:50 **Conference Hall**

Invited Address

Co-Chairs: T. Miyashita, Program Vice-Chair, Tohoku Univ., Japan
H. Mori, Program Vice-Chair, FUJIFILM, Japan

Invited Address - 1 **Active-Matrix Technologies for Flexible Displays**
10:40

J. Jang
Kyung Hee Univ., Korea

In this paper the TFT technologies for flexible displays are reviewed. The TFT backplanes with amorphous silicon, low temperature poly-Si, organic semiconductor and oxide semiconductor could be built on the substrates such as plastic and metal foil for flexible displays. The current issues and advantages on these technologies are discussed together with the TFT backplanes built on flexible substrates in ADRC.

Invited Address - 2 **A Scalable Business Approach to 3D through End-to-End Innovation**
11:15

J. Swillens
Philips 3D Solutions, The Netherlands

3D has the potential to completely replace the 2D world. In this address, Jos Swillens, CEO of Philips 3D Solutions, describes in detail a scalable business approach to 3D through end-to-end innovation with their WOWvx technology. WOWvx enables seeing 3D without glasses and unlocks existing content from the 2D world.

Workshop on LC Science and Technologies

Wednesday, December 5

13:20 - 14:45 **Conference Hall**

LCT1: Fast Response LCDs (1)

Chair: T. Nose, Akita Pref. Univ., Japan
Co-Chair: K. Miyachi, Sharp, Japan

LCT1 - 1: 13:20 ***Invited*** **High Quality OCB-III Display with New Driving Method Having Fast Response and High Contrast Ratio**

K. Nakao, Y. Tanaka, H. Takahara, S. Kawaguchi, K. Nishiyama, S. Araki, A. Takimoto
Toshiba Matsushita Display Tech., Japan

We have developed high performance OCB-III TFT-LCDs using LED blinking backlight. The OCB-III enables super high motion picture quality by securing a sufficient black period in a frame time and 1.4 ms MPRT is achieved. The OCB-III is superior to CRT in terms of motion picture quality.

LCT1 - 2 13:45 **A 32-in. High Video Image Quality OCB-LCD TV**

T. C. Hsu, C. L. Pan, C. L. Wu, J. C. Cheng, M. T. Hsu, Z. F. Chen
Chunghwa Picture Tubes, Taiwan

This paper proposes the 32" high video image quality OCB LCD-TV utilizes the method “Dynamic Scanning Backlight with Black Insertion” to enhance video image quality. This method includes dynamic backlight luminance control to enhance contrast over 1500:1 and scanning backlight with black insertion to reduce MPRT less than 6ms.

LCT1 - 3 14:05 **Development of OCB-LCD Improving Response at Low Temperature**

N. Kubota, M. Tsukane, T. Fukami, T. Kojima, K. Nakao, H. Wakemoto, Y. Kizu[*], R. Hasegawa[*]
Toshiba Matsushita Display Tech., Japan
[*]Toshiba, Japan

We have developed high performance OCB LCD with fast response at low temperature. This is accomplished by use of low rotational viscosity LC material and improvement of bend transition. The new OCB LCD achieves very fast response time and bend transition at low temperature. This is suitable for outdoor-use.

LCT1 - 4
14:25

Development of 3.5-in. VGA Field-Sequential-Color Optically Compensated Birefringence a-Si:H TFT LCDs with Fast Splay-to-Bend Transition and High Transmittance

C.-H. Wu, P.-S. Shih, J. H. Yang, P.-Y. Chen, J. Chang, H.-L. Pan, K. F. Hsu, C.-Y. Lin, S.-H. Lin, C. C. Chang, K.-H. Yang
HannStar Display, Taiwan

A 3.5" VGA FSC TFT-OCB prototype with a high panel transmittance of 15.2 % and a fast splay-to-bend-transition time less than 0.2 sec at panel startup has been developed using conventional a-Si:H TFT process. A new pixel design that increased the aperture ratio by 45% over a conventional design and a novel driving scheme to obtain a higher LC transmittance at bright state were used to achieve the high panel transmittance.

----- Break -----

15:00 - 16:25 **Conference Hall**

LCT2: Display Measurement

Chair: T. Ishinabe, Tohoku Univ., Japan
Co-Chair: H. Wakemoto, Toshiba Matsushita Display Tech., Japan

LCT2 - 1:
15:00

Invited **Study on Appropriate Method for Measurement of Luminance and Color of FPD**

K. Yanai, H. Matsui, Y. Tanaka
Topcon Technohouse, Japan

The purpose of our research was to examine the effect of a solid angle of light on the measured value of the luminance from Flat Panel Display. The influence of degree of the solid angle on the measured value of luminance was found to be significant.

LCT2 - 2
15:25

Inside Sub-Pixel Dynamic Observation: Local Flicker and Micro-Structure LC Response

P.-C. Liao, H.-L. Hou, C.-Y. Chiu, C.-H. Tsao, C.-Y. Lee, T.-J. Chang
AU Optronics, Taiwan

We proposed a quantification scheme for inside sub-pixel dynamic observation (ISDO) of LCD optics. Two applications are introduced. First, the individual-area flicker within a sub-pixel can be verified. Each optimized Vcom can be found. Second, LC response of micro-structures, such as ITO slit, bump and full ITO, can be individually measured.

LCT2 - 3
15:45 **Fluid Flow in Homogeneous and Homeotropic Nematic LC Cells Induced by Step Voltage Excitation**

Y. Iwata, H. Naito, M. Inoue, H. Ichinose**, M. Klasen-Memmer***, K. Tarumi****
Osaka Pref. Univ., Japan
**Toyo, Japan*
***Merck, Japan*
****Merck KGaA, Germany*

Flow effects in homogeneous and homeotropic nematic liquid crystal (NLC) cells have been studied from the analysis of transient currents. The measured transient currents were well reproduced by taking into account the flow effects. It is found that the flow effects accelerate field-induced director response in homeotropic NLC cells, while the flow effects are negligible in homogeneous NLC cells.

LCT2 - 4
16:05 **A Highly Accurate Method for Measuring the Ordinary and Extraordinary Refractive Indices of LC Materials**

Y. Ohno, T. Ishinabe, T. Miyashita, T. Uchida
Tohoku Univ., Japan

A new method for measuring the ordinary and extraordinary refractive indices of liquid crystal materials was devised by considering multiple reflections and interference. The refractive indices can be obtained from the numerical fitting between measurement and calculated values of the amplitude ratios and phase differences. This method is effective for design of high-quality liquid crystal displays.

----- Break -----

16:40 - 18:00 **Conference Hall**

LCT3: High Performance LCDs

Chair: H. Fujikake, NHK, Japan
Co-Chair: M. Inoue, Toyo, Japan

LCT3 - 1:
16:40 ***Invited*** **Polarized Light Control Technology for High Quality LCDs**

T. Ishinabe, T. Uchida
Tohoku Univ., Japan

Optical performance of liquid crystal displays has been extremely improved with a development of optical film compensation technologies. This paper describes the fundamental characteristics of the optical films and the development of high quality LCDs using light control technology.

LCT3 - 2
17:05

Sandwich Electrode with Multi-Domain Vertical Alignment LCD

T.-C. Yang, S.-L. Lee, C.-M. Chang, F.-Y. Gan
AU Optronics, Taiwan

We have developed a high performance and yield amorphous silicon liquid crystal display. Moreover, it is not only low cost and complex but protrusion and organic layer free different from conventional MVA LCDs. However, this new model owns the similar function of multi-domain vertical alignment. On 2.5 inches (163 pixels per inch) panel, transmittance and contrast ratio of our new model are all 8.2% and 400 up at NTSC 49%, respectilvely.

LCT3 - 3
17:25

A Field Sequential Color LCD Based on Color Field Arrangement for Color Breakup and Flicker Reduction

Y.-T. Hsu, F.-C. Lin, C.-H. Chen, Y.-P. Huang, H.-P. Shieh, J.-H. Chen[*], J.-M. Hong[*]
Nat. Chiao Tung Univ., Taiwan
[*]AU Optronics, Taiwan

Field sequential color liquid crystal displays (FSC-LCDs) are well known that the color breakup (CBU) is the serious issue needed to be solved. We have developed a new driving technique on a 5.6-in. OCB mode FSC-LCD. This proposed 4-color field arrangement (4-CFA) method can effectively eliminate the CBU of FSC-LCDs.

LCT3 - 4L
17:45

Disclination Free BVA (Biased Vertical Alignment) Mode

Y. B. Lee, K. C. Lee, H. C. Liu, C. H. Yu, W. C. Lin
HannStar Display, Taiwan

BVA (Biased Vertical Alignment) mode is a effective wide-viewing-angle LCD with a distinct advantage of lower manufacture cost like as TN-Mode. But it always exists disclination problem. In this paper, we make use of hole pattern on C/F side to improve the disclination issue and also reduce bias voltage level.

Author Interviews
18:00 – 19:00

Thursday, December 6

9:00 - 10:10 **Conference Hall**

LCT4: New Materials

Chair: A. Fujita, Chisso Petrochem., Japan
Co-Chair: M. Kimura, Nagaoka Univ. of Tech., Japan

LCT4 - 1: 9:00 ***Invited*** **Self-Organized Photonic Crystals of Organic and Polymer Materials for Laser Applications**

S. Furumi
Nat. Inst. for Materials Sci., Japan

This presentation reports the self-organized organic photonic crystals for laser applications. First, chiral liquid crystals are used to control the optically-excited lasing by external stimuli. Second is establishment of new potentials of colloidal crystals. Introduction of a light-emitting layer between the colloidal crystals generates efficient lasing in the photonic band-gap.

LCT4 - 2: 9:25 ***Invited*** **Electro-Optical Switching in a Blue Phase III Stabilized by a LC Oligomer**

A. Yoshizawa
Hirosaki Univ., Japan

We report electro-optical switching with a response time of the order of 10^{-2} s for a blue phase III (BPIII) exhibited by the newly designed compound. Switching caused by the phase transition between BPIII and N can supply not only a pronounced black state without surface treatment but also a homogeneous bright state.

LCT4 - 3 9:50 **Novel LC Materials toward the Faster Response Time and Lower Driving Voltage**

A.-C. Chen, P.-J. Huang, S.-H. Liu, K.-L. Cheng
ITRI, Taiwan

To reduce the response time and the driving voltage of LCDs, two novel types of LC materials were designed and synthesized. A series of trifluoro-methyl LCs were prepared and evaluated, which exhibit low rotational viscosity. Meanwhile, various N,N-disubstituted piperazine compounds were also prepared which resulted in a high dielectric anisotropy.

----- Break -----

10:40 - 12:05 **Conference Hall**

LCT5: Alignment Process (1)

Chair: M. Kimura, JSR, Japan
Co-Chair: I. Hirosawa, Japan Synchrotron Radiation Res. Inst., Japan

LCT5 - 1: 10:40 ***Invited*** **LCD Photoalignment: What is Next?**

V. G. Chigrinov, H. S. Kwok, H. Hasebe[*], H. Takatsu[*], H. Takada[*]
Hong Kong Univ. of S&T, Hong Kong
[*]Dainippon Ink & Chems., Japan

Liquid crystal (LC) photo-alignment (PA) using azo-dyes is reviewed. Azo-dye PA method provides a controllable LC pretilt angle and strong anchoring energy of the liquid crystal cell, as well as high thermal and UV stability and high VHR value. The application of this method to the LC alignment and fabrication of various types of LC displays (LCD) is discussed.

LCT5 - 2 11:05 **Characterization of the Photo-Alignment Material SD-1/SDA-2 with Spectroscopic Ellipsometry**

I. Valyukh, H. Arwin[*], V. Chigrinov[**], S. Valyukh[**]
Dalarna Univ., Sweden
[*]Linking Univ., Sweden
[**]Hong Kong Univ. of S&T, Hong Kong

Spectroscopic ellipsometry is applied for investigation of the azo-dye SD-1/SDA-2 which are used for photoalignment of liquid crystals. The measured optical constants were modelled with an ensemble of the Lorentz oscillators. The results can be used for simulation of the optical properties of LC devices.

LCT5 - 3 11:25 **Control of Pretilt Angle for Vertically Aligned LCDs Using Magnetic Field with UV Curable LC Monomers**

K. Okuyama, T. Miyashita, H. Katakura[*], J. Shimizu[*], T. Uchida
Tohoku Univ., Japan
[*]Sony, Japan

In VA-LCDs, control of pretilt angle at the surface is a key technology to improve image quality. We newly developed an alignment-control method using magnetic field and UV-curable LC monomers. The tilting direction of liquid crystal is controlled and monodomain alignment with pretilt angle of 89° has been successfully obtained.

LCT5 - 4 11:45 **Molecular Orientation at Surface of Alignment Films Studied by Near Edge X-Ray Absorption Fine Structure Spectroscopy**

T. Tominaga, M. Kimura, S. Kimura
JSR, Japan

Surfaces of alignment films are studied by near edge X-ray absorption fine structure (NEXAFS) spectroscopy. The molecular orientation at the surface of rubbed polyimide films, photo-alignment films, and homeotropic alignment films are determined with their polarization dependence of NEXAFS spectra.

----- Lunch -----

15:10 - 16:35 **Conference Hall**

LCT6: Alignment Process (2)

Chair: V. Chigrinov, Hong Kong Univ. of S&T, Hong Kong
Co-Chair: R. Yamaguchi, Akita Univ., Japan

LCT6 - 1: 15:10 ***Invited*** **LC Alignment on Inorganic Layers with nm-Sized Topography**

K. Hiroshima
Univ. of Yamanashi, Japan

High reliability LC alignment layers have been required. Obliquely evaporated SiO layers and anodic porous alumina are known as inorganic alignment films, which consist of nm-sized columnar and porous structures. Aligning mechanism is understood in minimum elastic energy conditions. Various inorganic LC aligning layers and their aligning properties are described.

LCT6 - 2 15:35 **Azimuthal Nematic Bistability at Nanoimprinted Surface Groove**

J. S. Gwag[*], J.-I. Fukuda[,**], M. Yoneya[*,**], H. Yokoyama[*,**]*
[*]ERATO-SORST, JST, Japan
[**]AIST, Japan

Azimuthal nematic bistability was induced by a composition action between two azimuthally orthogonal anchoring energies which were led by the combination of a nanoimprinted groove and a mechanical rubbing. The azimuthal easy directions can be controlled by the modulation of groove pitch and rubbing conditions. Fukuda's model is used to express surface anchoring of nematic liquid crystal in surface groove.

LCT6 - 3 15:55 **Patterned LC Alignment on Micro-Grating Structures Fabricated by Direct Laser Writing**

C. H. Lee, H. Yoshida, Y. Miura, K. Tokuoka, A. Fujii, M. Ozaki
Osaka Univ., Japan

Local alignment of nematic liquid crystal (LC) through local micro-grating structures fabricated via a two-photon-excitation laser-lithography process was demonstrated. A local twisted-nematic region was prepared using one rubbed and one fabricated micro-grating surface. The optical polarizing photographs suggest that local alignment of LC molecules is achieved on the micro-grating structure.

LCT6 - 4
16:15 **Transmittance Enhancement of Ridge-Free Vertical Alignment TFT-LCD**

Y.-Y. Huang, H.-P. Chiu, C.-C. Lin, C.-R. Lee, H.-T. Yu
Chunghwa Picture Tubes, Taiwan

The transmittance of conventional chevron-typed microdomain vertical alignment mode has evidently been investigated to be maintained by specific indium-tin-oxide (ITO) slit patterns of ridge-free VA display. The ITO pattern with *dendritic type* is experimentally and simulatedly found to enhance the panel transmittance, contrast ratio and to accelerate the response time.

----- Break -----

16:45 - 18:10 **Conference Hall**

LCT7: Novel LCD Modes

Chair: H. Okada, Univ. of Toyama, Japan
Co-Chair: T. Takahashi, Kogakuin Univ., Japan

LCT7 - 1:
16:45 ***Invited*** **Flexible Color LCD Panel Driven by Low-Voltage Operation Organic TFT**

Y. Fujisaki, H. Sato, T. Takei, T. Yamamoto, H. Fujikake, S. Tokito, T. Kurita
NHK, Japan

An organic TFT (OTFT)-driven color flexible ferroelectric LC (FLC) display panel with 64×64 pixels and a resolution of 50ppi has been developed. We integrated a flexible FLC with polymer networks and walls, and pentacene-OTFT by printing and lamination technique. Color moving images were successively displayed at low driving voltage by using a field-sequential method.

LCT7 - 2
17:10 **New Approach to Reduce the Driving Voltage for TN-LCDs**

K. Takatoh, T. Kaneko, T. Uesugi, S. Kobayashi
Tokyo Univ. of Sci. Yamaguchi, Japan

A novel TN-LCD mode of extremely low driving voltage, RTN-LCD, is proposed. The structure is unique at two points: (1) Molecules decline without applying electric voltage; (2) By applying electric voltage, a part of the LC layer twists in the opposite direction. For practical application, further stabilization would be required.

LCT7 - 3
17:30

Preparation and Evaluation of Nematic Optically Compensated Birefringence Mode LCD

R. Nakamura, T. Ishinabe, T. Uchida, H. Mori[*]
Tohoku Univ., Japan
[*]*FUJIFILM, Japan*

In order to evaluate the performance of the nematic optically compensated birefringence (NCB) mode, we fabricated NCB cells and optimized the cell parameters to obtain dual domains. The fabricated NCB mode LCD had fast response time (ton+toff) less than 8ms and a high contrast ratio of over 800:1.

LCT7 - 4
17:50

Color Reflective RGBW BiNem Display

J. Osterman, S. Jacquier, C. Joubert, J.-D. Laffitte, J. Angelé, F. Leblanc
Nemoptic, France

A color reflective RGBW Q-SVGA BiNem® display with 100 dpi resolution and 5.1" diagonal has been developed. The manufacturing was performed on 14"×16" color filter glass substrates using standard LCD production equipments. The brightness is measured to >20% at acceptable color saturation, and 16 graylevels are demonstrated.

Author Interviews
18:10 – 19:10

Friday, December 7

9:00 - 12:00 **Main Hall C**

Poster LCTp1: LCD Modes (1)

LCTp1 - 1

Novel Single Cell Gap Single Mode Transflective Display Based on HAN Cell

P. Xu, H. Y. Mak, V. Chigrinov, H. S. Kwok
Hong Kong Univ. of S&T, Hong Kong

New transflective LCD with single cell gap has been studied. Compared to double cell gap structure and single cell gap with two modes, fabrication of single cell gap structure consisting single mode is much easier. Based on this new configuration, transflective LCD with high brightness and contrast could be obtained.

LCTp1 - 2 **Optimized Single Cell Gap Transflective LCD without Sub-Pixels Separation**

H. Y. Mak, P. Xu, X. Li, V. Chigrinov, H. S. Kwok
Hong Kong Univ. of S&T, Hong Kong

Twisted Nematic (TN) liquid crystal display is optimized for transflective liquid crystal displays. Each pixel of the new configuration is partially transmissive and reflective with the help of a semi transparent mirror. This TN LCD configuration has a good performance, easy to fabricate and suitable for high quality transflective TFT-LCDs.

LCTp1 - 3 **Wide Viewing Angle and Minimum Gray Color Shift for Transflective ECB Mode with Low Cost**

J. I. Lim[,**], W. S. Park[*], S. H. Ahn[*], C. W. Kim[*], J. S. Yi[**]*
[*]Samsung Elect., Korea
[**]Sungkyunkwan Univ., Korea

Transflective ECB mode without wideband quarter-wave retarder plate has gray color shift problem, narrow viewing angle and low contrast ratio. In order to overcome this problem, we optimized configuration of transflective ECB mode and driving voltage condition by appling A-plate We obtained small gray color shift, and wide viewing angle.

LCTp1 - 4 **Low Blue Shift and High Transmittance Transflective LCD with Multi Cell Gap Design**

Y.-L. Lin, H.-C. Tung, C.-J. Hu, F.-Y. Gan
AU Optronics, Taiwan

We demonstrate the multi cell gap design in transflective LCD for obtaining different gaps among pixel. We change the total thickness of the insulating layer on the array substrate to construct multi cell gap structure. Our result shows that transmittance of LCD with multi cell gap design can be increased by 11.8%, and blue shift can be less than 0.05.

LCTp1 - 5 **Microlens Arrays Design to Improve the Brightness for Transflective LCD**

H. K. Shin, T.-H. Yoon, J. C. Kim
Pusan Nat. Univ., Korea

We propose a new transflective liquid crystal display with two microlens arrays and a transflective plate. With minimal transmission area, high light efficiency can be obtained for both reflective and transmissive modes, respectively. Compared with the conventional structure, the light efficiencies increase by 97% and 80% in transmissive and reflective modes, respectively.

LCTp1 - 6 **Simulation of High Brightness on Transflective LCD with Micro Cylindrical Lens Array**

C.-W. Chen, Y.-H. Chang, C.-Y. Chen, Y.-F. Wang, H.-C. Wu, C.-C. Lin[*]
Nat. Yunlin Univ. of S&T, Taiwan
[*]Chunghwa Picture Tubes, Taiwan

We propose an optical component for transflective liquid -crystal displays (LCDs). Several micro cylindrical lens array structures were designed and compared using the optical simulation software LIGHTTOOL. Simulation results demonstrated that the cylindrica l lens arrays enhance brightness in both the reflective and transflective mode. The optimized structure effectively collects more ambient light and also improves the backlight system ratio.

LCTp1 - 7 **A New Transflective OCB-LCD with Fast Response Time and Wide Viewing Angle**

I. Fukuda, T. Ohnishi, T. Ishinabe[*], T. Uchida[*]
Kanazawa Inst. of Tech., Japan
[*]Tohoku Univ., Japan

A new transflective LCD using an OCB-mode LCD was designed to improve response time and viewing-angle of transflective displays. We verified that a wide viewing-angle exceeding ±80° (CR > 10:1) could be achieved in both reflective and transmissive parts by using optimum design parameters of compensation films.

LCTp1 - 8 **A Motion-Blur-Free OCB-LCD for Mobile TV Applications**

S.-H. Chang, I.-A. Yao, P.-P. Liao, C.-J. Chen, C.-L. Yang, J.-P. Pang
Innolux Display, Taiwan

Optically Compensated Bend (OCB) LCDs using black insertion technology, blinking backlight technology and ultra aperture ratio (UHA) technology have been developed for mobile displays. The pseudo-impulse driving method significantly improves the motion picture quality of conventional hold-type LCDs. The UHA technology can further improves the insufficient transmittance of OCB LCD caused by the impulse driving method.

LCTp1 - 9 **A High Performance OCB-LCD for Slim TV Applications**

I.-A. Yao, S.-H. Chang, Y.-J. Hsu, K.-W. Chien, C.-J. Chen, C.-L. Yang, J.-P. Pang
Innolux Display, Taiwan

We have developed 15.4"W (WXGA) OCB LCDs by combing black insertion technology with scanning backlight technology. In order to achieve the slim LCD module application, we developed the novel side-edge scanning LED backlight to replace the conventional direct-type scanning LED backlight. Based on this technology, the high efficiency slim LCD TV with MPRT less than 6 ms could be achieved.

LCTp1 - 10 **Novel Electrode Structure in the Super In-Plane Switching LC Cell for Fast Response Time**

J.-S. Yang, J.-H. Lee[*]*, S.-W. Choi*[*]*, G.-D. Lee*
Dong-A Univ., Korea
[*]*LG.Philips LCD, Korea*

We propose a novel electrode structure for fast response time in the Super In-Plane Switching(S-IPS) LC cell. To improve the response time of the S-IPS cell, the bent electrode is applied to the conventional structure. As a result, we could achieve fast response time compared to the conventional structure.

LCTp1 - 11 **Fast Response TN-LC for Color Sequential Displays**

C.-N. Mo, W.-C. Lin, S.-L. Lyu
Chunghwa Picture Tubes, Taiwan

To fabricate a color sequential display based on TN liquid crystal materials was attempted. Electro-optical properties of switching speed, contrast, and surface alignment were illustrated as functions of intrinsic anisotropy. We investigated the electro-optical effect of the unsymmetrical switching properties in rise and decay of twist nematic liquid crystal.

LCTp1 - 12 **A New Optical Configuration for Transflective Ferroelectric LCD with Single Cell Gap**

X. Li, P. Xu, A. Murauki, V. Chigrinov
Hong Kong Univ. of S&T, Hong Kong

We propose a new optical configuration of transflective FLC display mode with single cell gap. Since no double cell gap structure, no sub pixels separation or patterning polarizers or retarders are included in the configuration, the fabrication process is very easy.

LCTp1 - 13 Electro-Optical Response of an Overdriven LCD

J.-J. Wu, S.-H. Fan, S.-S. Wei, Y. Shen[*], C.-C. Peng[*]
Nat. Taipei Univ. of Tech., Taiwan
[*]VastView Tech., Taiwan

An overdriven MVA liquid crystal display at low gray level usually shows optical bounce phenomenon that results in double edge and motion image blur. In this study, we investigated the MVA display and found out the cause of the optical bounce.

LCTp1 - 14 Low Cost and High Optical Performance Mobile Phone MVA LCDs with the Elimination of Both Protrusion and ITO Slit Geometries

H. L. Ong, C. C. Chiu, C. M. Huang[*], C. C. Lee[*],
C. F. Hsu[*], F. C. Wu[*]
Kyoritsu Optronics, Taiwan
[*]Wintek, Taiwan

We successfully fabricated high-performance MVA LCDs at low cost for mobile phone applications while eliminating both protrusions and ITO slit geometries. We designed special pixels to amplify the weak fringe field effects based on Kyoritsu's new amplified intrinsic fringe field MVA technology. The fabrication process is simple and high yield. The cost is even lower than wide viewing angle TN.

LCTp1 - 15 Optical Design of Reflective LC Mode for Wide Viewing Angle

T. W. Ko, K.-M. Kim[*], J. C. Kim[**], H. C. Choi, S. H. Lee[***],
G.-D. Lee[***]
LG.Philips LCD, Korea
[*]Dong-A Univ., Korea
[**]Busan Nat. Univ., Korea
[***]Chonbuk Nat. Univ., Korea

We proposed an optical configuration of a reflective LCD for wide viewing angle and high contrast ratio. We optimize the configuration of the proposed LC cell on the Poincaré sphere. To verify the optical performance, we experimentally compare the proposed LC cell with the conventional LC cell.

LCTp1 - 16 Autonomous Compensation in Improving Viewing Angle-Dependent Color Deviation and Maintaining Contrast Ratio of Vertically-Aligned TFT-LCD

Y.-Y. Huang, Y.-M. Chen, C.-C. Lin, C.-R. Lee, H.-T. Yu
Chunghwa Picture Tubes, Taiwan

A feasible avenue has been investigated to concurrently improve the color deviation and contrast ratio of a preexisting 4-domain vertical alignment mode through the well utilization of the naturally different sensitivity of electric field of two distinct liquid crystals that may result in the sphere-like optical axis distribution in space.

LCTp1 - 17 Controllable Viewing Angle LCD in PVA Mode

W.-J. Shin, T. Y. Won
Inha Univ., Korea

We report our theoretical study on the viewing angle controllability of a LCD, with a single LC layer. Our numerical simulation revealed that the range of viewing angle wherein the CR is greater than 50:1 is calculated to be 180° for wide viewing angle mode while that for narrow viewing angle mode being 40° with respect to the horizontal direction.

LCTp1 - 18 Investigation of Twist-to-Splay Transition Behavior of Bistable Chiral Splay Nematic LCD with Four-Terminal Electrode Structure

K.-S. Min, S.-H. Park, C. G. Jhun, J. C. Kim[*], S.-B. Kwon
Hoseo Univ., Korea
[*]Pusan Nat. Univ., Korea

If a strong horizontal field is applied to the π twist state of the BCSN mode, the twist-to-splay transition occurs. When the applied voltage is removed, the re-twist process, which increases the transition time, is observed between the grid electrodes. In this paper, electrode structure effects on the re-twist phenomenon are described.

LCTp1 - 19 Electro-Optical Modes of Multistable Ferroelectric LCD Cells

E. P. Pozhidaev[,**], V. G. Chigrinov[*], H. Gurumurthy[*], P. Xu[*], H. S. Kwok[*]*
[*]Hong Kong Univ. of S&T, Hong Kong
[**]P.N.Lebedev Phys. Inst. of Russian Ac. of Scis., Russia

The multistability effect exhibiting in FLC is responsible for three new electrooptical modes with continuous, memorized and reversible gray scale. The modes differ among themselves under the shape of the gray scale curve that can be either S (double or single) or V-shaped. Origin of the phenomenon is under consideration.

LCTp1 - 20L Optical Design of a Transflective Dual Mode Liquid Crystal Cell

J. H. Lee, S. R. Lee, C. P. Chen, C. G. Jhun[*], T.-H. Yoon, J. C. Kim
Pusan Nat. Univ., Korea
[*]Hoseo Univ., Korea

We propose an optical configuration of a transflective dual mode liquid crystal cell, which has transmissive dynamic and reflective memory sub-cells. It is designed to obtain wide-band characteristics in both sub-sells with the same compensation film, single cell-gap, and single rubbing direction. The proposed cell shows high contrast ratio and low driving voltage.

LCTp1 - 21L **Normally Black Twisted-Nematic LC Device with High Contrast Ratio**

K.-H. Kim, J.-I. Baek, J. C. Kim, T.-H. Yoon
Pusan Nat. Univ., Korea

We propose an optical configuration for a normally black twisted-nematic liquid crystal device. We employed a half-wave plate (HWP) and a +A plate to achieve the superior dark state. Furthermore, excellent dispersion characteristics were also obtained in the bright state.

LCTp1 - 22L **Single Cell Gap Transflective Low-Twist-IPS LCD**

D. L. Park, D. H. Kim, I. D. Song, S. I. Park, N. Y. Lee, G. S. Lee[*], J. H. Lee[*], J. C. Kim[*], T. H. Yoon[*]
LG.Philips LCD, Korea
[*]Pusan Nat. Univ., Korea

In this paper we propose in-plane switching of a low twist liquid crystal cell for single cell gap transflective LCD. We achieved single cell gap in transflective display without any in-cell patterned retarder by using a TN LC layer and obtained single gamma by optimizing electrodes.

LCTp1 - 23L **Method to Improve Viewing Angle Properties of ECB Mode LCD**

C.-C. Chen, W.-Y. Ling, C.-J. Chen
Innolux Display, Taiwan

We proposed a novel compensated ECB LCD with optimized driving voltage and SWV with inner diffusion film was used. The optical performance of ECB parallel alignment panel can be improved. As a result, viewing angle enlarged to 70/70/70/70(U/D/L/R) and without gray level inversion phenomenon around polar 60 deg.

9:00 - 12:00 **Main Hall C**

Poster LCTp2: Novel LCDs

LCTp2 - 1 **Ultraviolet Embossed Alignment Layer for Flexible LCD**

H. Hah, S.-J. Sung[*], J.-K. Park
KAIST, Korea
[*]Samsung Elect., Korea

UV embossed alignment layer for the flexible LCD was fabricated to prevent from problems encountered with thermal treatment of rubbing process on plastic substrate. The mechanical stability was achieved by polymer wall. In bent environment, UV embossed alignment layer for the flexible LCD provided good LC properties and mechanical stability.

LCTp2 - 2 **A Novel Method to Calculate Electro-Optical Properties of Polymer Stabilized Nematic LC Cell**

Y. Asakawa, T. Takahashi, S. Saito
Kogakuin Univ., Japan

A novel method is proposed to calculate theoretically the molecular alignment in LC cell taking account of the variation of the polymer stabilization coefficient along the cell thickness direction. Due to the method, theoretical treatments become possible for the generation of pre-tilt angle by polymer stabilization under the voltage application.

LCTp2 - 3 **Spontaneous Vertical Alignment of Nanoparticles-Doped LCs and Its Application of Hybrid Aligned Nematic Mode**

C. W. Kuo, S. C. Jeng, H. L. Wang, W. Y. Teng, C. C. Liao
ITRI, Taiwan

We investigated the electro-optical properties of nanoparticles-doped hybrid aligned nematic (HAN) cells. Nanoparticles induced the spontaneous vertical alignment of LCs, hence the vertical alignment layers can be eliminated from traditional HAN cells. This alignment method is suitable for the production of flexible LCD requiring low temperature process.

LCTp2 - 4 **Nano-Particle Behaviors in LC Cells Having a Single-Sided Alignment Layer Structure**

M. Inoue[,**], S. Tasaka[*], H. Imaoka[*], S. Sano[***],*
K. Takatoh[*], S. Kobayashi[*]
[*]Tokyo Univ. of Sci. Yamaguchi, Japan
[**]Toyo, Japan
[***]Ube Material Ind., Japan

We have confirmed that the amount of mobile ions in the LC cells decreases if nanoparticles of MgO and SiO_2 are doped into the liquid crystal or alignment layer. We also have succeeded in identifying the ion polarity by fabricating and using LC cells having a single-sided alignment layer structure.

LCTp2 - 5 **Enhancement of Contrast Ratio by Using Ferroelectric Nanoparticles in the Alignment Layer**

S. Kundu, M. Akimoto, I. Hirayama, S. Kobayashi,
K. Takatoh
Tokyo Univ. of Sci. Yamaguchi, Japan

We demonstrate the effect of the ferrorlectric nano particles dispersed in the alignment layer of a TN LC panel. In comparison to the ordinary TN LC panel with commonly used polymide layer, the TN LC panelswith alignment layer doped with ferroelectric nanoparticles in different percentages show much higher contrast ratio. 2.5 wt% and 5 wt% BTO mixtures shows better performances.

LCTp2 - 6 **Switching Characteristics of Polymer-Stabilized Dual-Frequency LC π Cell**

C.-Y. Huang, R.-X. Fung, Y.-G. Lin, C.-T. Hsieh
Nat. Changhua Univ. of Education, Taiwan

We fabricate a non-bias dual-frequency polymer-stabilized LC pi cell. The high curing voltage and low curing intensity give the cell a low dark state and a high bright state. The response time is under 1 ms due to the strong electric torque. The low operating voltage of ~ 5V makes the cell compatible with conventional TFT driving voltages.

LCTp2 - 7 **Dual Domain TN-LC Mode Mixed with UV-Curable Reactive Mesogen**

S. S. Kim, S. H. Hwang, S. G. Kim, Y. J. Lim,
A. K. Srivastava, M.-H. Lee, S. H. Lee
Chonbuk Nat. Univ., Korea

The TN-LC has a problem of gray scale inversion. To improve this problem, dual domain was employed by forming different pretilt angle in each domain using polymerization of UV-curable RM. Consequently, dual domain was formed and gray scale inversion of mid-gray level was improved especially in lower direction.

LCTp2 - 8 **Withdrawn**

LCTp2 - 9L **Nanoparticles-Induced Vertical Alignment in Dye-Doped Guest-Host Liquid Crystal Display**

W.-Y. Teng, S.-C. Jeng[*]*, C.-W. Chen, C.-W. Kuo*[*]*,*
Y.-R. Lin[*]*, C.-C. Liao*[*]*, J.-T. Shy, W.-K. Chin*
Nat. Tsing Hua Univ., Taiwan
[*]*ITRI, Taiwan*

This research is to develop a Guest-Host liquid crystal display (GH-LCD) using the method of nanoparticles-induced vertical alignment (NIVA). The NIVA is very similar to the conventional homeotropic LC cell with vertical alignment layers, and it can be applied to manufacture flexible plastic LCD requiring the low temperature process.

9:00 - 12:00 **Main Hall C**

Poster LCTp3: Display Measurement

LCTp3 - 1 **Multi Cell Gap Measurement for Red / Green / Blue Pixels in LCD**

Y. Li, H. Y. Yun, S. H. Ahn, C. W. Kim
Samsung Elect., Korea

A measurement method is developed to obtain the multi cell gap of Red / Green / Blue pixels in LCD. Cell gap in different color pixels (Red, Blue and Green) may not be same due to the layer structure and manufacture process. To obtain these cell gap results is very useful for process evaluation, panel design and optical properties improvement.

LCTp3 - 2 **A New Method of Measurement to Determine the Pretilt Angle and Cell Gap of a π-Cell**

S.-Y. Chien, W.-C. Chen, K.-H. Yang
HannStar Display, Taiwan

A new method to determine the pretilt angle and cell gap of a π-cell is proposed. Utilizing a curve fitting procedure that compares the measured angular retardation of a π-cell with the theoretical retardation of a model, the pretilt angle and cell gap of a π-cell can be measured directly instead of deriving data from measuring a corresponding homogeneous cell.

LCTp3 - 3 **Comparison between Field Sequential FLCD and the Other Displays by Using 2D Colorimeter**

Y. Kaneko[*], M. Inoue[,**], K. Takatoh[**], T. Miyama[**], S. Kobayashi[**], J. Frausing[***], J. Jensen[***]*
[*]Toyo, Japan
[**]Tokyo Univ. of Sci. Yamaguchi, Japan
[***]Delta, Denmark

The Field Sequential FLCD (Ferroelectric Liquid Crystal Display) has been reported as one of the high-speed (fast response time), superior color reproductivity and high contrast ratio displays. We have confirmed that Field Sequential FLCD has better ability than TN mode and OCB mode by using ICAM as 2D colorimeter.

LCTp3 - 4 **A Modeling of LC Director Using a Fast Q-Tensor Method for Dynamics Characteristics**

Y.-H. Choi, G.-D. Lee
Dong-A Univ., Korea

We modeled LC dynamics simulator using a fast Q-tensor method which can model the configuration of the liquid crystal director fields containing defect dynamics. From the simulation, we can observe the results by using a fast Q-tensor method is more similar the real LC cell than other methods.

LCTp3 - 5L **Column Spacer Design Rule for Thermal Stability of LCD**

H. C. Kim, H. S. Choi, J. I. Ryu, J. Y. Lee
BOE OptoElect. Tech., China

Thermal Stability of LCDs with Column Spacer were studied. Gravity mura and Bubble Defect are major problem of TFT-LCD with Column Spacer caused by Thermal Expansion of Liquid Crystal. We calculated inner pressure of panel and applied the results to LCD panel. And we achieved stability of the wide temperature range of LCD.

9:00 - 12:00 **Main Hall C**

Poster LCTp4: New Materials

LCTp4 - 1 Fast Response LC Materials for OCB Mode LCD

Y. H. Yao, Y. P. Hsieh, P. C. Chen, J. T. Chou, P. J. Hsieh, H. L. Kuo
ITRI, Taiwan

The performance of LC mixtures for OCB mode display is optimized by key additional components. Two compounds with thiocyano group are the key compounds. The resulting LC mixtures give over twice response speed than original one. A new LC mixture, SH-4 with speed of 0.884 ms was created.

LCTp4 - 2 Studies of the Motion of Vertical Aligned Biaxial Nematic LC

J. Y. You[*], N. C. Choi[**], J .Y. Jung[*], K. W. Rhie[*], S. T. Shin[,**]*
[*]Korea Univ., Korea
[**]Samsung Elect., Korea

We characterized ODBP-C7, a biaxial nematic liquid crystal by measuring with voltage-transmittance curve, and birefringence. We observed by birefringence measurement that different transmittance exhibited when it had with and without applied field. The motion of vertically aligned biaxial nematic LC can be explained by two optical characteristics of ODBP-C7.

LCTp4 - 3 Dye-Doped LC Electroluminescent Devices with a Polymer-Coated Cathode Structure

M. Honma, M. Sato, T. Nose
Akita Pref. Univ., Japan

Liquid crystal electroluminescent cells are fabricated by doping organic fluorescent dyes, and their electroluminescence properties are investigated. We propose a polymer-coated cathode structure to avoid the reduction and neutralization of cations on the surface of the cathode electrode. It is found that improvement of the luminance is successfully obtained.

LCTp4 - 4L **Nanostructured Liquid Crystal Composite with High Kerr Constant**

S.-W. Choi, S.-I. Yamamoto[*], Y. Haseba[*], H. Higuchi[**], H. Kikuchi[**]
JST, Japan
[*]Chisso Petrochem., Japan
[**]Kyushu Univ., Japan

We confirmed that the Kerr constant of nanostrutured chiral LC composites was closely related to the parameters of their host LCs, such as Δn, $\Delta \varepsilon$, and elastic constant ratio (K_{33}/K_{11}). We also succeeded in obtaining very larger Kerr composites by using the novel design rule of host LC.

9:00 - 12:00 **Main Hall C**

Poster **LCTp5: Alignment Process (1)**

LCTp5 - 1 **Photoalignment Properties of Brilliant Yellow Dye**

Y. Oleg[,**], H. Gurumurthy[*], V. G. Chigrinov[*], H. S. Kwok[*], H. Hasebe[***], H. Takatsu[***]*
[*]Hong Kong Univ. of S&T, Hong Kong
[**]Inst. of Phys., Ukraine
[***]Dainippon Ink & Chems., Japan

Photoalignment properties of commercially available Brilliant Yellow (BY) dye are investigated. Excellent photoalignment for different kinds of liquid crystals (LC) on BY films is observed. This alignment shows extraordinary high photo-and thermal stability. The alignment properties of this dye extend the field of the sulfuric azo dyes effective for photoalignment.

LCTp5 - 2 **Protrusion-Less VA Mode Generated by Hybrid Photo-Alignment Technology**

M.-H. Wu, R.-C. Yang
AU Optronics, Taiwan

MVA is widely applied in LCD industry. However, the light-leakage of dark-state leads to its contrast-ratio decreasing. We have developed a protrusion-less technique for solving this drawback by hybrid photo-alignment (HPA) technology. HPA combined photo-alignment technology with fine-slit pixel design, not only achieving high CR value but enhancing LC-alignment ability.

LCTp5 - 3 **Optimization of Photo-Alignment Layer for In-Cell Retarders**

Y. Kuwana, H. Hasebe, O. Yamazaki, K. Takeuchi, H. Takatsu, V. Chigrinov, H. S. Kwok**
Dainippon Ink & Chems., Japan
**Hong Kong Univ. of S&T, Hong Kong*

We have optimized a photo-alignment layer to suit for making in-cell retarders and achieved high thermal stability of the layer comparable to that of conventional rubbed PI alignment layer. Patterning resolution using optimized photo-alignment layer is also investigated.

LCTp5 - 4 **Photostability Evaluation of LC Cell by Far Field Observation**

*R. Yamaguchi, M. Ogura, S. Sato**
Akita Univ., Japan
**Akita Pref. R&D Ctr., Japan*

The real time evaluation of the LC cell photostability has been investigated by irradiating the focused blue-violet laser beam. The LC alignment degradation and/or decomposition cause after a few minutes irradiation. A far field pattern (FFP) appears and changes as a progress of the LC alignment degradation.

LCTp5 - 5 **Ferroelectric LC Aligned on SiO_2 Thin Films Using the Ion Beam Deposition**

X. Li, A. Murauski, V. Chigrinov, A. Khokhlov, E. Khoklov**
Hong Kong Univ. of S&T, Hong Kong
**Izovac, Belarus*

We present results of a ferroelectric liquid crystal (FLC) display cells, aligned on inorganic SiO_2 thin film surfaces by using oblique ion beam sputtering deposition on the substrates. High quality alignment on large size substrates was also easily achieved because of the linear design of the ion beam sputtering source, which was a big challenge for FLC on SiOx layers before.

LCTp5 - 6L **Characteristics of Liquid Crystal Alignment in High Aperture Ratio Fringe Field Switching Mode TFT-LCD by using Ion Beam Alignment**

S. Choi, D. Suh, Y. Park, O. Son, D. Lee, G. Son
BOE HYDIS Tech., Korea

We compared a polyimide alignment technology by ion beam to that by rubbing. Especially, we confirmed a difference of alignment ability in a shadow area of structure. We accomplished more uniform alignment by ion beam alignment compared with rubbing in high transmittance design of high aperture ratio FFS (HFFS) mode.

LCTp5 - 7L **Pretilt Angle Control of Liquid Crystal Cell by Ion Beam Alignment Method**

H. J. Jang, J-.H. Seo, S. R. Lee, D. H. Song, T.-H. Yoon, J. C. Kim
Pusan Nat. Univ., Korea

We investigate an Ar+ ion beam alignment process to control the pretilt angle of a liquid crystal cell. The vertical functional molecule of the alignment material is partially destructed by the ion beam. The pretilt angle is controlled by the remaining portion of the functional molecules. The wide pretilt angle range can be achieved from 0 to 90 degree.

9:00 - 12:00 **Main Hall C**

Poster **LCTp6: Alignment Process (2)**

LCTp6 - 1 **Effect of Soaking in Acetone on Rubbed Polyimide Film (PMDA-ODA) Studied by Grazing-Incidence X-Ray Diffraction: Dependence of Rubbing Condition on Crystallization by Acetone**

I. Hirosawa, T. Koganezawa, T. Sakai[*]
Japan Synchrotron Radiation Res. Inst., Japan
[*]Nissan Chem. Ind., Japan

We studied effect of washing by acetone on rubbed polyimide film by grazing incidence X-ray diffraction. Surface sensitive diffraction of strongly rubbed film in parallel to rubbing direction increased after soaking acetone. No increasing was observed in non-rubbed film. Thus, increasing of crystallinity by soaking depended on rubbing condition.

LCTp6 - 2 **Washing Effect on Rubbed Polyimide Film (PMDA-ODA) Studied by Grazing-Incidence X-Ray Diffraction**

T. Koganezawa, I. Hirosawa, T. Sakai[*]
Japan Synchrotron Radiation Res. Inst., Japan
[*]Nissan Chem. Ind., Japan

Effect of washing in several kinds of solvent on rubbed polyimide (PMDA-ODA) film was investigated by grazing incidence X-ray diffraction. Surface sensitive peaks of (002) reflection of as-rubbed polyimide film in parallel to rubbing direction became intense after soaking in all solvents. Thus, it was proved that washing process improve degree of crystallinity.

LCTp6 - 3 **Formation of Bi-Stable Anchoring Property for Nematic LCs Induced by Unidirectional Rubbing**

K. Shimoyama, T. Takahashi, S. Saito
Kogakuin Univ., Japan

A novel method is proposed to adapt bi-stable anchoring properties on the substrate. A mixed solution of PVCi and PI was used as an alignment material. It has been confirmed that two types of domains coexist in the sample cell, and molecules of liquid crystal align with an angle of 30 deg. to 45deg. with respect to the rubbing direction.

LCTp6 - 4 **LC Molecular Orientation in Membrane Films Studied by Capacitance Measurements**

R. Ito, A. Takeda, T. Nose
Akita Pref. Univ., Japan

Conformation change of the fibers in membrane film during the stretching process is investigated by SEM observations, and its LC molecular orientation effects are evaluated by capacitance measurements. It is confirmed that the LC molecules are well aligned along the fiber aligning structure and they can use to attain extremely thick LC layer for the longer wave length electromagnetic-wave applications.

LCTp6 - 5L **High-Precision Measurement of Polar Anchoring Strength and Capacitance of Alignment Layers**

R. Ogawa, Y. Ohno, T. Ishinabe, T. Miyashita, T. Uchida
Tohoku Univ., Japan

We devised a high precision measurement method for the polar anchoring strength and the capacitance of alignment layer. The measured result is constant to the cell gap, therefore, we confirmed the validly of this method.

9:00 - 12:00 **Main Hall C**

Poster LCTp7: LCD Modes (2)

LCTp7 - 1 **Color Washout Improvement for Mobile Display Application**

Y.-C. Lu, T.-C. Cheng, S.-L. Lee, C.-J. Hu, F. Y. Gan
AU Optronics, Taiwan

In this paper, we describe a solution for MVA technology for wider viewing angle. The MVA mode has a color-wash-out issue when viewing the panel in oblique direction. For small size media display, we have adapted 2G1D method to solve color washout issue. The experiment result shows that color washout is much improved and it is also consistent with the simulation result.

LCTp7 - 2 **Analysis of Grayscale Inversion of In-Plane Driving LC Mode**

S. J. Hsu, M. Shibazaki, C. Y. Tsai, C. J. Chang, S. W. Hsu, T. Inada*, W. C. Chang, D. L. Ting*
TPO Displays, Taiwan
**TPO Displays Japan, Japan*

We have studied a root cause of grayscale inversion of In-plane driving liquid crystal mode by analyzing a polarized state of light by using the Poincare sphere. According to the upper result, we could solve the grayscale inversion by using a bi-axial retardation film. As a result, we could confirm the excellent viewing angle performance without any grayscale inversion.

LCTp7 - 3 **Advanced AFFS$^+$ Technology for Upgraded Outdoor Readability**

J. B. Park, S. Choi, C. H. Lee, M. C. Kim, S. J. Jang, K. H. Park, Y. S. Cho
HYDIS Tech., Korea

We developed novel AFFS+ technology with improved outdoor readability compared to conventional one. Instead of AR concept, AG/AR technology is adopted for improving rainbow moiré and mirror effect which were induced by AR polarizer. And, the optimized structure of touch screen (TS) including circular polarizer for AFFS+ module is proposed.

LCTp7 - 4 **Improvement of Gamma Variation by Monitoring the Angle of Polarizer Absorption Axis**

C.-W. Wu, C.-J. Huang, C.-C. Hu, Y.-L. Cheng
Chunghwa Picture Tubes, Taiwan

Gamma is one of the most important optical performance characteristics of a liquid crystal display. In this paper, we present investigations on the relationship between gamma and polarizer. The gamma variation caused from each polarizer variation could be improved by monitoring and controlling the axial direction of polarizers.

LCTp7 - 5 **Novel PVA Pixel Design for Mobile Touch Screen Panel Application with Excellent Optical Performance and Pressure Resistant Characteristics**

J. H. Kim, W. S. Park, Y. S. Yeo, J. Y. Lee, S. H. Ahn, C. W. Kim
Samsung Elect., Korea

We developed a novel PVA LCD for mobile touch screen panel (TSP) application with excellent optical performance and pressure resistant characteristics by optimizing pixel structure and fabrication process. Our new pixel design rule enabled better electro-optical properties, less ripple and bruising characteristics compared with those of the conventional PVA structure.

LCTp7 - 6 **Numerical Simulation of LCD under Grid Computing System**

S. Y. Cho, H. J. Yoon, T. Y. Won*
Inha Univ., Korea
**Sanayi Sys., Korea*

We report numerical study on the optical properties for the design of LCD panel under grid computing environment. We compared results of simulation by grid computing with verified results of simulation by one pc. We are to expect grid computing system capacity of large scale data and simulation time reduced.

LCTp7 - 7 **Optical Design of Reflective Horizontal-Switching LC Cell for Excellent Contrast Ratio**

K.-M. Kim, J.-H. Lee, G.-D. Lee*
Dong-A Univ., Korea
**LG.Philips LCD, Korea*

We propose an optical configuration for reflective LC cell with single polarizer, which can show high contrast ratio by eliminating phase dispersion. The proposed optical design was performed on a Poincaré sphere. From calculations, we confirm that the proposed configuration can show high contrast ratio compared with conventional configuration.

LCTp7 - 8 **Characteristics of Hybrid Type Alignment Film in Color TFT-LCD**

M. S. Kwak, H. R. Chung, J.-Y. Lee, J. H. Choi, K. R. Kim, S. P. Hong, C. H. Park, S. H. Choi, S. M. Lee, C. G. Lee
LG.Philips LCD, Korea

The structural behavior of Hybrid type Alignment Film that has different characteristics along as curing condition was analyzed by SEM and AFM. Formation of double layer was dependant with prebaking condition. Double layer surface morphologies was changed by the temperature condition were analyzed by AFM. Electrical characteristics measurements were studied as well to reveal the mechanism about the surface change.

LCTp7 - 9 **Study on Characterization of Outdoor Readability by AFFS$^+$ Panel with Surface Treated Acryl Cover**

M. C. Kim, Y. K. Song, Y. J. Shin, C. H. Lee, S. J. Jang, K. H. Park, Y. S. Jo
HYDIS Tech., Korea

We had announced AFFS$^+$ technology that was adopted with additional reflection area and anti-reflection (AR) pol. However, AR pol. has demerits such as low hardness and high cost compared to AG pol. Therefore we will investigate outdoor readability by AR & AG pol. in AFFS$^+$ with surface treated Acryl cover.

LCTp7 - 10 Research on Transmittance and Contrast Ratio with Wide Color Gamut

X. P. Zheng, H. J. Liu, D. K. Yoon, S. J. Lee, L. J. Huangfu, S. K. Lee
Beijing BOE OptoElect. Tech., China

When 19inch color gamut is changed from 72% to 92.6% by lamp and color filter spectrum tuning, panel transmittance increase from 6.15% to 6.29% and contrast ratio is changed from 824 to 991. In this research, the relationship between module spectrum and panel transmittance, contrast ratio is studied.

LCTp7 - 11L Viewing Angle Switching Panel Using Twisted Nematic Liquid Crystal

C. P. Chen, Y.-H. Kwon, T.-H. Yoon, J. C. Kim
Pusan Nat. Univ., Korea

A viewing angle switching panel usable for the conversion of wide and narrow viewing angle has been demonstrated. Unlike the previous designs, this one features twisted nematic liquid crystal and it is capable of switching the viewing angle omni-directionally by electrically controlling the birefringence effect of the LC layer.

LCTp7 - 12L Reduced Light Scattering Intensity from Liquid Crystal Layers for Higher Contrast Ratio in IPS-Pro LCDs

Y. Utsumi, D. Kajita, S. Takeda, H. Kagawa, I. Hiyama, Y. Tomioka, K. Ono[*]
Hitachi, Japan
[*]Hitachi Displays, Japan

We investigated the light scattering intensity of homogeneous alignment liquid crystal layers. We found that the light scattering intensity was proportional to a specific variable, consisting of the optical and mechanical properties of LCs and layer thickness. Using an optimized LC, we created IPS-Pro LCD with a high contrast ratio.

LCTp7 - 13L Multi-Color Liquid Crystal Display without Color Filter

S. K. Park, J. S. Kim, H. S. Cho[*], C. G. Jhun[**], S. B. Kwon[**]
Chungnam Nat. Univ., Korea
[*]NDIS, Korea
[**]Hoseo Univ., Korea

To make multi-color displays without color filter, R, G, B sub-pixel structured cholesteric LC cells have been studied. To make R, G, B colors, UV induced pitch variant chiral dopant was added to cholesteric LC mixtures. Through the optimization of the UV irradiation condition, vivid colors were achieved.

LCTp7 - 14L **Bistable Characteristics of Dual Frequency Nematic Liquid Crystal Cell with Pixel-Isolating Polymer Wall**

S. R. Lee, J. H. Lee, H. J. Jang, D. H. Song, T.-H. Yoon, J. C. Kim
Pusan Nat. Univ., Korea

We propose a bistable nematic LC mode which has π- and 2π-twisted states. The fast switching can be achieved by using a dual frequency LC. Due to the effect of pixel-isolating polymer wall and topological inequivalence between the two states, the cell has a possibility of good memory characteristic.

9:00 - 12:00 **Main Hall C**

Poster LCTp8: New Applications

LCTp8 - 1 **Appication of the Cholesteric LC as a Indicator of a Dairy Product Turned Sour**

N. C. Choi[,**], J. Y. Jung[*], K. W. Rhie[*], S. T. Shin[**]*
[*]Korea Univ., Korea
[**]Samsung Elect., Korea

Using the relaxation of a voltage holding ratio of twist nematic cell that was put in front of ChLC layer, we could know how long time did the sample pass by a change of the sample color. The color change according to time and temperature could be a good indicator of a dairy product or medicine turned sour.

LCTp8 - 2 **Electrically-Switchable Two-Dimensional LC Diffraction Grating**

J.-I. Baek, Y.-H. Kwon, K.-H. Kim, J. C. Kim, T.-H. Yoon
Pusan Nat. Univ., Korea

A 2D-LC diffraction grating is reported. Both top and bottom substrates induce the fringe-field, whose in-plane components are perpendicular to each other, by which the initially vertical-aligned LC forms 4-domain twisted-configuration in the presence of applied voltages. We demonstrate an electrically-switchable phase grating with polarization-independence by using the proposed structure.

LCTp8 - 3 **Method for Corresponding on Sunglasses in Mobile LCD**

K.-J. Lee, D.-H. Lim, J.-M. Park, Y.-J. Kim, B.-H. Jung, C.-H. Park
BOE HYDIS Tech., Korea

We investigated two conditions which could generate proper transmittance meeting our specification with sunglasses in mobile LCD. In order to solve this problem, we investigated two methods – i) Application of retardation film and ii) Rubbing angle change.

LCTp8 - 4 **Secure Display by Use of Visual Cryptography Based on Polarization Processing**

H. Yamamoto, Y. Hayasaki
Univ. of Tokushima, Japan

A new type of secure display has been realized by utilizing polarization processing. The viewing zone of a secret image is three-dimensionally limited by a pair of encrypted images so that only one person can view the secret information. The polarization processing improves the image quality of the decoded images.

LCTp8 - 5L **Synthesis of New Side-On Type Photochromic Nematic Liquid Crystalline Polymer and Its Photomechanical Behavior**

H.-J. Choi[*], Y.-J. Bae[*], L. C. Chien[**], M.-H. Lee[,**]*
[*]Chonbuk Nat. Univ., Korea
[**]Kent State Univ., USA

To explore novel photoresponsive liquid crystalline polymer (LCP) actuator, a new difunctional photosensitive nematic monomer was synthesized, and polymerized via acyclic diene metathesis polymerization (ADMET) method. A brown colored free-standing polymer film showed nematic liquid crystalline property, and photochromic effect. The fiber drawn from the melt polymer bent towards the direction of UV light upon irradiation.

15:10 - 16:35 **Conference Hall**

LCT8: Fast Response LCDs (2)

Chair: M. Ozaki, Osaka Univ, Japan
Co-Chair: O. Okumura, Seiko Epson, Japan

LCT8 - 1: 15:10 ***Invited*** **Tunable LC Negative-Zero-Positive Index Metamaterials**

I. C. Khoo
Pennsylvania State Univ., USA

We describe here two types of liquid crystalline meta-materials that possess tunable or recon-figurable negative-zero-positive index materials: core-shell nano-spheres randomly dispersed in aligned nematic LCs, and planar nano-structured frequency selective surfaces with aligned nematic LC. These meta-materials may find applications in the next generation reflective, transmissive, modulation and switching elements and devices in the visible – infrared – Terahertz and microwave regimes.

LCT8 - 2
15:35

Enhancement of LCDs Performance by Doping Nanoparticles of Inorganic Materials into Their Host Media and Interpretation of These Effects

K. Inoue[*], F. Haraguchi[*], H. Hoshi[*], Y. Saeki[*], S. Kodaira[*], M. Inoue[,**], K. Takatoh[*], S. Kobayashi[*]*
[*]Tokyo Univ. of Sci. Yamaguchi, Japan
[**]Toyo, Japan

It is shown that there occurs reduction of threshold voltage of TN and ECB LCDs doped with the nanoparticles of SiO_2 and MgO: this phenomenon is shown to be attributed to the reduction of order parameter due to the existence of these nanoparticles.

LCT8 - 3
15:55

Fast Response at Low Temperature of Nanoparticle Doped Nematic LCs

T. Takahashi, K. Miyamoto, Y. Toko[*], S. Takigawa[**], S. Yokoyama[**], N. Toshima[***], S. Kobayashi[***]
Kogakuin Univ., Japan
[*]Stanley Elec., Japan
[**]Ube Ind., Japan
[***]Tokyo Univ. of Sci. Yamaguchi, Japan

An STN-LCD doped with a special metal nanoparticles of Ag/Pd is shown to be useful for a direct dot matrix LCD and show a faster response time by 3 to 5 times compared to those without nanoparticles. This phenomenon is shown to be attributed to the reduction of rotational viscosity.

LCT8 - 4
16:15

Novel PSV-LCDs with Temperature Shift Free Operating Voltages Exhibiting High Speed Response, and Continuous Gray Scale for Field Sequential Full Color LCDs

T. Fujisawa, K. Takeuchi, I. Nishiyama, K. Maruyama, K. Hatsusaka, H. Hasebe, H. Takatsu, S. Kobayashi[*]
Dainippon Ink & Chems., Japan
[*]Tokyo Univ. of Sci. Yamaguchi, Japan

New photo-curable monomers and new FLC materials have been synthesized with aiming at largely updating the performance of FLCD exhibiting V-shaped switching called PSV-FLCD; and we succeed in reducing their operating voltage with temperature dependence free characteristics. We demonstrate a field sequential full color LCD with an excellent performance.

----- Break -----

16:50 - 17:50 **Conference Hall**

LCT9: Transflective LCDs

Chair: I. C. Khoo, Pensylvania State Univ., USA
Co-Chair: S. Komura, Hitachi Displays, Japan

LCT9 - 1
16:50

Fast Response Transflective LCD Using OCB Mode

M. Okita, E. Kisara, K. Nishiyama, K. Nakao
Toshiba Matsushita Display Tech., Japan

We have newly developed 4.3-inch diagonal transflective LCD using OCB (Optically Compensated Bend) mode. By using a dual gap structure and optimizing the parameters of retardation films and a LC cell, same gamma curves are obtained in the transmissive and reflective modes.

LCT9 - 2
17:10

Novel Transflective IPS-LCDs with Three Retardation Plates

J. Matsushima, S. Uehara, K. Sumiyoshi
NEC LCD Techs., Japan

We propose a novel transflective in-plane switching LCD structure with the three retardation plates. A wide viewing characteristic in transmissive mode and a high reflectance characteristic in reflective mode are obtained by means of the retardation plates system and vertically-driven reflective region.

LCT9 - 3
17:30 **Brightness Enhancement in Transflective LCD by Concentration of Uniaxially Collimated Light with a Micro-Lenticular Lens**

T. Sugita, M. Adachi, S. Komura[*], T. Nagata[*], M. Sasaki[*], N. Koganezawa[*], S. Nishizawa[*], N. Umebayashi[**], K. Shimazaki[**]
Hitachi, Japan
[*]Hitachi Displays, Japan
[**]Hitachi Maxell, Japan

We adapted a micro-lenticular lens to a transflective LCD with a small aperture ratio to improve the transmissive efficiency by concentrating uniaxially collimated light from a backlight developed for this lens. The lens designed for both high brightness and a desirable diffusion of light gives twice the luminance of a conventional backlight and enhances brightness over the whole display area.

Author Interviews
18:10 – 19:10

Supporting Organizations:
LC Physics and Condensed Matter Forum, JLCS
Chemistry and LC Material Forum, JLCS
Liquid Crystal Display Forum, JLCS
LC Photonics and Optical Device Forum, JLCS
Soft Matter Forum, JLCS
Molecular Alignment Electronics
Technical Group on Information Display, ITE
Technical Committee on Electronic Information Displays, Electronics Society, IEICE

EXHIBITION

13:00–17:00 Wednesday, Dec. 5
9:00–17:00 Thursday, Dec. 6
9:00–14:00 Friday, Dec. 7

Main Hall C
Sapporo Convention Center

Free admission with your registration name tag.

Workshop on Active Matrix Displays

Wednesday, December 5

13:20 - 14:35 **Main Hall A**

AMD1: TV Application -LCD vs. OLED-

Chair: Y. Yamamoto, Sharp, Japan
Co-Chair: M. Kimura, Ryukoku Univ., Japan

AMD1 - 1: 13:20 ***Invited*** **Novel IPS-Pro Technology for FHD LCD-TVs Driven at 120 Hz**

K. Ono, R. Oke, I. Mori, K. Endo
Hitachi Displays, Japan

By combining a zigzag pixel TFT arrangement and column line inversion driving, we reduced temperature increase of a data driver IC. The technology offers an advantage in that 37" FHD LCDs can be driven at 120 Hz with only eight 720-channel ICs. Furthermore, dynamic contrast ratio, greater than 2000:1, was obtained at horizontal viewing angles less than 160 degrees.

AMD1 - 2: 13:45 ***Invited*** **Stacked Source and Drain Structure for Micro Silicon TFT for Large Size OLED Display**

N. Morosawa, T. Nakayama, T. Arai, Y. Inagaki, K. Tatsuki, T. Urabe
Sony, Japan

A novel “Micro Silicon” technology for large size OLED display has been developed. The micro crystalline silicon TFTs crystallized by dLTA (diode Laser Thermal Anneal) system have high and stable current in a large display area. Moreover we developed a stacked source and drain structure for micro silicon TFT to have both high on-current and low off-current characteristics.

AMD1 - 3: 14:10 ***Invited*** **Characteristic of the 20.8-in. WXGA Polymer AM-OLED Integrating Micro Bump Light Scattering Reflector**

N. Kamiura
Toshiba Matsushita Display Tech., Japan

We have developed a 20.8-in. polymer AM-OLED display integrating a new light extraction structure. We introduced a micro bump light scattering reflector in the TFT glass substrate and investigated the characteristic of the display. The contrast ratio was over 300,000:1 and the viewing angle variation of the CIE(1976) coordinate Δu’v’ was less than 0.01 showing remarkable performance over wide viewing angle.

----- Break -----

15:00 - 16:20 **Main Hall A**

AMD2: LCD Application

Chair: T. Nishibe, Toshiba Matsushita Display Tech., Japan
Co-Chair: S. Hirota, Hitachi, Japan

AMD2 - 1
15:00

Improvement of Motion Blur for IPS-Pro LCD-TVs Driven by 180 Hz Impulsive Driving

I. Mori, Y. Sato, Y. Ooishi[*], K. Ono
Hitachi Displays, Japan
[*]Hitachi, Japan

We have developed a 32-in. diagonal TFT-LCD with an average normalized blurred edge time of 6.5ms using a 180Hz frame rate driving method that uses two driving schemes: interpolation of frame transformation from 60Hz to 90Hz, and impulsive driving of flexible black data insertion from 90Hz to 180Hz.

AMD2 - 2
15:20

Improving Off-Axis Image Quality for Mobile-MVA Applications

S.-C. Fan Jiang, C.-H. Lin, C.-M. Chang, C.-J. Hu, F.-Y. Gan
AU Optronics, Taiwan

Mobile multi-domains vertically alignment (M-MVA) display has been improved to achieve low color washout at large viewing angle. We utilized an extra capacitor ($C_{C.C}$) between C_{LC2} and source electrode to induce lower pixel voltage ($V_{C.C}$) and make an applicable ratio of different tilt-domains in one pixel to improve color washout.

AMD2 - 3 **Withdrawn**

AMD2 - 5L
15:40

A Fully Monolithic Wireless Display System

E. Zyambo, L. Lukama, C. Brown[*], K. Miyata[*], M. Brownlow
Sharp Labs. of Europe, UK
[*]Sharp, Japan

We present a fully monolithic wireless interface for mobile displays, fabricated with CG-Silicon thin film transistors. The new interface uses near-field inductive coupling to transfer wirelessly both the video data and power for the LCD and backlight. Experimental results are presented from a 2.2" QVGA prototype demonstrating 100% wireless operation.

AMD2 - 4
16:00 **A New Structure of Cu compound / Cu as the Metal Electrode for TFT LCD Process**

C.-N. Lin, B. Chen, F. Wu, W.-C. Tsai, C.-H. Chen, F.-Y. Gan, P.-L. Chen
AU Optronics, Taiwan

A Cu compound\Cu structure was deposited on glass or Si substrate by DC magnetron sputtering to form as the metal electrode layer. The Cu compound used as the interface layer between Cu and substrate could not only enhance the adhesion ability but also inhibit the diffusion of Cu into substrate.

----- Break -----

16:30 - 18:00 **Main Hall A**

AMD3: Novel Application

Chair: M.-K. Han, Seoul Nat. Univ., Korea
Co-Chair: H. Hamada, Sanyo Elec., Japan

AMD3 - 1: ***Invited*** **Wireless Power Transmission Sheet with**
16:30 **Organic FETs and Plastic MEMS Switches**

M. Takamiya, T. Sekitani, Y. Miyamoto, Y. Noguchi, H. Kawaguchi[*], T. Someya, T. Sakurai
Univ. of Tokyo, Japan
[*]Kobe Univ., Japan

Design innovations to overcome the shortcomings of a wireless power transmission sheet made with plastic MEMS switches and organic FETs (OFETs) for printable low-cost electronics are shown. The mixed circuits of MEMS switches and OFETs with two different frequencies reduce the number of coil sheets form 2 to 1.

AMD3 - 2: ***Invited*** **A CG Silicon System LCD with Optical Input**
16:55 **Function**

C. Brown, H. Kato, K. Maeda, B. Hadwen[*]
Sharp, Japan
[*]Sharp Labs. of Europe, UK

A 300ppi VGA CG Silicon System LCD with integrated optical input function is described. The input function is achieved by integrating a 1-transistor active pixel image sensor circuit within each display pixel. The sensor fixed pattern noise is substantially reduced through the use of a self-calibration system.

AMD3 - 3
17:20 **Integrated Ambient Light Sensor in LTPS LCD Panel with Silicon Nanocrystals Photosensor**

A.-T. Cho, W.-J. Chiang[*], C.-T. Peng, C.-W. Chao, C.-S. Weng, K.-C. Lin, F.-Y. Gan, C.-J. Lin[*], Y.-C. King[*]
AU Optronics, Taiwan
[*]Nat. Tsing Hua Univ., Taiwan

Photosensor using Si nanocrystals layer sandwiched between two electrodes with capacitance structure is first time proposed to integrate with ambient-light photo-sensing application on LTPS-LCD panels. Si-nanocrystals photosensor shows high optical-sensitivity in visible region for wide ambient-light illumination, can be integrated compatibly in LTPS with only one additional post-anneal manufacturing process.

AMD3 - 4
17:40 **Behavior Characterization of p/i/n Thin-Film Phototransistor**

Y. Nishizaki[*], T. Yamashita[*], T. Shima[*], M. Kimura[,**], H. Hara[***], S. Inoue[***]*
[*]Ryukoku Univ., Japan
[**]Innovative Materials & Processing Res. Ctr., Japan
[***]Seiko Epson, Japan

P/i/n thin-film phototransistor is characterized, and n-type and p-type behaviors are compared. Photo-induced current can be independent of applied voltage in saturation operation because depletion layer is formed in whole intrinsic region and electric field is unchanged in most intrinsic region. This is preferable for artificial retina.

Author Interviews
18:00 – 19:00

Thursday, December 6

9:00 - 10:30 **Main Hall A**

AMD4/OLED4: Organic TFT & OLED

Chair: J. Jang, Kyung Hee Univ., Korea
Co-Chair: Y. Fujisaki, NHK, Japan

AMD4/ OLED4 - 1: 9:00 ***Invited*** **A Flexible, Full-Color and Top-Emission AM-OLED Display Driven by OTFTs**

I. Yagi, N. Hirai, Y. Miyamoto, M. Noda, A. Imaoka, R. Yasuda, N. Yoneya, K. Nomoto, J. Kasahara, A. Yumoto, T. Urabe
Sony, Japan

We have demonstrated a flexible, full-color and top-emission AM-OLED display driven by an organic TFT backplane. Organic insulators, including a newly-developed gate insulator, are utilized for all the insulating layers of the backplane, which remarkably enhance both mechanical flexibility and specifications of the display.

AMD4/ OLED4 - 2: 9:25 ***Invited*** **Active Matrix Drive of Flexible Sheet Displays Using MIS-Type Organic Light-Emitting Transistors**

K. Kudo, K. Nakamura[*], T. Hata[*], A. Yoshizawa[*]
Chiba Univ., Japan
[*]Pioneer, Japan

We have developed novel metal-insulator-semiconductor-type organic light-emitting transistors (MIS-OLETs), and have improved the characteristics of the MIS-OLETs by optimizing the device structure. In addition, we have demonstrated an active matrix display using these MIS-OLETs fabricated on a plastic substrate.

AMD4/ OLED4 - 3 9:50 **High-Resolution AM-OLED Display with Top-Emitting Smart White and Overall Unified Brightness (OUB) Technology**

D.-Z. Peng, H.-L. Hsu, S.-C. Wang, P.-K. Su, R. Nishizawa
TPO Displays, Taiwan

A 2-in. QVGA (200 ppi) full-color AM-OLED display with top emission technology has been developed by WOLED with color filters. To improve the uniformity of the brightness, an Overall Unified Brightness (OUB) approach has been applied. With these technologies, a high-resolution AM-OLED display with better front-of-screen performance for mobile applications could be achieved.

AMD4/ OLED4 - 4 10:10 **New Fast Threshold Voltage Detecting Pixel Scheme for High Resolution and Large Area AMOLED Display**

H.-S. Shin, W.-K. Lee, S.-G. Park, T.-J. Ha, M.-K. Han
Seoul Nat. Univ., Korea

We propose a new polycrystalline silicon pixel scheme, which detects a threshold voltage rapidly by clock signal, for active matrix organic light emitting diode displays. We have fabricated the pixel circuit on the glass substrate and verified that the proposed pixel circuit could successfully compensate the threshold voltages variation.

----- Break -----

10:50 - 12:10 **Main Hall A**

AMD5: Organic TFT

Chair: K. Kudo, Chiba Univ., Japan
Co-Chair: K. Nomoto, Sony, Japan

AMD5 - 1: 10:50 ***Invited*** **Printed OTFT for Active Matrix Driven QR-LPD**

H. Maeda, M. Matsuoka, M. Nagae, H. Honda, T. Suzuki, H. Kobayashi
Dai Nippon Printing, Japan

Printed OTFT was fabricated with combination of printing technique and photo-assisted surface modification to define precise electrode pattern on plastic/glass substrate. Utilize this technique with solution processable gate insulating polymer and semiconductive polymer, 100 dpi AM backplane was obtained with uniform mobility. As a result, QR-LPD was successfully driven.

AMD5 - 2 11:15 **Five-Inch-Diagonal-Sized Full-Color Liquid Crystal Display Driven by Solution-Processed Organic Thin-Film Transistors**

M. Kawasaki, S. Imazeki, M. Fujimori, S. Hirota, T. Arai, T. Shiba, M. Ando
Hitachi, Japan

A five-inch-diagonal-sized QVGA liquid crystal display with organic thin-film transistors (OTFTs) has been demonstrated. A solution-processed organic semiconductor film, crystallized at a temperature of 100 °C, has been used to obtain good uniformity as well as high mobility of OTFT performance.

AMD5 - 3 11:35 **Field-Effect Transistors Based on Liquid Crystalline Oligothiophene Semiconductors with Solution Process**

M. Funahashi, F. Zhang, N. Tamaoki[*]
Univ. of Tokyo, Japan
[*]*Nat. Inst. of Advanced Ind. S&T, Japan*

2-Alkyl-5"-(p-alkylphenyl)terthiophenes were synthesized. They exhibited highly ordered smectic phases around room temperature. This compound was applied to thin film transistors fabricated with solution process. The surface morphology is remarkably developed by thermal annealing at low temperature. The carrier mobility was 0.042 cm^2/Vs with the on/off ratio exceeding 1000000.

AMD5 - 4L 11:55 **10.5-in. VGA All-printed Flexible Organic TFT Backplane for Electrophoretic Displays**

T. Okubo, Y. Kokubo, K. Hatta, R. Matsubara, M. Ishizaki, Y. Ugajin, N. Sekine, N. Kawashima, T. Fukuda*, A. Nomoto*, T. Ohe*, N. Kobayashi*, K. Nomoto*, J. Kasahara**
Toppan Printing, Japan
**Sony, Japan*

We have developed an all-printed flexible organic TFT with a short channel length below 10 μm and mobility of over 0.01 cm^2/Vs using an offset-based high-resolution printing technique and inkjet printing of small-molecule organic semiconductor. These technologies have been successfully applied to demonstrate a 10.5-in. VGA flexible active-matrix electrophoretic display driven by an all-printed organic TFT backplane.

----- Lunch -----

13:30 - 14:55 **Main Hall A**

AMD6: poly-Si TFT

Chair: H. Kumomi, Canon, Japan
Co-Chair: S. Horita, JAIST, Japan

AMD6 - 1: 13:30 ***Invited*** **Low Temperature Polysilicon TFTs on Polyimide Substrates for Flexible Display Applications**

G. Fortunato, M. Cuscunà, L. Maiolo, L. Mariucci, A. Minotti, A. Pecora, D. Simeone
IFN-CNR, Italy

A novel process to fabricate non self-aligned low-temperature poly-silicon TFTs on polyimide (PI) is presented. PI is spin-coated on Si-wafer carrier, thus overcoming difficulties in substrate handling and eliminating the problem of plastic shrinkage, and mechanically released from the carrier, after TFT fabrication. Electrical characteristics of the devices are presented.

AMD6 - 2 13:55 **New F-Shaped Triple Gate SLS-Processed n-Type Poly-Si TFT for Reducing Kink Effects**

S.-H. Choi, H.-S. Shin, S.-G. Park, M.-K. Han
Seoul Nat. Univ., Korea

We have proposed and fabricated a new F-shaped triple gate which successfully suppresses the kink current of sequential lateral solidification (SLS) - Processed polycrystalline silicon thin film transistors without any additional process. It is verified by experimental and simulation results. The proposed F-shaped triple-gate TFT reduces the kink effect of poly-Si TFT effectively.

AMD6 - 3
14:15 **Improvement of Electrical Characteristics for Fluorine-Ion Implanted Poly-Si TFTs Using Pr_2O_3 Gate Dielectric**

C.-W. Chang, J.-J. Huang, H.-R. Chang, T.-F. Lei
Nat. Chiao Tung Univ., Taiwan

High-performance fluorine-ion-implanted poly-Si TFTs with high-κ Pr_2O_3 gate dielectric are demonstrated. Experimental results have shown that the fluorine-doped poly-Si channel would effectively minimize the trap states, leading to improved electrical characteristics even without any hydrogenation process. In addition, the presence of fluorine in poly-Si TFT obviously exhibited superior electrical reliability.

AMD6 - 4
14:35 **Back- and Front-Interface Trap Densities Evaluation and Stress Effect of Poly-Si TFT**

K. Takatori, H. Asada, S. Kaneko
NEC LCD Techs., Japan

Using dual-gated poly-Si TFTs, the back- and front-interface trap densities are deduced from the extracted threshold voltage and the film thickness. When the positive-gate bias and temperature stress are applied, the variation of the back-interface trap density shows a correlation to the threshold voltage shift.

----- Break -----

15:10 - 16:35 **Main Hall A**

AMD7: Crystallization

Chair: G. Fortunato, IFN-CNR, Italy
Co-Chair: N. Matsuo, Univ. of Hyogo, Japan

AMD7 - 1:
15:10 ***Invited*** **SELAX Technology for Poly-Si TFTs Integrated with Amorphous-Si TFTs**

T. Kaitoh, T. Miyazawa, H. Miyake, T. Noda, T. Sakai, Y. Owaku, T. Saitoh
Hitachi Displays, Japan

An advanced LTPS (A-LTPS) manufacturing process, which enables production of LTPS-TFTs by utilizing the conventional a-Si TFT production line is developed. The a-Si TFT process was combined with SELAX technology to improve the carrier mobility in the region where the peripheral circuits are to be fabricated. A 2.4-in. IPS-LCD panel was successfully fabricated using the developed technology.

AMD7 - 2: 15:35 ***Invited*** **Recent Advance in Single-Shot Laser Crystallization Method for Large Si Grain Arrays**

T. Endo
ALTEDEC, Japan

We have developed an advanced phase-modulated excimer laser annealing method called "Pseudo-Single-Nucleus Lateral Crystallization". Two-dimensional array of large Si grains were obtained by a single shot. Most of grains could be considered pseudo-single-crystals. Here, we introduce our concept and present the characteristics of the grain analyzed by various tools.

AMD7 - 3 16:00 **Local Electrical Property of Coincidence Site Lattice Boundary in Location-Controlled Silicon Islands by Scanning Spread Resistance Microscopy**

N. Matsuki, R. Ishihara, A. Baiano, Y. Hiroshima[*]*,*
S. Inoue[*]*, C. I. M. Beenakker*
Delft Univ. of Tech., The Netherlands
[*]*Seiko Epson, Japan*

Local electrical property of coincidence site lattice boundary (CSLB) in a silicon island fabricated by μ-Czochralski was investigated using scanning spread resistance microscopy (SSRM). SSRM shows no electrical evidence at the {111}∑3 CSLB, while exhibits increase of resistance at {221}∑9 CSLB. This results show good similarity with our simulation.

AMD7 - 4L 16:20 **Characteristics of Pseudo-Single-Crystal Si TFTs**

M. Mitani, T. Endo, Y. Taniguchi, T. Katou, S. Shimoto, T. Ohno, S. Tsuboi, T. Okada, K. Azuma, G. Kawachi, M. Matsumura
ALTEDEC, Japan

We have characterized Si-TFTs fabricated in pseudo-single-crystal Si (PSX-Si) that was free of random grain boundaries. The field-effect mobility was 848 cm^2/Vs for the n-channel TFT. This value is very close to those for the SOI device. PSX-Si has crystal quality close to that of single-crystal Si.

----- Break -----

16:45 - 18:10 **Main Hall A**

AMD8: SOG & μc-Si TFT

Chair: N. Morosawa, Sony, Japan
Co-Chair: S. Utsunomiya, Seiko Epson, Japan

AMD8 - 1: 16:45 ***Invited*** **Future Development of SOG Technologies for Advanced Displays**

T. Nishibe, H. Nakamura
Toshiba Matsushita Display Tech., Japan

Some SOG displays with circuit integration are now on market successfully mainly in mobile phones which need to be skillfully designed only in the limited space. For aiming a larger scale of SOG displays, next-step development has just begun. In this paper, future development of SOG technologies will be forecasted and discussed.

AMD8 - 2 17:10 **2.4-in. VGA LTPS TFT-LCD with Low Voltage Driving**

Y. F. Liao, C. H. Tsai, C. F. Su, I. C. Shih, J. P. Liu
Chunghwa Picture Tubes, Taiwan

We developed a 2.4-inch diagonal, VGA (640x480xRGB) LTPS TFT-LCD with high resolution of 334 pixel-per-inch (ppi) and low voltage driving (5V). The panel was integrated level shift, vertical de-multiplexer, gate driver circuit and DC-DC converter circuit. The DC-DC converter implement to supply various voltages for panel circuits, therefore high voltage crystalline-Si (c-Si) data driver IC are unnecessary.

AMD8 - 3 17:30 **High Performance Bottom Gate μc-Si TFT Fabricated by Low Damage, High Density Plasma Source**

A. Hiroe, M. Hirayama, Y. Shirai, A. Teramoto, T. Ohmi
Tohoku Univ., Japan

New microwave (2.45GHz) plasma source for large area plasma chamber called CMEP is presented. μc-Si deposition trend has been investigated using microwave plasma CVD chamber, and bottom gate TFT has been fabricated. Mobility of 1.4cm^2/Vsec and on/off ratio of more than 10^5 is achieved after hydrogen plasma treatment.

AMD8 - 4 17:50 **Bottom-Gate Microcrystalline Silicon TFTs on PEN Plastic Substrate**

K. Kandoussi, T. Mohammed-Brahim, K. Belarbi,
C. Simon, N. Coulon
Univ. Rennes 1, France

Bottom-gate μc-Si TFTs are fabricated on plastic PEN substrate at a maximum process temperature of 180°C. μc-Si films are deposited by PECVD at 150°C. These TFTs exhibit an electron mobility of 5 cm^2/V.s, a low off-current even at a reverse gate voltage of -10V and stability under operating.

Author Interviews
18:10 – 19:10

Friday, December 7

9:00 - 12:00 **Room 107, 108**

Poster AMDp: Active-Matrix Display

AMDp - 1 **A Novel Pixel with 1G-2D Structure for MVA Mode LCD**

C. C. Chen, Y. C. Lin, W. M. Hung, C. J. Chen, C. L. Yang, J. P. Pang
Innolux Display, Taiwan

We have designed a novel pixel for multi- domain vertically aligned (MVA) mode TFT-LCDs, which is based on the structure of 1G-2D, whereas with driving method of 1G1D, by adopting two vertical parallel data line of different layers. It provides a solution to improve off-axis color washout of MVA mode, and has lager aperture ratio benefit compare with conventional 1G-2D structure.

AMDp - 2 **A Novel Device Structure with Low Color Shift for VA LCD**

Y. C. Lin, C. C. Chen, W. M. Hung, C. J. Chen, C. L. Yang, J. P. Pang
Innolux Display, Taiwan

We designed a novel pixel for VA mode LCD with a series-wound thin-film transistor circuit. With the method of 1G1D, the series-wound TFT circuit which comprises two TFT with different charging ability can achieve the performance of eight-domain technology and thus reduce the complication of driving design.

AMDp - 3 **Consistent Common Voltage MVA 8-Domain TFT-LCDs**

H. Y. Chen, T. H. Hsieh, C. L. Yang, J. P. Pang
Innolux Display, Taiwan

We have proposed a new MVA 8-domain pixel with 1G1D structure, and two series-wound TFTs structure. We focus on image sticking characteristic in our design. By taking a diagnosis of common inconsistent problem, we carefully adjusted the capacitances in individual sub-pixels to make both common voltage matching, and acquire an almost image sticking free performance.

AMDp - 4 **Additive Printing and Soft Lithography for AMLCD Organic Backplanes**

I. C. Sage, R. P. Tuffin, P. J. Rose
QinetiQ, UK

An organic active matrix backplane for driving large low resolution liquid crystal displays has been fabricated using inkjet and microcontact printing. Soft lithographic printing of the TFT electrodes is the only high resolution process; other steps are compatible with conventional printing. Efficient switching is achieved using solution processed organic semiconductor.

AMDp - 5 **6,13-bis(Triisopropylsilylethynyl) Pentacene Thin-Film Transistors Using Spun on Dielectric**

J.-H. Kwon, J.-H. Seo, S.-I. Shin, D. H. Choi, B.-K. Ju
Korea Univ., Korea

We present the latest results on the use of soluble materials such as organic semiconductors (OSCs) or gate-dielectrics for simplified processing of organic thin-film transistors (OTFTs). From electrical measurements, we obtained device performance characteristics such as charge carrier mobility, threshold voltage and subthreshold voltage, which were 6.48 $\times$ 10^{-3} cm^2/Vs, -13 V, and 1.83 V/decade, respectively.

AMDp - 6 **Organic Thin-Film Transistors with Soluble Processing Hybrid Dielectrics**

S.-I. Shin, J.-H. Kwon, J.-H. Seo, B.-K. Ju
Korea Univ., Korea

In this study, organic thin-film transistors (OTFTs) using pentacene as an organic semiconductor have been made by hybrid dielectrics of PVP / SOG into gate dielectrics by a spin coating method. We obtained devices with electrical characteristics, including field-effect mobility as large as 1.50 cm^2/Vs.

AMDp - 7 **Organic Thin-Film Transistors with Ink-Jet Printing Conductive Polymer as Top-Contact Electrodes**

K. T. Lin, J. P. Lu, C. H. Chen, Y. Z. Lee, K. Cheng
ITRI, Taiwan

We report results for organic thin-film transistor (OTFT) with ink-jet printed PEDOT as source-drain electrodes on pentacene semiconductor. Two- step printing process and substrate heating are required for solving the aggregation problem of water-based electrode solution onto the hydrophobic pentacene layer.

AMDp - 8 **Highly Sensitive Photoinduced Current Characteristic of π-Conjugated Dendrimer Based Organic Thin-Film Transistor**

S. J. Kim, M. Y. Cho, K. Kim, J. Joo, K. H. Kim, M. J. Cho, D. H. Choi
Korea Univ., Korea

We fabricated organic thin film transistors (OTFTs) using soluble π-conjugated dendrimer as 4(HP3T)-benzene and investigated current-voltage characteristics the OTFT devices with the condition of low intensity irradiation. We observed the variation of the source-drain current with varying the energy of incident light. The photo-responsivity of our devices was higher than that in previous reports.

AMDp - 9 **Characterization of Plastic-Based Organic Thin-Film Transistors with Nanocomposite Insulators**

G. H. Kim, S.-M. Yoon, C. A. Kim, K. S. Suh, H.-M. Youn, B.-U. Kim**
ETRI, Korea
**Dongjin Semichem, Korea*

Photosensitive nanocomposite materials, which were prepared by blending high-dielectric aluminum tin oxide into a photo-curable blend, exhibit excellent electrical, physical, and chemical properties. Dielectric constants increased with increasing the nanoparticle content. In order to explore the effects of our nanocomposite insulators, pentacene was deposited on various photo-cured nanocomposites, and the performance of organic thin-film transistors was investigated.

AMDp - 10 **Photoinduced Characteristics of Organic Thin-Film Transistor Using π-Conjugated Dendrimer**

M. Y. Cho, H. S. Kang, S. J. Kim, J. Joo, K. H. Kim, M. J. Cho, D. H. Choi
Korea Univ., Korea

We fabricated OTFT device using soluble π-conjugated dendrimer, 4(HPBT)-benzene, and investigated photoinduced characteristics of the device. The OTFT device showed a carrier mobility as high as 6×10^{-3} cm^2/Vs in dark conditions and sensitive photoinduced characteristics even at low light intensity. We observed the shift of threshold voltage and saturation current in photoinduced I_d-V_g characteristic curves.

AMDp - 11 **Turn-on Voltage Control of Pentacene Organic Thin-Film Transistor by UV Irradiation on SiO_2 Surface**

K. Hong, W.-K. Kim, S. Y. Kim, B. J. Song, J.-L. Lee
Pohang Univ. of S&T, Korea

The turn-on voltage of pentacene organic thin-film transistor was shifted from 6.8 to 0.4 V when the SiO_2 surface was exposed to UV-light. Photoemission spectroscopy results showed that surface silanol groups were converted to Si^{3+} after UV treatment. This led to the decrease of electron traps at the SiO_2/pentacene interface.

AMDp - 12 **N-Channel Organic Thin-Film Transistor Based on N,N'Dioctyl-3,4,9,10-Perylene Tetracarboxylic Diimide Grown by Organic Vapor Deposition**

K. J. Lee, S. H. Han, S. H. Lee, J. Jang
Kyung Hee Univ., Korea

We fabricated bottom contact n-type OTFT based on PTCDI-C_8 grown by OVD. The surface energy was selectively controlled by octadecyltrichlorosilane and oxygen plasma. We could obtain large PTCDI-C_8 grain on TFT area. The OTFT based on OVD grown PTCDI-C_8 was characterized in air without passivation.

AMDp - 13 **Effect of Imidization Ratio of Polymer Gate Insulator on Carrier Mobility of Pentacene-Based O-TFTs**

T. Houryu, Y. Iimura
Tokyo Univ. of A&T, Japan

We have studied the effect of imidization ratio of polymer gate materials, which induce homeotropic LC alignment, on the carrier mobility of pentacene-based O-TFTs. The mobility increases with decrease of imidization ratio, and it exceeds 1cm^2/Vs. We study the origin of the mobility enhancement, and clarify the positive correlation between the mobility and the crystalline quality of pentacene film.

AMDp - 14 **Determination of Capture Cross-Section of Trap States from On- and Off-Current Characteristic for Poly-Si TFTs**

M. Kimura[,**], T. Tsujino[*]*
[*]Ryukoku Univ., Japan
[**]Innovative Materials & Processing Res. Ctr., Japan

A novel technique to determine a capture cross-section of trap states is proposed for poly-Si TFTs. The energy profile of the trap state density is determined by fitting on-current characteristics of the measurement and simulation. The capture cross-section is determined by fitting off-current characteristics, which is 6×10^{-15} cm^2.

AMDp - 15 **The Electrical Characteristics of High-κ Pr_2O_3 Thin-Film Transistors with Nitrogen-Implanted Polysilicon Films**

C.-K. Deng, H.-R. Chang, B.-S. Chiou
Nat. Chiao Tung Univ., Taiwan

This paper demonstrates the poly-Si TFTs with high-κ Pr_2O_3 gate dielectric and nitrogen implantation to achieve high-performance characteristics. Nitrogen atoms with various dosages are implanted into α-Si film before SPC annealing. The electrical characteristics of Pr_2O_3 poly-Si TFT with the implanted nitrogen dosage of 5×10^{12} cm^{-2} could be greatly improved.

AMDp - 16 **Performance Improvement of Poly-Si TFTs under Reduced Thermal Activation Temperature**

B. Zhang, Z. G. Meng, S. Y. Zhao, M. Wong, H.-S. Kwok
Hong Kong Univ. of S&T, Hong Kong

As thermal activation temperature reduced, p-channel poly-Si TFTs presented improvements of electrical characteristics. This was attributed to the reduction of deep trap states generation at poly-Si/SiO_2 interface during source/drain activation. Low parasitic resistance and good reliability were still obtained for low temperature activated devices. Thus low temperature activation process is suggested for fabrication of high performance poly-Si TFTs.

AMDp - 17 **Study on a New Fabrication Technology of Poly-Si TFT by Direct Conversion from a-Si TFT**

S. Nishizaki, Y. Endo, T. Fujiwara, K. Ohdaira,
H. Matsumura
JAIST, Japan

This paper is to study on fundamental issues of a new fabrication technology of poly-Si TFT, in which bottom-gate a-Si TFT is directly converted to poly-Si TFT. It is revealed that this new approach to fabricate poly-Si TFT is feasible as a new low cost fabrication technology of poly-Si TFT.

AMDp - 18 **High Performance TFTs and PIN Sensors Fabricated by TDX Technology**

C.-W. Chao, C.-S. Weng, H.-W. Tseng, Y.-C. Lin,
C.-T. Peng, K.-C. Lin, F.-Y. Gan
AU Optronics, Taiwan

Thin-beam directional X'tallization (TDX) can form extremely long uniformly-spaced poly-Si grains without mask. We used TDX poly-Si film as active layer of TFT and PIN sensor. We found the performance of TFT and PIN sensor changed with the relationship between laser scan direction and channel direction. The anisotropic properties of TDX poly-Si film would induce the failure of LCD circuit.

AMDp - 19 **SiNx/SiO_2 Gate Insulator Effects on Reducing the Leakage Current of Poly-Si TFTs Employing Advanced Solid Phase Crystallization**

C.-Y. Kim[,**], H.-K. Lee[*], S.-H. Jung[*], C.-D. Kim[*],*
I. B. Kang[*], S.-G. Park[**], M.-K. Han[**]
[*]LG.Philips LCD, Korea
[**]Seoul Nat. Univ., Korea

Poly-Si TFTs employing advanced solid phase crystallization were fabricated and investigated. We adopted the dual layered gate insulator composed of silicon nitride (SiNx) and silicon oxide (SiO_2). The leakage current decreased by up to one order of magnitude compared with that of TFT with SiO_2 gate insulator and the breakdown field increased by 9 MV/cm.

AMDp - 20 **Material Properties of Low-Temperature Si Oxide Film Formed by Using Silicone Oil and Ozone Gas**

S. Horita, K. Toriyabe, K. Nishioka
JAIST, Japan

Si oxide films were deposited, using silicone oil and ozone at more than 200°C. The concentrations of C, H, Fe, Ni and Na are negligible for device performance. The TDS spectra showed that the films contained much of water. However, the electrical properties are comparable with those of TEOS film.

AMDp - 21 **A Novel Structure of LTPS PMOS Process for AMLCD**

Y.-W. Chen, M.-Y. Chen, Y.-C. Liao, T.-W. Chiu, H.-C. Hsieh, K.-C. Lin, F.-Y. Gan
AU Optronics, Taiwan

A simple PMOS poly-Si TFT structure was developed. Active and data line are patterned in one mask by partial exposure method, in which the S/D metal direct contact to active source/drain region and connect to data line without interlayer dielectric layer. The new structure can be accomplished with five masks.

AMDp - 22 **The Influence of Gate Bias on LDD Resistance in Poly-Si TFTs**

C.-C. Chiu, Y.-J. Hsu, C.-H. Lu, C.-C. Shih, K.-C. Lin, F.-Y. Gan
AU Optronics, Taiwan

The influence of gate bias on parasitic resistance has been investigated in poly-Si TFTs with lightly doped drain (LDD). The most significant point is that the carrier distribution in LDD region will be influenced by gate electric field as LDD length is smaller than 0.7μm when V_{GS} at 20V.

AMDp - 23 **Examination of Origin of Low-Temperature Process by Excimer Laser Annealing Following Laser-Plasma X-Ray Irradiation onto a-Si Film**

K. Uejukkoku, A. Heya, S. Amano, Y. Takanashi, S. Miyamoto, R. Takesako[*], M. Adachi[**], N. Matsuo, T. Mochizuki[*]
Univ. of Hyogo, Japan
[*]Nippon Gijutsucenter, Japan
[**]Meisyo Kiko, Japan

We investigated the crystallization by laser plasma soft-x-ray (LPX) irradiation followed by Excimer Laser Annealing (ELA). The crystalline fraction of poly-Si films prepared at 50 mJ/cm^2 for the LPX followed by the ELA was 80 %. The LPX irradiation before ELA decreased the critical energy density for the start of the crystallization.

AMDp - 24 Electrical Enhancement of Poly-Si TFTs Using FSG ILD Passivation

J.-J. Huang, C.-W. Chang, C.-K. Dneg, T.-F. Lei
Nat. Chiao Tung Univ., Taiwan

Polycrystalline silicon TFT with fluorinated silicate glass (FSG) inter-layer dielectric (ILD) passivation layer were proposed in this study. The outdiffused fluorine atoms from FSG ILD could replace Si dangling bonds at grain boundaries in poly-Si film. The proposed short-channel TFT with FSG ILD passivation have electrical enhancement.

AMDp - 25 Drastic Activation of Dopant in Si Film Using ELA for High-Performance TFT

T. Noguchi, K. Kawai, E. Kinjo, R. Nakamura, T. Miyahira, J. Kakazu, T. Suzuki[*], M. Sato[*]
Univ. of the Ryukyus, Japan
[*]SEN, Japan

After laser annealing for n- and p-doped Si film, the conductivity and the crystallinity were analyzed. The conductivity increased with improving the crystallinity. By an optimization, 50nm-thick film shows 50ohm/sq. for a B^+ dose of 5×10^{15} cm^{-2}. Laser activation is expected to source and drain or CMOS gate for SoP.

AMDp - 26 Effect of a-Si Thickness on Ni-Mediated Crystallization with Bottom-Gate TFT

D. H. Kang, J. H. Oh, W. H. Park, K. W. Ahn, B. S. Oh, J. Jang, Y. J. Chang[*], J. B. Choi[*], H. K. Min[*], C. W. Kim[*]
Kyung Hee Univ., Korea
[*]Samsung Elect., Korea

Nickel mediated crystallization of amorphous silicon has been studied with its thickness variation on the gate insulator of a bottom-gate TFT. With decreasing the thickness of an active layer from 150 nm to 50 nm, threshold voltage of the bottom-gate poly-Si TFT decreases from -5.8 V to 0.1 V and gate voltage swing changes from 1.76 to 0.49 V/dec.

AMDp - 27 Inverted-Staggered Non-Laser Poly-Si TFTs with a Very Thin a-Si Layer on Planarized Gate Insulator

K. W. Ahn, J. H. Oh, D. H. Kang, W. H. Park, B. S. Oh, J. H. Bae, J. H. Cheon, J. Jang, Y. J. Chang[*], H. K. Min[*], C. W. Kim[*]
Kyung Hee Univ., Korea
[*]Samsung Elect., Korea

We studied inverted-staggered thin-film transistor (TFT) with non-laser crystallization of a 20 nm thick amorphous silicon (a-Si:H) layer on planarized gate insulator. The n-channel poly-Si TFT with n+ a-Si:H source/drain contacts exhibited a field-effect mobility of 16.9 $cm^2/V{\cdot}s$, a threshold voltage of 1.9 V, and the minimum off-state current of ~3.0×10^{-12} A/μm at Vds = 10 V.

AMDp - 28 **5-in. WQVGA a-Si TFT LCD with High Reliability Integrated Gate Driver**

C. J. Shih, C. Y. Hsu, C. C. Kuo, C. P. Ku, C. K. Yu, C. H. Tsai
Chunghwa Picture Tubes, Taiwan

A 5" WQVGA (480x272) a-Si TFT LCD has been presented using integrated gate driver circuit. We proposed a reliable shift-register circuit for gate driver to suppress the Vth shift of the pull-low a-Si transistor after long time operation. By modifying the clock signals of the pull-down TFT, the periodically additional refreshment can decrease the charge-trapping effect.

AMDp - 29 **High Speed Amorphous Silicon Gate Driver Integration in 15-in. TFT-LCD Panels with Quad-Type Sub-Pixel Structure**

S. C. Choi, Y. H. Jang, S. Y. Yoon, B. Kim, H. N. Cho, M. D. Chun, N. W. Cho, S. H. Jo, K. S. Park, T. W. Mun, H. Y. Kim, C. I. Ryu, C.-D. Kim, I. B. Kang
LG.Philips LCD, Korea

We successfully integrated amorphous silicon gate drivers operating at the high driving speed (~90kHz) on 15-in. XGA TFT-LCD with a quad-type sub-pixel structure. The integrated gate drivers showed good electrical characteristics as well as high stability. The TFT-LCD demonstrated good performance, which has the high cost competitiveness with the reduced data drivers and the integrated gate drivers.

AMDp - 30 **A Novel Anti-Coupling Circuit Compensation Method for High Image Quality in Twisted Nematic Liquid Crystal Displays**

H. C. Liu, H. H. Wu, C. H. Yu, C. C. Tseng, K. C. Lee, Y. T. Lin, S. C. Lin, W. C. Fang, T. C. Chiu
HannStar Display, Taiwan

HannStar (HSD) present a novel anti-coupling circuit compensation method to inverse the common voltage signal which been influenced by coupling effect from panel feedback and gain the notable efficacy up to 30% for improving the Greenish and cross-talk and provides a dynamic and immediate compensation without extra cost.

AMDp - 31 Advanced Overdrive Method for Dynamic Impulsive Driving

E. G. Chen, S.-H. Chen, T.-H. Hsieh, C.-L. Yang, J.-P. Pang
Innolux Display, Taiwan

Tuning procedures for overdrive look-up table of flexible impulsive driving waveforms were developed. The motion picture quality was visually and quantitatively improved after application of new overdrive LUT. Different areas in overdrive LUT are applied different tuning method. MPRT was measured on fringe-field switching displays, and BET value shows 14% improvement to 10.2ms with the new overdrive method.

AMDp - 32 The Stability Comparison of Microcrystalline Silicon TFTs Fabricated at Different Temperatures

Y.-H. Peng, C.-C. Chang, Y.-S. Lee, C.-H. Chen, C.-Y. Hou, K.-F. Huang, T.-S.Huang, J.-K. Chang, H.-T. Chou
AU Optronics, Taiwan

Temperature and pressure effect of microcrystalline silicon film deposition have been investigated. Results show that non-porous μc-Si:H film can be successfully deposited at lower temperature and higher pressure by PECVD, and the good crystallinity of μc-Si:H film used as the channel layer can significantly improve the stability of μc-Si:H TFTs.

AMDp - 33 Amorphous-Layer-Free and Porous-Free Microcrystalline Silicon Grown under High Deposition Pressure by Conventional Plasma-Enhanced Chemical Vapor Deposition

K.-F. Huang, C.-Y. Hou, Y.-S. Lee, C.-H. Chen, Y.-H. Peng, H.-T. Chou, C.-C. Chang, T.-S. Huang, H.-C. Chiu
AU Optronics, Taiwan

Amorphous-layer-free and porous-free microcrystalline silicon grown at high pressure has been successfully produced by PECVD using the seeded growth method. μc-Si:H bottom gate TFTs show low subthreshould swing (1 V/degree) and high on-current, and this could be an alternative to polysilicon thin films for application of large-area AMLCDs.

AMDp - 34 **Development of Stable 14.1-in. Micro-Crystalline Silicon AMLCD at Low Temperature**

C.-C. Chang, C.-H. Chen, Y.-H. Peng, F.-S. Tseng, C.-Y. Hou, Y.-S. Lee, K.-F. Huang, H.-T. Shih, M.-T. Hsieh, J.-F. Chen**
AU Optronics, Taiwan
**Nat. Chiao Tung Univ., Taiwan*

Bottom-gate microcrystalline silicon thin film transistors (μc-Si TFTs) have been produced by the radio frequency glow discharge technique using three different plasma treatment on the interface between microcrystalline and SiN layers. Our first microcrystalline silicon TFTs have better stability at high temperature stress.

AMDp - 35 **Deposition of Porous-Free Microcrystalline Silicon Film for TFT Application in Large-Size AMLCDs**

Y.-S. Lee, C.-W. Lin, C.-C. Chang, C.-Y. Hou, K.-F. Huang, Y.-H. Peng, C.-H. Chen, J.-K. Chang, H.-T. Chou, T.-S. Huang, H.-C. Chiu*
AU Optronics, Taiwan
**Tatung Univ., Taiwan*

The deposition conditions containing lower plasma power, higher pressure, and adequate argon plasma can effectively deposit the device-quality μc-Si:H film without porous layer. Moreover, the electrical characteristics of TFTs with porous-free μc-Si:H film as a channel layer can be significantly improved as compared with that of conventional a-Si:H TFTs.

AMDp - 36 **Withdrawn**

AMDp - 37 **The High Temperature Stability of a-Si TFT Device**

C.-C. Shih, C.-C. Chang, C.-S. Wei, Y.-S. Lee, C.-H. Chen, F.-Y. Gan
AU Optronics, Taiwan

High temperature stability has been studied. It is found that the activation energy, sub-threshold slope can be reduced due to improved film quality. After Bias-High-Temperature Stress reliability test, the Vth shift and the ON current degradation of the improved a-Si:H TFT were smaller than the standard TFT device.

AMDp - 38 **Instability of Amorphous Silicon TFTs under AC Drain Bias Stress**

C.-C. Chiu, C.-C. Shih, K.-C. Lin, F.-Y. Gan
AU Optronics, Taiwan

The instability of amorphous silicon thin-film transistors (a-Si:H TFTs) under AC drain bias stress has been studied for the first time. The threshold voltage shift (ΔV_T) was found to be independent on the signal frequency. In addition, the degradation of a-Si:H TFTs was associated with duty ratio.

AMDp - 39 Hydrogenated Amorphous Silicon Thin-Film Transistors with Organic Passivation Layer

K.-L. Fang, H.-C. Wu, C.-Y. Liao, C.-C. Yang, H.-T. Lin, C.-H. Chen
AU Optronics, Taiwan

TFT with photosensitive organic material used as passivation layer reveals better electrical performance than that of conventional SiN_x. After Long time reliability test and stability test, this positive-tone photosensitive organic passivation film was successfully used to reduce process steps in our AMLCD panel.

AMDp - 40 Hydrogenated Amorphous Silicon TFT-LCD with Novel Non-Vacuum Plasma Etching

C.-C. Yang, C.-Y. Liao, K.-L. Fang, H.-T. Lin, C.-H. Chen
AU Optronics, Taiwan

BCE TFT is at first time successfully fabricated by a non-vacuum plasma etching. With newly developed non-vacuum plasma etching for a-Si etching of a-Si:H TFT, the high-cost cryopump can be saved and the production cost can be much lower than that of conventional vacuum dry etching process.

AMDp - 41 Analysis of the Leakage Current in a-Si:H TFT Device

J. Y. Yang, Y. K. Kang, S. P. Kim, W. S. Ryu, M. S. Yang, I. B. Kang
LG.Philips LCD, Korea

We have investigated the off-current characteristics of a-Si:H TFTs. According to our study, a phosphorous(P) contamination is a critical factor which causes to increase of the off-current. It can be suppressed by plasma treatment. There are two main effects; the first, residual P could be eliminated by etch out of a-Si:H surface. The second is compensation of defect sites.

AMDp - 42 The Electrical Characteristic of a-Si:H TFT Device by Back-Channel Treatment

P. M. Chen, W. Y. Lo, C. S. Wei, J. J. Shih, C. H. Shih, M. S. Chen, F. Y. Gen, T. Huang
AU Optronics, Taiwan

The electrical characteristic changes of a-Si:H TFT device by back-channel post treatment in different gas are investigated. The VG of minimum off-state leakage current will be shift to lower voltage by O_2, He and O_2/SF_6 compose gas treatment. The Bias-Temperature-Stress tests at O_2/SF_6 treated devices reveal the same reliability level as well as hydrogen treatment.

AMDp - 43 **The Effect of Passivation Materials on Electrical Performances of a-Si:H TFTs Fabricated on a Metal Foil**

S.-Y. Park, C.-W. Han, N.-B. Choi, C.-D. Kim, I.-B. Kang
LG.Philips LCD, Korea

A concept is introduced in which two dielectrics are made cooperative in acting as the passivation layer for a-Si:H TFTs fabricated on a metal foil. The bilayer insulator consists of silicon nitride (SiNx) in contact with the active layer that can prevent moisture penetration and a much thicker acrylic polymer with good bending properties under mechanical stress.

AMDp - 44 **Investigation on the Causes That Affected the Channel Length in the Thin Film Transistor Four Mask Fabrication Process**

T.-Y. Min, Z.-T. Wang, H.-J. Qiu, W.-B. Gao, S.-U. Choi, S. K. Lee
BOE OptoElect. Tech., China

To reduce the production cost and the investment in the TFT LCD industry, the four mask fabrication process with high yield and stable characteristic was developed. The channel length of Thin Film Transistor after a etch process was not only closely related photo-resist thickness of slit area, but also depended on a Ripple of photo-resist according to the channel slit design.

AMDp - 45 **Back-Channel Treatment Effect on the Off-State Leakage Current Suppression of a-Si TFT**

C.-S. Wei, C.-H. Shih, Y.-S. Lee, C.-H. Chen, C.-C. Chang, M.-S. Chen, F.-Y. Gan, T. Huang
AU Optronics, Taiwan

The back-channel treatment effects of N_2, NH_3, H_2 plasma on the suppression of off-state leakage current of a-Si:H TFTs under a backlight illumination or high temperature operation have been investigated. The result shows that suitable back-channel plasma treatments can significantly suppress the off-state leakage current.

AMDp - 46 **Highly Leakage-Resistant Hydrogenated Amorphous Silicon TFTs**

S. Yan, O. Hung, T.-H. Hsieh, C. Yang, J.-P. Pang
Innolux Display, Taiwan

In this study, the conduction mechanism of the highly leakage-resistant hydrogenated amorphous silicon dual gate TFTs has been demonstrated. A negatively differential resistance (NDR) is observed due to the influence of the electric potential of the floating metal of the dual gate TFTs, which alleviates the leakage current.

AMDp - 47 The Asymmetry Dual-Gate a-Si:H Thin Film Transistors

C.-Y. Liang[,**], H.-L. Chen[**], F.-S. Yeh[*], T.-C. Chang[***]*
[*]Nat. Tsing Hua Univ., Taiwan
[**]AU Optronics, Taiwan
[***]Nat. Sun Yat-Sen Univ., Taiwan

Asymmetry dual-gate a-Si:H thin film transistors have been fabricated in a-Si:H on bulk glass substrates. The device exhibits higher on current than standard back channel etched thin film transistors (BCE TFT), and the reduced parasitic capacitance makes it a suitable and applicable device than the conventional dual-gate a-Si:H TFT.

AMDp - 48L Fabrication of Poly-Si TFTs on Fine Quartz Fibers for Display Applications

A. Mimura, Y. Sugawara[*], M. Hiroshima, T. Ikehara, R. Maeda, K. Suzuki, K. Yase, I. Shuu[**], A. Nakajima[**], S. Toda[**], H. Koaizawa[**]
AIST, Japan
[*]NAIST, Japan
[**]Furukawa Elec., Japan

Top-gate poly-Si TFTs were fabricated on fine quartz fibers using one-dimensional substrate processing for display applications. Resist-spray-coating (MEMS process technique) was applied to treat the long fibers. Successful operations of both n- and p-channel TFTs were confirmed.

AMDp - 49L Organic Thin Film Transistors with Ink-jetted Organic Semiconductor Layer and 3-in. QQVGA AM-OLED Panel

C. Harada, S. Ohta, T. Chuman, H. Ochi, H. Sato, S. Ishizuka, A. Yoshizawa
Pioneer, Japan

Organic thin film transistors (OTFTs) that include a solution-processed gate insulator and an organic semiconductor were fabricated. The organic semiconductor was formed using ink-jet printing. The OTFTs showed a high mobility of 0.55 cm^2/Vs. In addition, a 3-in. QQVGA organic light-emitting diode panel driven by these OTFTs was fabricated.

AMDp - 50L Nucleation and Growth Dynamics of Si Grains in the Nano-/Micro-Second Domain

T. Katou, T. Endo, S. Shimoto, Y. Taniguchi, K. Azuma, M. Matsumura
ALTEDEC, Japan

We will present a new backward-trace method for nucleation and growth dynamics of Si grains that occur in the nano-/micro-second time domain. The method is applied to characterize the pseudo-single-nucleus lateral crystallization method. Defect formation during grain growth can be categorized by the orientation of the initial nuclei.

AMDp - 51L **Growth of Ultra-Large Pseudo-Single-Crystal Si**

S. Shimoto, Y. Taniguchi, T. Katou, T. Endo, T. Ohno, K. Azuma, M. Matsumura
ALTEDEC, Japan

Arrays of large Si grains with 21 μm $\times$ 15 μm area as well as 25 μm-long but narrow Si grains have been successfully grown by single shot irradiation of an excimer-laser light pulse at room temperature. This paper presents details of these results together with their origins.

AMDp - 52L **Device Simulation of Carrier Transport Parallel, Oblique and Perpendicular to Grain Boundaries in Doped Poly-Si Film**

M. Kimura[*,**]
**Ryukoku Univ., Japan*
***Innovative Materials & Processing Res. Ctr., Japan*

Carrier transport parallel, oblique and perpendicular to grain boundaries in doped poly-Si film is analyzed using device simulation. Arrhenius plots agree between experimental and simulation results. Carrier transport is dominated by phonon scattering in grains and potential barriers at grain boundaries with consideration of height changing of potential barriers.

AMDp - 53L **Acceleration of Current Programming Speed for AMOLED using Active Negative-Capacitance Circuit**

C. H. Shim, R. Hattori
Kyushu Univ., Japan

Settling time of current programming for AMOLED was shortened to the range of micro-second even in 10 nA of the programming current level by differentiator feedback using an active negative-capacitance circuit. The circuit can be easily implemented in a conventional CMOS current driver since neither a huge capacitance nor an additional panel circuit is required.

AMDp - 54L **Dual-Self-Aligned Vertical Multi-Channel Organic Transistors**

H. Naruse, S. Naka, H. Okada
Univ. of Toyama, Japan

Dual self-aligned vertical multi-channel organic transistor has proposed and demonstrated. Layout of shadow gate and transparent source/drain are sequentially determined using dual back-surface exposure. Vertical 100 nm-channel and multi-structures are obtained using interdigital gate electrodes. This device is promising for a back-plane with high current driving capability.

AMDp - 55L **A New Poly-Si TFT Pixel for Digital Driving AMOLED Displays without any Storage Capacitors**

H.-S. Park, S.-H. Kuk, T.-J. Ha, H.-S. Shin, M.-K. Han
Seoul Nat. Univ., Korea

We propose a new poly-Si pixel structure for digital driving AMOLED displays, which employs two cross-coupled inverters without any storage capacitors. The undesirable effects by the leakage current are removed as well as the addressing time being reduced. Due to pull-down operation, the emission time can be controlled precisely.

AMDp - 56L **Suppression of SPC-Si TFT Leakage Current Effect on Active Matrix Displays by Employing an Improved Circular Switch**

S.-G. Park, J.-H. Lee, H.-S. Park, S.-H. Kuk, M.-K. Han
Seoul Nat. Univ., Korea

We have fabricated a new SPC-Si TFT pixel, which can suppress SPC-Si TFT leakage current effect on AMOLED displays, by employing a new circular switching TFT. Our experiment result showed that the OLED current variation of proposed pixel circuit can be suppressed less than 11% while that of conventional pixel was about 35%.

AMDp - 57L **a-Si:H HEX-TFTs, A New Technology for Flat Panel Displays**

H. Lee, J. S. Yoo[*], C.-D. Kim[*], I. B. Kang[*], J. Kanicki
Univ. of Michigan, USA
[*]LG.Philips LCD, Korea

Single and multiple Hexagonal a-Si:H TFTs were designed and fabricated. It is shown that parallel connection of those devices increase the OLED output current to desirable value for give pixel electrode design. Enhanced electrical properties and stability of multiple Hexagonal TFTs are discussed in comparison to the single standard TFT.

AMDp - 58L **Long Pulsed Laser Activation Technology for Submicron TFTs on Glass**

T. Ide, D. Iga, A. Sasaki, K. Mitsuhashi
ALTEDEC, Japan

It was find that the high resistance area due to insufficient annealing area at the gate edge by laser activation for 30ns pulse duration can be improved by extending the pulse duration of the laser from the results of non-stationary heat transfer analysis and electrical characterization of the SOI-MOSFETs (L= 0.5 μm).

AMDp - 59L **Effect of Plasma Pre-treatment on Nanocrystalline Silicon Film Deposited without Substrate Heating**

S. J. Kim, S. M. Han, T. J. Ha, M. K. Han
Seoul Nat. Univ., Korea

We deposited nanocrystalline silicon thin film without substrate heating. Although there is no external source of heating, plasma of reaction gases increases the deposition temperature. Plasma treatment on the surface of substrate before deposition supplies thermal energy for growth of crystalline silicon. As we performed plasma preheating, crystallinity of nc-Si film was improved while deposition temperature was limited.

AMDp - 60L **Indium Oxide Thin-Film Transistors Fabricated by Room Temperature RF-Magnetron Sputtering**

J. H. Noh, S. Y. Ryu, C. S. Kim, S. J. Jo, H. S. Hwang, H. K. Baik
Yonsei Univ., Korea

We have fabricated a bottom-gate In_2O_3 TFT with high mobility using rf magnetron sputtering at room temperature. Device shows an average field effect mobility of 12.3 $cm^2V^{-1}s^{-1}$, and sharp on-to-off transition with about 7 orders of magnitude. Adopting our bottom-gate In_2O_3 TFT, a load-resistance inverter was set up and good dynamic operation has been demonstrated.

AMDp - 61L **Novel Si/SiN Precursor Structure for High-Qiuality Poly-Si TFT Fabrication**

T. Serikawa
Osaka Univ., Japan

A novel Si/SiN precursor structure has been proposed for fabricating high grade poly-Si films. In the structure, a-Si film is directly deposited on silicon nitride film, not on SiO_2 film. The a-Si films were easily crystallized without formation of spike-like roughness. Moreover, high quality poly-Si TFTs were fabricated.

AMDp - 62L **A Novel Pixel Drive Circuit Using Double Data Sources for Active Matrix OLED Panels**

*J.-H. Choi, M.-H. Jung, O.-H. Kim, H.-J. Chung**
Pohang Univ. of S&T, Korea
**Kumoh Nat. Inst. of Tech., Korea*

A new pixel structure composed of five TFTs and two capacitors adopting LTPS TFTs is proposed. It can solve the problem of previously proposed pixel scheme that driven by current programming or voltage programming. Simulation of the proposed circuit is carried out with SMART SPICE of RPI poly-Si TFT model.

AMDp - 63L **Pentacene Thin-Film Transistors with Thin Polymer Gate Dielectric and Silver Electrode**

J. H. Kim, K. C. Song, K.-H. Beak, D. J. Kim*, L. M. Do*
ETRI, Korea
**Chungnam Nat. Univ., Korea*

We report on organic transistors with a thin polymer gate dielectric driven with low-voltage. Using low cost processible metal electrodes such as aluminum gate and silver source/drain, 240 nm thin poly-4-vinylphenol (PVP) dielectric, and pentacene semiconductor, we obtained devices on glass with mobilities > 1cm^2/Vs. As baking temperature of PVP dielectric is increased, the mobility of TFTs is improved.

AMDp - 64L **Improvement of Density of States in the CLC Poly-Si using Microlens Array**

N. K. Son, A. R. Kim, Y. D. Son, J. Jang
Kyung Hee Univ., Korea

High performance of CLC poly-Si thin film transistor used in AMLCD and AMOLED applications, directly depends on the density of states (DOS) in the channel material. In this paper, we investigated the DOS of CLC poly-Si TFTs using microlens array and conventional CLC method. The CLC poly-Si TFTs using microlens array has lower DOS than conventional CLC method. Also, we have compared with CLC poly-Si TFTs and ELA poly-Si TFTs.

AMDp - 65L **A Simple High-Aperture Pixel Structure with Storage Capacitor Electrode Covering Data Bus Line**

Y. H. Lu, Y. T. Chen, K. H. Chen, Y. H. Lin, J. Y. Lee, M. C. Chan
HannStar Display, Taiwan

A simple high-aperture pixel structure has been applied to small size a-Si TFT-LCD devices. The high aperture is achieved by the shielding effect resulting from storage capacitor electrodes above data bus lines. As a result, we have developed 65% aperture ratio on a subpixel size 51x153 μm^2 (2.4-in. QVGA) with traditional 5-PEPs process and high production yield.

AMDp - 66L **<110> Orientation and Location Controlled Si Grains Through Combined MILC and μ-Czochralski Process**

C. Tao, R. Ishihara, J. W. Metselaar, C. I. M. Beenakker
Delft Univ. of Tech., The Netherlands

We propose to control the crystallographic orientation of the position-controlled large grains by combining the MILC poly-Si pre-cursor and excimer laser crystallization with the μ-Czochralski process. It was observed that the surface crystal orientation of the large (5μm), location controlled Si islands have a strong <110> preference without random grain boundaries inside the islands.

AMDp - 67L **Enhanced Pentacene OTFT Properties with Surface Treatment on PSPI Gate Dielectric**

L.-M. Do, M.-W. Lee, K.-H. Baek, K.-C. Song, J.-H. Kim, D.-J. Kim[*], K.-J. Lee[*], M.-H. Yi[**]
ETRI, Korea
[*]Chungnam Nat. Univ., Korea
[**]Korea Res. Inst. of Chem. Tech., Korea

The pentacene organic thin field transistor (OTFT) with photosensitive polyimide (PSPI) gate dielectric was examined with various surface treatments. The mobility of OTFTs strongly depends on interface energy properties between gate dielectric and semiconductor layer. Although the OTFT mobility was decreased through PSPI gate dielectric patterning process, the mobility was improved from 0.11 cm^2/Vs to 0.75 cm^2/Vs by control of surface energy with UV ozone and hexamethyldisilazane (HMDS) treatment.

13:30 - 14:55 **Main Hall A**

AMD9: Oxide-Semiconductor TFT

Chair: M. Furuta, Kochi Univ. of Tech., Japan
Co-Chair: T. Noguchi, Univ. of the Ryukyus, Japan

AMD9 - 1: 13:30 ***Invited*** **Highly Stable Ga_2O_3-In_2O_3-ZnO Thin-Film Transistors for AM-OLED Application**

Y. S. Park, C. J. Kim, S. I. Kim, I. Song, J. C. Park, H. Lim, S. W. Kim, E. Lee
SAIT, Korea

The (Ga, In) doped-ZnO TFT shows excellent electrical properties and good stability under constant current stress. It shows a μ_{FE} of 10 cm^2/Vs, I_{off} below 2 pA and I_{on}/I_{off} ratio of above 10^8. The V_{th} shift was less than 0.2 V for 100 Hrs at 3 μA and 60°C.

AMD9 - 2: 13:55 ***Invited*** **Amorphous In-Zn-Ga-O Based TFTs and Circuits**

K. Abe, H. Kumomi, K. Nomura[*], T. Kamiya[**], M. Hirano[***], H. Hosono[,**,***]*
Canon, Japan
[*]ERATO-SORST, JST, Japan
[**]Tokyo Inst. of Tech., Japan
[***]Frontier Collaborative Res. Ctr., Japan

Thin film transistors (TFTs) using amorphous In-Ga-Zn-O channels show excellent uniformity, high saturation mobilities >10 $cm^2V^{-1}s^{-1}$, low off currents $<10^{-12}$ A, small sub-threshold swings <0.2 $Vdec^{-1}$, and small series resistances. The output of an 11-stage ring oscillator using the TFTs is reproduced by circuit simulation with an *a*-Si:H TFT model.

AMD9 - 3
14:20

4-in. QVGA AMOLED Display Driven by GaInZnO TFT

J. Y. Kwon, K. S. Son, J. S. Jung, T. S. Kim, M. K. Ryu, K. B. Park, J. W. Kim, Y. G. Lee, C. J. Kim, S. I. Kim, Y. S. Park, S. Y. Lee, J. M. Kim
SAIT, Korea

We demonstrated 4inch QVGA AMOLED display driven by GaInZnO TFT. The structure of GaInZnO TFT is back channel etch which is conventional structure for a-Si TFT. The mobility of GaInZnO TFT is 2.6 cm^2/Vs and Vt is 3.8V. It is thought that GaInZnO TFT could be backplane for AMOLED TV.

AMD9 - 4L
14:40

Transparent and High-Aperture-Ratio AMOLED Panel Using Very Stable ZnO TFTs

C.-W. Byun, C.-S. Hwang, S.-H. Ko. Park, J.-H. Shin, M. Ryu, S. Yang, J.-I. Lee, D.-H. Cho, W.-S. Cheong, S.-M. Yoon, H. Y. Chu, K. I. Cho
ETRI, Korea

In this paper, we represent a transparent and high-aperture-ratio AMOLED panel applied by a new structural concept using very stable ZnO TFTs. The new structural concept is that the OLED layers are overlaid on all pixel area achieving higher aperture ratio (A/R) of 59.4%. Also the panel emits both sides thanks to trans-parent electrodes and TFTs. The fabricated panel size is 2.5" and its resolution is qCIF+ (mono type). The transmittance of the panel is 60%.

Author Interviews
18:10 – 19:10

Supporting Organizations:
LC Physics and Condensed Matter Forum, JLCS
Chemistry and LC Material Forum, JLCS
Liquid Crystal Display Forum, JLCS
Technical Group on Information Display, ITE
Technical Committee on Electronic Information Displays, Electronics Society, IEICE
Technical Committee on Electron Devices, Electronics Society, IEICE
Technical Group of Silicon Devices and Materials, IEICE
Thin Film Materials & Devices Meeting

Workshop on FPD Manufacturing, Materials and Components

Wednesday, December 5

13:20 - 14:40 **Main Hall B**

FMC1: Manufacturing Technologies (1)

Chair: T. Sakai, Philips Appl. Tech., The Netherlands
Co-Chair: Y. Ukai, Sony, Japan

FMC1 - 1
13:20 **Development of High Current Mass Separated Ion Implantaion System for LTPS-TFT Manufacturing**

M. Yoshida, H. Hourai, T. Sodekoda, Y. Ayame, I. Nakamoto, K. Odagiri, Y. Kawasaki
IHI, Japan

The high current mass separated ion implantation system for LTPS-TFT manufacturing has been developed. This system is applicable not only to low dose implantation process such as channel and LDD doping but also to high dose process such as Source/Drain doping with good uniformity, high throughput and pure ion species.

FMC1 - 2
13:40 **Permanent Magnet Ion Beam Analysis for the Implant of Very Large FPDs**

D. Aitken
Superion, UK

A ribbon ion beam analysing magnet is described that can resolve O_2^+(32) from PH_2^+(33) with a poor quality beam of any size. It is compatible with straightforward modification of an unanalysed ion doping system because the output beam is parallel to the extracted beam and the in-vacuum magnet requires no power or cooling supplies.

FMC1 - 3:
14:00 ***Invited*** **Advanced Nanoimprint Technology for Display Applications**

M. Beck, A. Löfstrand, N. Nilsson, B. Heidari
Obducat, Sweden

Different types of micro- and nano-structures can enhance the performance of modern displays. The task of these structures is to increase the amount of emitted light, contrast, and resolution. In this paper we discuss how to produce these structures on both hard substrates and polymer sheets by using nanoimprint lithography.

FMC1 - 4: 14:20 ***Invited*** **Ink-Jet Printed Self-Aligned Organic Light Emitting Diodes and Its Application to Highly Functional Products**

H. Okada, K. Matsui, M. Yamanaka, S. Naka, M. Shibata, M. Ohmori[*], S. Ueno[**], N. Kurachi[*], M. Sawamura[*], M. Hattori[*], T. Inoue[*], T. Miyabayashi[*], Y. Takao[***], S. Hibino[***], I. Tsuchiya[***], H. Bessho[***], K. Ohara[****], K. Ikeda[****], H. Mizuno[****], M. Ohama[****], M. Hoshino[****], S. Ayukawa[*****], R. Miyasato[*****], N. Tsutsui[*****], N. Miura[*****]
Univ. of Toyama, Japan
[*]Brother Industries, Japan
[**]Chubu Sci. & Tech. Ctr., Japan
[***]Tokai Rubber Industries, Japan
[****]Tsuchiya, Japan
[*****]ITES, Japan

Ink-jet printed self-aligned organic light emitting diodes (SA-OLEDs) and its application to three kinds of prototypes have investigated. A multicolor SA-OLED using small electrophosphorescent material, a light-emitting seal (LES) using SA-OLED and laminate process without any vacuum, and a non-contact electromagnetic power supply for the OLED have demonstrated. These device concepts are useful for flexible light-emitting poster without power supply line.

----- Break -----

15:00 - 16:20 **Main Hall B**

FMC2: Manufacturing Technologies (2)

Chair: A. Abramov, Corning, USA
Co-Chair: T. Unate, Sekisui Chem., Japan

FMC2 - 1: 15:00 ***Invited*** **High Speed Laser Scoring of Low Coefficient of Thermal Expansion (CTE) Glass Substrates**

A. Abramov, Y. Sun, N. Zhou
Corning, USA

A method to score a low thermal expansion coefficient glass with a laser at a speed of up to 1000mm/s and above is presented. It is achieved using a special laser beam. A consistent laser scoring process is experimentally demonstrated using EAGLE$^{2000®}$ and EAGLE XG™ glass substrates.

FMC2 - 2 15:20 **Breakless Cutting of EAGLE XG Using Standard Scoring Wheel**

T. Ono, O. Teng, G. Pai**
Corning Tech. Ctr., Japan
**Corning Display Techs., Taiwan*

The mechanism of glass sheet cutting using standard and Penett® wheels is explained as a function of key parameters. The advantage of Penett wheel scoring is deep median crack extension, but it can be obtained with standard wheel on EAGLE XG™. This provides significant benefits, increasing panel cleanliness and strength.

FMC2 - 3: 15:40 ***Invited*** **A Study on Roll-to-Roll Method for Flexible TFT Backplane Manufacturing**

T. Sakai, A. J. J. van der Horst, A. J. Hovestad, J. G. L. Otten, H. C. M. van Doremalen
Philips Appl. Techs., The Netherlands

A Roll-to-Roll based manufacturing method is studied by using various manufacturing metrics to validate its applicability to flexible TFT backplane manufacturing. It is revealed that in segmented form it generates an excessive WIP resulting in long cycle time and limited diversity in product types, while in integrated form it results in low equipment efficiency.

FMC2 - 4 16:00 **A Novel Cell Thinning Method for Liquid Crystal Displays**

Y.-C. Liu, L.-Y. Yeh, J.-W. Chwu, C.-C. Lin, M. S. Chen, F. Y. Gan
AU Optronics, Taiwan

A vertical-spindle grinding method is applied to thin TFT-LCD cells, with high removal rate of 21.5μm/min and fine surface roughness of 0.343μm simultaneously. The proposed technique provides the feasibility to produce the TFT-LCD cells composed with different-thickness TFT and CF substrates. This method also exhibits stable and practicable for production.

----- Break -----

16:40 - 18:00 **Main Hall B**

FMC3: Manufacturing Technologies (3)

Chair: L. Palmateer, Qualcomm MEMS Tech., USA
Co-Chair: Y. Fujimoto, Dainippon Screen MFG, Japan

FMC3 - 1: *Invited* FPD World Wide Market Overview
16:40

J. Masuda
iSuppli Japan, Japan

The total display market will pass $100 Billion in 2007, dominated by LCD technology. While LCD is the key device in the market, other technologies continue to challenge it. PDP has been a key technology for large size TV, and OLED technology has been entering for mobile displays. In this paper, the display market trends will be described.

FMC3 - 2 Perfluoro Carbon Emission Reduction Activities in
17:00 Japanese LCD Industry

K. Matsumura, S. Masui[*], H. Kurokawa[**], S. Mochizuki[***]
Toshiba Matsushita Display Tech., Japan
[*]Sharp, Japan
[**]Hitachi, Japan
[***]Epson Imaging Devices, Japan

Thin Film Transistors (TFTs), which drive LCDs, use many chemical and gas substances during the manufacturing processes, and thus intensify the necessity to address environmental aspects. Especially, the greenhouse gases used in etching processes and cleaning of the thin film deposition equipment are becoming a big concern in recent years when the global warming issue has drawn worldwide attention.

FMC3 - 3 Micro-Sampling Technique for Organic Fine Particles
17:20 on FPDs

K. Horikoshi, K. Ogata, K. Hashimoto[*], N. Ooki[*], H. Seki[*]
Hitachi, Japan
[*]Hitachi Displays, Japan

We developed a micro-sampling method for organic fine particles, which cause defects in FPDs. The method is capable of picking up the fine particles buried in upper layers. After picking up the particles by this method, we can easily identify the particles by conventional analytical tools (FT-IR, Raman, MS, etc.) and determine the source of the particles.

FMC3 - 4 Introduction of Defect Analysis by Cell Electrical Test
17:40 for LTPS LCD and OLED

Y. Miyake, K. Chikamatsu, J. Mizoguchi
Agilent Techs. Int. Japan, Japan

This paper proposes the defect analysis method for cell and/or module panels using Cell-E Test. Detailed defect information used for process feedback and further analyses is acquired without disassembling panels, bringing more efficient analysis work. The analysis result on TFT I-V-property, which may cause MURA, is shown as an example.

Author Interviews
18:00 – 19:00

Thursday, December 6

9:00 - 12:00 **Room 107, 108**

Poster FMCp: FPD Manufacturing, Materials & Components

FMCp - 1 **Glass-Strength Dependence of Cutting Conditions in Thin Laminated TFT-LCD**

S.-C. Wang, L.-Y. Yeh, C.-C. Lin, M. S. Chen, F. Y. Gan
AU Optronics, Taiwan

Considering glass-strength improvement for thin laminated TFT-LCD manufacturing, mechanical wheel-cutting glass-separating processes with less damage on glass edge and surface were studied by using various wheels and different cutting conditions. The influence of scribe load and type of scribe wheel on glass cutting quality and edge strength are experimentally investigated.

FMCp - 2 **A Mathematical Model for the Single-Sided Lapping Machine in LCD Cell Thinning Process**

J. L. Hsu, J. W. Chwu, C. W. Chen, Y. C. Liu, C. C. Lin, M. S. Chen
AU Optronics, Taiwan

An abrasive approach is applied to the thinning of assembled LCD cell in a single-sided lapping machine. The process enhances the ease of use for portable display devices. We have developed a new mathematical model to describe the mechanism and verified the model by tests.

FMCp - 3 **Broadening Use of Light-on Pad Array Test (LoPAT) Enabling 100% Inspection for Mobile COG Displays**

K. Chikamatsu, Y. Miyake, J. Mizoguchi
Agilent Techs. Int. Japan, Japan

This paper describes the important tips for light-on pad array test(LoPAT) which is becoming more adopted among small-sized COG device manufactures. And light-beam-induced current is utilized to locate the defect's source address, which overcomes the difficulty in the conventional LoPAT. The solution is quite beneficial to the failure analysis work after cell inspection, especially for high resolution displays.

FMCp - 4 **Analysis and Solution of 3840 Bright Points Defect on TFT-LCD Mass Production**

M. Zhang[,**], W. Wang[*], J. S. Xue[*], Z. M. Zhang[***]*
[*]Beijing BOE OptoElect. Tech., China
[**]Graduate Univ. of the Chinese Ac. of Sci., China
[***]Inst. of Computing Tech. of the Chinese Ac. of Sci., China

The “3840” bright point defect is mainly caused by ESD attack using SEM, FIB and microscope. The unsuitable PI rubbing angle in cell process and ESD circuit deficiency in TFT design, which can arouses the ESD attack, is thought theoretically to be the reason of “3840” bright point defect.

FMCp - 5 **X-1 Bright Line Defect Analysis during TFT-LCD Production**

M. Zhang[,**], J. Guo[*], C. P. Long[*], Z. M. Zhang[***]*
[*]Beijing BOE OptoElect. Tech., China
[**]Graduate Univ. of the Chinese Ac. of Sci., China
[***]Inst. of Computing Tech. of the Chinese Ac. of Sci., China

The mechanism of defect formation is speculated by the production processes and ESD theory, which leads to corrective methods. The vacuum pad on the robot is found out to induce ESD attack. After changing the pad material, charge disperses from the pad area. X-1 bright line defect occurrence ratio decreases.

FMCp - 6 **Optimization of ODF Process for Mobile TFT-LCD Manufacturing**

K.-J. Lee, J.-M. Park, H.-C. Kim, J.-H. Seo, Y.-J. Kim, B.-H. Jung, C.-H. Park
BOE HYDIS Tech., Korea

We optimized LC amount without “Bubble” and “Gap Mura” in ODF process producing Mobile TFT-LCD with column spacer. If cell process condition is only optimized to “Bubble”, “Gap mura” owing to cell gap difference between active area center and edge area could be occurred by increased LC amount. We investigated the condition related LC amount. From our investigation, the height of seal spacer as well as LC amount in LCD panel have to be also considered to prevent “Gap mura”.

FMCp - 7 **Preparation of Al Doped ZnO/Ag/Al Doped ZnO Multilayer Thin Film by Facing Targets Sputtering Method**

S. M. Kim, Y. S. Rim, H. W. Choi, S. J. Park, K. H. Kim
Univ. of Kyungwon, Korea

In order to evaluate the property of AZO thin film for TCO, AZO/Ag/AZO multilayer thin films were prepared with different thicknesses of Ag layer without substrate heating by using FTS system. As a result, as-deposited AZO/Ag/AZO multilayer thin films were prepared with high transmittance and low resistivity.

FMCp - 8 **Development of Inductively-Coupled RF Plasma Source for Carbon Alignment Film Deposition**

T. Matsumoto, Y. Kinoshita, Y. Matsuda, Y. Andoh,
Y. Setsuhara[*]*, Y. Iimura*[**]
Nissin Ion Equipment, Japan
[*]*Osaka Univ., Japan*
[**]*Tokyo Univ. of A&T, Japan*

We have developed a carbon alignment film deposition system using multiple inductively-coupled RF antennas. The system exhibited a high deposition rate and uniform film thickness over an area of 445 x 335 mm^2. Twisted nematic cells composed of ion-irradiated carbon films showed a well-aligned LC texture.

FMCp - 9 **Oxygen and Sulfur Hexafluoride Added Plasma Ash Study in Reactive Ion Etch on Channel Region in TFT Array Process**

H. J. Qiu, Z. T. Wang, T. Y. Min, W. B. Gao, S.-U. Choi
Beijing Orient Elect. OptoElect. Tech., China

In order to optimize the array process of fabrication of the TFT-LCD, the photoresist ash test and molybdenum reactive ion etching was investigated. Through DOE matrix test, the influences on the ash rate, uniformity were discussed. We found that the surface oxidation of Molybdenum is main cause of molybdenum unetch.

FMCp - 10 **Large Scaled Atomic Layer Deposition Reactor for Al_2O_3 in FPD Applications**

K. Washio, Y. Mori, N. Miyatake, K. Murata,
Y. Sugawara[*]*, Y. Uraoka*[*]
Mitsui Eng. & Shipbuilding, Japan
[*]*Nara Inst. of S&T, Japan*

We studied atomic layer deposition (ALD) Al_2O_3 films deposited in an ALD reactor, which handles glass substrates of 370mm×470mm in size. The ALD Al_2O_3 films were deposited at 80°C with plasma assisted process. Their growth rate, thickness variation, step coverage and electrical breakdown field were 0.16nmcycle^{-1}, ±5%, 100% and 7.0MVcm^{-1}, respectively.

FMCp - 11 Film Quality of Low Temperature Synthesized SiO_2 Insulator Films by ICP-CVD Using Tetramethylsilane

H. Furuta[,***], T. Hiramatsu[**,***], T. Matsuda[*,***], C. Li[*,***], M. Furuta[*,***], T. Hirao[*,***]*
[*]Kochi Univ. of Tech., Japan
[**]Kochi Casio, Japan
[***]Kochi IPC, Japan

SiO_2 insulator films were synthesized below 150 °C using tetramethylsilane by ICP-CVD method. The Si-O-Si network chain length was increased and the surface roughness was decreased with the improvement of film qualities. Applying additional RF bias on substrate increased breakdown voltage and also increased the peak shift of Si-O stretch.

FMCp - 12 Development of High Performance TFT-LCD's Photo-resist for 4-Mask Processing

T. Katoh, K. Ushijima, T. Fujino, Y. Yamabe, H. Muraki, K. Nakamura
Zeon, Japan

Four Photo-resist Exposure Process (4PEP) enables the TFT array manufacturing cost to be reduced drastically. The reproducibility of the Half-tone film thickness of conventional photo-resists was not good. As a result, it was difficult to control the uniformity of Half-tone film thickness all over the large sized glass substrates. Authors developed "Continuously Variable Thickness control System (CVTS)" for new 4PEP resist.

FMCp - 13 Electrical Properties of Ion Implanted ZnO Thin Film for Source and Drain Regions of ZnO-TFTs

T. Matsuda[,**], M. Furuta[*,**], T. Hiramatsu[**,***], H. Furuta[*,**], C. Li[*,**], T. Hirao[*,**]*
[*]Kochi Univ. of Tech., Japan
[**]Kochi Ind. Promotion Ctr., Japan
[***]Kochi Casio, Japan

Crystallinity and carrier mobility of sputtered ZnO were enhanced with ion implantations and post annealing. Activation ratios of implanted ZnO were over 100% for Al and Ga, and 15% for In, respectively. The activation mechanism of In and the other ions were different each other as generation of oxygen vacancy.

FMCp - 14 **Characterization of ZnO Films Fabricated by Radio Frequency Magnetron Sputtering under Different Substrate Temperatures for TFTs Application**

C. Li[,**], M. Furuta[*,**], T. Hiramatsu[**,***], T. Matsuda[*,**], H. Furuta[*,**], T. Hirao[*,**]*
[*]Kochi Univ. of Tech., Japan
[**]Kochi IPC, Japan
[***]Kochi Casio, Japan

The structural, electrical and optical properties of ZnO thin films deposited by the rf magnetron sputtering methods were investigated in terms of the deposition temperature and post-annealing effects. It was found that increased deposition temperature and post-annealing will contribute to improve the quality of the ZnO films.

FMCp - 15 **Activation Behavior of Boron Implanted Poly-Si Films Annealed by Rapid Thermal Process**

M. Furuta, H. Tsubokawa[*], K. Shimamura[*], T. Hirao
Kochi Univ. of Tech., Japan
[*]Mitsui Eng. & Shipbuilding, Japan

Activation behavior of boron implanted poly-Si films has been investigated. At the dose of 1E15 cm-2, carrier concentration exhibited maximum at 600 °C. The reverse annealing was observed as the temperature further increased. From SIMS studies, dopant segregation and deactivation occurred simultaneously as the temperature exceeded 600 °C.

FMCp - 16 **Effect of Microstructure on Optical Properties of Rf-Sputtered ZnO Films for ZnO-TFTs**

M. Furuta[,**], M. Tachikawa[***], C. Li[*,**], T. Matsuda[*,**], T. Hiramatsu[**,****], H. Furuta[*,**], T. Hirao[*,**]*
[*]Kochi Univ. of Tech., Japan
[**]Kochi Ind. Promotion Ctr., Japan
[***]Tosadenshi, Japan
[****]Kochi Casio, Japan

Effects of microstructure on optical properties of rf-sputtered ZnO films have been investigated. Crystallite size was increased as the rf-power and gas ratio (O_2/Ar) decreased. As the rf-power decreased and the O_2/Ar increased, optical absorption near band edge decreased. Bombarded energetic oxygen particles will create tail states in forbidden gap.

FMCp - 17 **Influence of Ar Gas on Inductively Coupled Plasma Etching of ZnO Film in CH_4/Ar**

T. Hiramatsu[,***], M. Furuta[**,***], C. Li[**,***], H. Furuta[**,***], T. Matsuda[**,***], T. Hirao[**,***]*
[*]Kochi Casio, Japan
[**]Kochi Univ. of Tech., Japan
[***]Kochi Ind. Promotion Ctr., Japan

The effect of Ar gas concentration on the etching by ICP method in Ar/CH4 mixture gas system has been investigated using Optical Emission Spectroscopy. It was found that the Ar gas works two jobs, which was removal of deposited carbon on the films surface and the assist of ZnO etching.

FMCp - 18 **Color Properties of New Blue Pigments**

T. Yanagimoto, T. Yoshioka, K. Fujishiro
Nippon Steel Chem., Japan

The new blue pigments were prepared of subphthalocyanines. They showed bright reddish-blue color, near to the EBU blue without any color compound, and higher contrast-ratio compared to the conventional coloring method (a mixing of PB15:6 and PV23). The relation ship between contrast-ratio and morphology of the pigment is also investigated.

FMCp - 19 **Modified Pigment and Its Colorful Photosensitive Composition for Color Filters**

C. C. Weng
ITRI, Taiwan

A modified pigment and colorful photosensitive composition employing the same are disclosed. The composition comprises a solvent, an alkali-soluble resin, reactive monomer, and a modified pigment. The modified pigments are provided with superior high contrast property, and thus it is suitable for producing color filters.

FMCp - 20 **Development of High Sensitivity - High Optical Density Resin Black Matrix for Color TFT LCD**

C. H. Park, Y. S. Na, S. J. An, J. K. Lim, M. W. Nam, T. W. Kim, G. Y. Park, C. G. Lee
LG Philips LCD, Korea

To improve productivity of Resin Black Matrix, we developed high sensitivity RBM available at exposure energy of 40mJ/cm^2. OD 4.5 / 1um was prepared for Carbon Black size reduce. Straightness of RBM was to increase flow property of pattern at oven, we implemented adjustment of binder polymer and dispersant.

FMCp - 21 **Effect of Developing Solution Flux on Total Pitch of Black Matrix in the Pattern of Color Filters**

H.-C. Wei, L.-H. Li, H.-S. Koo
Minghsin Univ. of S&T, Taiwan

From experimental results, characteristic diagram and Minitab analysis, one of major influence factors for total pitch of resin black matrix is developer flux and judge optimal developing condition. The variation of developer flux up to 60L/min can effectively control total pitch of resin black matrix in line width below 2μm.

FMCp - 22 **Evaluation and Effect of Thermal Compensation on Developing Solution Reduction in Usage for the Processing of Resin Black Matrix**

H.-C. Wei, C.-W. Hu, Y.-L. Hsia, H.-S. Koo[*]
Chunghwa Picture Tubes, Taiwan
[*]*Minghsin Univ. of S&T, Taiwan*

Analytic evaluation of thermal treatment on developing solution reduction in the fabrication of resin black matrix had successfully been demonstrated as well. The appropriate modulation of developing time, concentration and temperature of developing solution can effectively achieve the reduction of developing solution in usage amount and the alleviation of waste solution during production.

FMCp - 23 **Development of Silsesquioxane-Type Gate Insulating Thin Films for Poly(3-Hexylthiophene)-Based Field-Effect Transistor**

T. Hamada[*,**]*, K. Tomatsu*[**]*, T. Nagase*[*,**]*,*
T. Kobayashi[*,**]*, S. Murakami*[*,***]*, M. Watanabe*[*,****]*,*
H. Naito[*,**]*, K. Matsukawa*[*,****]
[*]*Japan S&T Agency, Japan*
[**]*Osaka Pref. Univ., Japan*
[***]*Tech. Res. Inst. of Osaka Pref., Japan*
[****]*Osaka Municipal Tech. Res. Inst., Japan*

Silsesquioxane materials were prepared by a sol-gel method, which have many advantages such as low cost, solution processability, and so on. We have investiga surface morphology. Top-contact organic field-effectted polymethylsilsesquioxane (PMSQ)-type gate insulating thin films with good high resistivity and transistors (OFET) devices were fabricated using PMSQ gate insulator and poly(3-hexylthiophene) (P3HT) as the organic semiconductor.

FMCp - 24 **Novel Negative Organic/Inorganic Hybrid Passivation Layer Comprised of Silsesquioxane for Simplifying Passivation Process**

S. H. Kim, J. H. Chang, J. S. Jeong, J. H. Yoon, D. H. Lee, Y. K. Kim, H. J. Kim, S. Y. Choi
Sekisui Fine Chem. Korea, Korea

We developed negative type organic/inorganic hybrid passivation layer comprised of silsesquioxane. Because we used silsesquioxane which has high thermal stability, could improve the decrease of transparency and the problem of outgas at high temperature. Our materials which used photo initiator could reduce cost. Therefore, we found that our materials were adaptable to the passivation layer on TFT LCDs.

FMCp - 25 **Dispersion and Preparation of Transparent Conductive Carbon Nanotube Films**

S. Manivannan, J. H. Ryu, I. O. Jeong, C. S. Lee, K. S. Kim, J. Jang, K. C. Park
Kyung Hee Univ., Korea

Single-walled carbon nanotubes dispersion in aqueous and organic solvents was attained by a polymer wrapping functionalization. Randomly oriented nanotube films were fabricated on glass following the spin coating process. Optical transmittance and electrical resistivity of the films were measured. The treated tubes were characterized by electron microscope and Raman spectroscopy.

FMCp - 26 **A Novel Screen-Printable Conducting Polymer Paste for Transparent Electrodes**

Y. H. Lee, J. W. Lee, H. N. Yoon
DPI Solutions, Korea

We have developed advanced screen-printable pastes for transparent electrodes that exhibit fine resolution of less than 70μm, which was almost same width with the mask, by controlling the rheological properties of pastes with increased thixotropy without much loss in conductivity. They maintained exceptional environmental stability, even with severe condition.

FMCp - 27 **Multiple Deposition of Ga-Doped ZnO Thin Films on COP Substrates for the Fabrication of Transparent Conductive Films**

A. Miyake, T. Yamada, H. Makino, S. Kishimoto[*], N. Yamamoto, T. Yamamoto
Kochi Univ. of Tech., Japan
[*]Kochi Nat. College of Tech., Japan

High transparency conductive Ga-doped ZnO (GZO) was prepared on plastic substrate by multiple deposition using ion plating. The multiple deposition limited the thermal loading to the substrate due to the plasma exposure and allowed to prepare the GZO film on plastic substrate.

FMCp - 28 **Understanding Optical Characteristics of a Cholesteric Liquid Crystal Polarizer Through Computational Simulation**

H. Cui, D. H. Lee, H. S. Lee, H. C. Yoon[*], K. C. Yoon[,**], S. T. Kim[*], J. R. Park*
Chosun Univ., Korea
[*]Samsung Fine Chems., Korea
[**]KAIST, Korea

Understanding of optical characteristics of cholesteric liquid crystal (CLC) polarizer is essential for practical design of CLC polarizer. In this paper, we have performed computational simulations for the effects of design parameters on the optical performances of CLC polarizer.

FMCp - 29 **High Gain Diffuser Film with Surface Relief of 2D Paraboloidal Lens Array**

S.-T. Hsiao, P.-H. Yao, C.-H. Tien
Nat. Chiao Tung Univ., Taiwan

A novel micro-structure diffuser film, paraboloidal lens array film (PLAF), is provided for the backlight module of liquid-crystal display. PLAF performing dual functions of light collection and diffusion is proposed to combine and replace BEFs and diffusers in the backlight module.

FMCp - 30 **Luminous Characteristics of Mercury-Free Flat Fluorescent Lamp with Surface-Type Patterned Electrode**

J. Y. Kim, J. H. Yang, J. M. Heo, J. K. Lim, H.-S. Tae, J.-H. Seo[*], H. B. Yoon[**], K. T. Jung[**], K. S. Lee[**]
Kyungpook Nat. Univ., Korea
[*]Incheon Univ., Korea
[**]Samsung Corning, Korea

The Luminous characteristics of a surface type discharge structure with various patterned electrodes on 6-in. Mercury-free flat fluorescent lamp are examined for investigating the basic property of an avoidance of discharge instability and an improvement of the luminous efficiency. The discharge characteristics are measured in each case of a patterned electrode shape and discharge gap.

FMCp - 31 **Effects of Driving Waveform on Discharge Characteristics in Hg-Free Backlight Unit**

J. N. Heo, J. K. Lim, H. S. Tae, J.-H. Seo[*], K. T. Jung[**], K. S. Lee[**]
Kyungpook Nat. Univ., Korea
[*]Incheon Univ., Korea
[**]Samsung Corning, Korea

This paper presents the effects of various driving waveforms on the discharge characteristics of the Hg-free backlight unit (BLU). The sine-type driving waveform shows unstable discharge characteristics. For the square-type driving waveform, two types of square-type waveform, that is, with and without a transformer, are examined.

FMCp - 32 **Optimization of Discharge Gap and Gas Pressure on Surface-Type Discharge for Scanning Mercury Free Flat Fluorescent Lamp**

J. H. Yang, J. Y. Kim, H.-S. Tae, J.-H. Seo[*], H. B. Yoon[**], K. T. Jung[**], K. S. Lee[**]
Kyungpook Nat. Univ., Korea
[*]Incheon Univ., Korea
[**]Samsung Corning, Korea

The discharge characteristics of surface type discharge in Hg-free back light unit (BLU) are examined based on the variations in the discharge gap and gas pressure for scanning BLUs. In particular, the discharge characteristics including the luminance and luminous efficiency are measured relative to the discharge gap and gas pressure. Finally, the dependence of the discharge gap and gas pressure on the surface type ac positive column discharge with two different drivers is analyzed and measured.

FMCp - 33 **Electrooptic Characteristics of Mercury-Type Flat Fluorescent Lamps Driven by Square Waves**

Y.-Y. Kim, J.-Y. Choi, J.-H. Ko
Hallym Univ., Korea

Electrooptic characteristics of mercury-type flat fluorescent lamps (FFLs) for 32-inch backlight applications were investigated under various driving conditions. The optimal driving conditions for high efficiency were obtained. A linear relationship between the luminance and the lamp current was observed, suggesting FFLs as appropriate light sources for applying dynamic brightening technology.

FMCp - 34 Optimization of LED Die Array

C. R. Ou, T.-T. Ho, J.-M. Lee
Hsiuping Inst. of Tech., Taiwan

Optimization for the LED die array is demonstrated. Thermal model with convection-conduction mechanism and the optical throughput simulations are considered simultaneous. Results indicate that the optimized LED dies arrangements for thermal and optical throughput might contradict to each other. Guidelines are suggested.

FMCp - 35 Color Mixing Characteristics in LED Backlight Unit

G. J. Park, Y. G. Kim, J. H. Yi, J. H. Kwon, J. H. Park[*], B. G. Kim[*], B. C. Ahn[*], H. S. Soh[**]
Yeungnam Univ., Korea
[*]LG.Philips LCD, Korea
[**]Hoseo Univ., Korea

The color mixing and hot spots are serious challenges in developing LED backlight units. A color mixing bar is designed to have M-type coupling windows in front of the corresponding LEDs. The rays entering into the color mixing bar are mixed up, and then enter into the lightguide panel. Elimination of hot spots and color mixing of RGB LEDs are efficiently obtained.

FMCp - 36 White Balance Draft Countermeasure in LED Backlight

C. C. Yang, H. X. Cao, K. C. Chang
ITRI, Taiwan

For ensuring that chromaticity of predetermined white would not be changed as time goes on, optical feedback system to detect RGB radiant intensity distribution and feed back new driving condition is necessary. This paper presents a new method to control light intensity of each LED in backlight.

FMCp - 37 Light-Distributing Plate for Ultra-Thin Direct LED Backlight

C. S. Chu, Y. T. Li, C. L. Yang
ITRI, Taiwan

The thickness of a LED direct backlight system is improved to be thinned out because light-distributing plate is applied. The light-distributing plate is placed between the LED and the diffuser plate, and light is guided from the LED to the diffuser plate in light mixing cavity. The light-distributing plate for adjusting uniformity of light from LED array could be used.

FMCp - 38 Multi-Layered Light Guide Plate without Using Optical Films

Y.-Y. Chang, W.-H. Yang, P.-H. Yao[*]
ITRI, Taiwan
[*]Nat. Chiao Tung Univ., Taiwan

A multi-layered light guide plate (LGP) with optimized reflective prism structure is employed to out-couple the light toward the normal-view direction. A prototype is manufactured by UV embossing replication. The luminance angular distribution of the multi-layered LGP shows the emitting light can be well-controlled, and a sheetless LGP is feasible.

FMCp - 39 Sheetless Integrated Light Guide Film for LCD Backlight

W. H. Yang, Y. Y. Chang
ITRI, Taiwan

An ultra-thin sheetless light guide film (LGF) is proposed. Optimized micro-pyramids and micro-prisms are employed to enhance the on-axis brightness. The thickness of LGF is only 0.3 mm and we have examined the feasibility of roll-to-roll UV embossing manufacturing. The ultra-thin LGF would be suit for flexible backlighting or illumination.

FMCp - 40 Monolithically Fabricated Micropatterned Light Guide Plates for Sheet-Less Backlight Unit

H.-S. Lee, J.-H. Lee[*], B.-K. Lee[*], W.-S. Choi[*], H. Song, H.-Y. Choi, J.-B. Yoon[*]
SAIT, Korea
[*]KAIST, Korea

A light guide plate with monolithically fabricated micropatterns on its surface was suggested. The fabricated 2 inch LGP showed an average luminance 2878 nit and 73.3% uniformity with four 0.85cd LEDs. The suggested monolithic LGP can reduce cost and thickness of back light units, and also its application fields can be extended to a flexible light source for flexible displays.

FMCp - 41 High Directivity Backlight with TIR Prism Sheet

T. Kunimochi, S. Suzuki, T. Yoshida, S. Kawashima, M. Egawa
Minebea, Japan

We have developed a high directivity backlight. The light of emission area was controlled by the concentric circular prisms on the surface of the light guide plate and the prism sheet. We achieved that the FWHM of angular distribution of the proto-type backlight was 3° to 17°.

FMCp - 42 **The Design for Optical Prism Sheet on the Bottom of the Directly-Under-Light Type Backlight Module**

C.-F. Chen, L.-M. Lu, P.-H. Yau[*], W.-H. Yang[**], H.-S. Lin[**]
Nat. Central Univ., Taiwan
[*]Nat. Chiao Tung Univ., Taiwan
[**]ITRI, Taiwan

In the directly-under-light type backlight module, uniformity is the important property. We put the optical prism sheet on the bottom of the backlight module and design the prism sheet to tune the prism angle for best uniformity. The result is not only to improve uniformity, but also enhance brightness slightly.

FMCp - 43 **Reflective Recycling Coupling Device for Ultra-Thin Light Guide Plate**

Y.-Y. Chang, W.-H. Yang
ITRI, Taiwan

A reflective-recycling coupling device is proposed to enhance the coupling efficiency and to perform uniform in-coupling for ultra-thin LGP. This device can also simplify the out-coupling design of LGP and improve the uniformity. The RRC device can be applied in the ultra-thin LGP for flexible backlighting or illumination.

FMCp - 44 **A Moiré Free Hybrid Optical Film for LCD Backlight**

Y. H. Lin, P. H. Yao[*], T. H. Lin
ITRI, Taiwan
[*]Nat. Chiao Tung Univ., Taiwan

How to eliminate Moiré without rotating film is an important issue in LCD. By multi-time diamond-turning, we created polygons with random shape and distribution. Then, we form an optical film with randomization microstructures, called a Moiré-free hybrid optical film. We successfully eliminate Moiré and keep the ability of brightness enhancement.

FMCp - 45 **Reflection-Orientated Reflector Sheet with Microstructure-Embossing Surface for Direct-Lit Backlight**

P.-H. Yao, W. S. Yang[*], C.-H. Tien
Nat. Chiao Tung Univ., Taiwan
[*]ITRI, Taiwan

A microstructure-embossing reflector sheet (μ-ERS) performing oriented reflection for a direct-lit backlight module is proposed. μ-ERS designed as an anisotropic reflector providing higher intensity distribution between two lamps to reduce lamp mura and concentrating central-axis intensity. The design, simulation results and measurement of μ-ERS in direct-lit backlight module are demonstrated.

FMCp - 46 Integration of Multiple Organic Light Emitting Diodes and a Lens for Emission Angle Control

F. Rahadian, T. Masada, I. Fujieda
Ritsumeikan Univ., Japan

For switching viewing angle and/or 3d/2d mode, we propose to integrate a lens on multiple OLEDs. Angular distribution of the light emitted from the lens surface is altered by turning on the OLEDs selectively. Such a light source can function as a backlight for an LCD. Pixel-level integration would allow one to construct an OLED display with similar functions.

FMCp - 47 Design of Output Couplers for an Edge-Lit Backlight with Viewing-Angle Control

K. Imai, I. Fujieda
Ritsumeikan Univ., Japan

A liquid crystal device inserted between a light source and a light-guide of an edge-lit backlight can control viewing range of a liquid crystal display. An output coupler with a vertical optical window is advantageous for uniform light extraction when a viewing angle range is switched.

FMCp - 48 Simulation of Two Way Viewing Liquid Crystal Display Panel with a Novel Micro Prism Array Structure

C.-Y. Chen, T.-Y. Hsieh, Y.-M. Chen[*], C.-C. Lin[*], J.-R. Sze[**]
Nat. Yunlin Univ. of S&T, Taiwan
[*]Chunghwa Picture Tubes, Taiwan
[**]Instr. Tech. Res. Ctr., Taiwan

In this paper, we propose a novel structure of micro-prism array for LCD to perform two-way-viewing. The micro-prism array is directly stuck on the LC panel then sent two different images from LCD into two viewers. The simulation shown the performance of our designed 2.2" two-way-viewing LCD can be optimized.

FMCp - 49 32-in. LED Backlight Module without Fan

Y. T. Li, C. H. Fan, C. L. Yang, C. C. Lin, C. S. Chu
ITRI, Taiwan

Cut some area of the LED Backlight Module for increasing the heat transfer show in Figure 1. There are easy to increase the heat transfer area and the manufacture for the backlight module. Because increase the heat transfers, then can without fan and heat pipe for the backlight.

FMCp - 50 **A Thin Module System for LCD Backlight with the Unified Component**

T.-Y. Li, T.-P. Lin, J.-M. Huang, C.-L. Tsou, C.-N. Mo
Chunghwa Picture Tubes, Taiwan

A novel backlight system which the brightness is increased 6.6% than conventional BLU system by using the single micro-patterned film. Using new LED package with wider radiation angle and combination with our novel single micro- patterned film, the thickness of backlight can be reduced 33%.

FMCp - 51 **Edge-Lit Backlight Utiliizing a Laser Diode and an Optical Fiber**

Y. Inaba, Y. Nagai, I. Fujieda
Ritsumeikan Univ., Japan

We propose to guide optical power from a laser diode through an optical fiber to a light-guide. The guided light leaks out from the grooves at the tip of the fiber and enters the light-guide. This configuration facilitates compact and efficient coupling between a light source and a thin light-guide.

FMCp - 52 **Zernike Coefficients for the Lightguide Analysis**

C. R. Ou, T.-T. Ho, R. Ho[*]
Hsuiping Inst. of Tech., Taiwan
[*]*RayOpt Res., Taiwan*

Analysis the deformation of the light guide is important for illumination applications. This article presents and discusses the advantages/ drawbacks of using the Zernike coefficients on light guide deformation. Results indicate that the summations terms of the Zernike polynomials and boundary conditions are two most critical tasks.

FMCp - 53L **Highly Adhesive Copper Wiring for FPD using Inkjet Printed Catalyst and Neutral Electroless Deposition**

S. Fang, Q. Zhou, T. Kamakura[*]*, H. Kitahara*[*]*,*
S. Ichikawa[*]*, M. Furusawa*[*]*, S. Inoue*[*]
Singapore Epson Ind., Singapore
[*]*Seiko Epson, Japan*

A novel, low cost, and directly patterned Cu wiring has been developed combining inkjet printing and neutral electroless deposition. Without photolithography process, highly adhesive Cu wiring with the width of ca. 70 μm, thickness up to 4 μm, low resistivity of 2.4 μΩcm and adhesive force of 20 kgf/cm^2, has been achieved on smooth glass without adhesion promoter metal layer.

FMCp - 54L **Electrical and Optical Properties of Amorphous Indium Zinc Oxide Thin Films by Facing Targets Sputtering Method**

Y. S. Rim, S. M. Kim, H. W. Choi, K. H. Kim
Univ. of Kyungwon, Korea

The indium zinc oxide (IZO) films were deposited by facing targets sputtering method using an IZO target (90 wt.% In_2O_3 and 10 wt.% ZnO). The electrical, optical, structural characteristics of IZO thin films were evaluated by Hall Effect Measurement, X-Ray Diffractormeter, UV/VIS spectrometer in visible range, scanning electron microscopy, respectively.

FMCp - 55L **Aging Properties of ITO Films with the Oxide Buffer Layers Grown onto PES Substrates**

S. M. Lee, C. S. Kim, S. H. Sohn
Kyungpook Nat. Univ., Korea

ITO thin films with the oxide buffer layers (SiO_2 and TiO_2) were deposited by a magnetron sputtering onto flexible PES substrates. The aging properties of ITO films with the oxide buffer layers grown onto PES substrates were investigated as a function of time placed in the air and the vacuum.

FMCp - 56L **Optimization of Light-Output Characteristics of Flat Fluorescent Lamps (FFLs) by Using Micro-lens Arrays**

J.-H. Park, H. S. Lee, M.-Y. Yu, Y.-Y. Kim, J.-H. Ko, S.-E. Lee[*]*, S.-H. Yu*[*]
Hallym Univ., Korea
[*]*Korea Polytechnic Univ., Korea*

The effect of microlens arrays on the light-output characteristics of flat fluorescent lamps (FFLs) was investigated by experiment and a ray-tracing simulation method. Experimental results about viewing-angle properties achieved by using two kinds of microlens arrays were consistent with those obtained from simulation works.

FMCp - 57L **Withdrawn**

FMCp - 58L **Secondary Optics Design and Analysis of Power LED**

H. J. Pyo, J. H. Park, Y. T. Jeong, J. S. Kim, J. T. Kim
Pukyong Nat. Univ., Korea

We designed secondary optics for light source of the display system. We designed the extra lens of light emitting diode(LED) and simulated it. As a result of simulation, the radiation pattern has the front forward direction, and is diffused within 50 degree. The brightness degrades slightly at the center.

FMCp - 59L **Design and Fabrication of Flat Fluorescent Lamp for LCD TV Backlight**

J. Park, J. Hur*, C. Kim*, S. Lim*
Dankook Univ., Korea
**Mirae Lighting, Korea*

The flat fluorescent lamp (FFL) was developed as a light source for LCD TV. The channel profile of FFL was designed to have high efficiency. The glass-forming machine (GFM) was developed to form the channel profile designed. The 32" FFL fabricated by using GFM showed high brightness and high efficiency.

Friday, December 7

9:00 - 10:00 **Main Hall B**

FMC4: Color Filters

Chair: J.-P. Lu, ITRI, Taiwan
Co-Chair: K. Fujishiro, Nippon Steel Chem., Japan

FMC4 - 1
9:00 **Taper Shape Control of Resin Black Matrix Containing Cardo-Type Binder**

M. Higashi, Y. Murata, K. Fujino, M. Kouno, K. Fujishiro
Nippon Steel Chem., Japan

The series of black resists composed of the cardo-type binder can give the smooth taper with even more than OD4/micrometer, whose taper shape strongly depends on both the carbon and monomer content in the black resist as well as the photo-process conditions.

FMC4 - 2
9:20 **Precise Black Matrix Patterning by Laser Explosion with Residue Reduction for Generation 10 Television LCDs**

T. Nagano, S. Asada, M. Tsukagoshi, K. Fujishiro**
OMRON Laserfront, Japan
**Nippon Steel Chem., Japan*

Color filters of LCDs have been produced by photo lithography process but whose reticules become much fine and large. Laser process is one of the attractive ways for cost compression, because it directly generates BMs without them. Precise BM patterning was achieved by newly developed method of “laser explosion”.

FMC4 - 3 9:40 **A 7-inch Plastic QVGA Color Filter Fabricated by All-Inkjet Printing**

J. P. Lu, F. K. Chen, P. C. Yeh, C. C. Hsiao, J. W. Shiu, K. Cheng, Y. Z. Lee, F. C. Chen[*]
ITRI, Taiwan
[*]*Nat. Chiao Tung Univ., Taiwan*

This article describes how to fabricate a 7 inch QVGA high saturation color filter panel by all-inkjet printing technique. Besides printing the red, green and blue color resists, we fabricate the fine stripe-type trenches for ink confining in a high throughput printing method. The color saturation of the resulting printed color filter can reach to 67.8% of NTSC.

----- Break -----

10:40 - 12:15 **Main Hall B**

FMC5: Materials

Chair: J. Koike, Tohoku Univ., Japan
Co-Chair: T. Itoh, Corning Japan, Japan

FMC5 - 1: **Withdrawn**

FMC5 - 2: 10:40 ***Invited*** **Control of Shape and Self-Assembly of Metal Nanoparticles**

M. Miyake
JAIST, Japan

Gold nanoparticles (AuNPs) are prepared in liquid-phase reduction method in the presence of discotic liquid-crystalline molecules with triphenylene (TP) as protective agents. By the tune of π-π interaction degree of TPs, linear 1D or hcp (2D) self-assemblies of AuTP are established. By UV irradiation, shape of AuTPs changed to disc.

FMC5 - 3: 11:00 ***Invited*** **Possibility of Cu-Mn Alloy for TFT Gate Electrodes**

J. Koike
Tohoku Univ., Japan

Cu-Mn alloy was deposited on SiO_2 or on glass substrates. After heat treatment, the alloy film showed resistivity decrease to the level of pure Cu, together with good adhesion and diffusion barrier property with the substrates. Ohmic contact was also obtained for ITO/Cu-Mn film both before and after heat treatment.

FMC5 - 4: 11:20 ***Invited*** **Transparent Conductive Ga-Doped ZnO Films Properties on Glass, PMMA and COP Substrates**

T. Yamamoto, T. Yamada, A. Miyake, T. Morizane, T. Arimitsu, H. Makino, N. Yamamoto
Kochi Univ. of Tech., Japan

Highly transparent conductive Ga-doped ZnO films were prepared on glass, unheated polymethyl methacrylate (PMMA) and cyclic olefin polymer (COP) substrates by reactive plasma deposition. On both plastic substrates, resistivity of the GZO films decreased from 2×10^{-3} to 5×10^{-4} Ωcm with increasing film thickness.

FMC5 - 5 11:40 **Adhesiveless CCL Development for LCD Driver by Polyimide Precursor Casting Method**

Y. Tokuda, H. Kawasato, A. Shimada, T. Nakabayashi, T. Suzuki
Nippon Steel Chem., Japan

CCL (Copper Clad Laminate) for COF (Chip On Film) has been manufactured by spatter plating method. For novel raw material proposal, we improved CCL by Polyimide precursor casting method. As a result, practicable CCL that have merits based on the casting method was developed.

FMC5 - 6L 12:00 **Spin-on Hybrid Dielectric for LCD and OLED Displays**

A. Krishnamoorthy, A. Gebrebrhan, R. Spear, M. Stifanos, M. Lowe, H. Bien, D. Yellowaga, P. Smith[*]
Honeywell Elect. Materials, USA
[*]Honeywell Specialty Materials, USA

Organosiloxane based spin on planarizing dielectric was developed for application in flat panel displays as a replacement to conformal chemical vapor deposited SiNx. In this paper, we demonstrate the successful intergation of siloxane-based materials into active matrix TFT's organic TFT's, color filters for LCD, and OLED devices.

----- Lunch -----

13:30 - 14:50 **Main Hall B**

FMC6: Optical Films

Chair: J. Rupp, Motorola, USA
Co-Chair: K. Miyazawa, Chisso Petrochem., Japan

FMC6 - 1: 13:30 ***Invited*** **Nano-Structured Mold to Attain Anti-Reflection on Optical Element Surface**

K. Kurihara, Y. Saitou[*], T. Nakano, H. Kato[*], J. Tominaga
AIST, Japan
[*]Ito Optical Ind., Japan

We provide a novel mold to attain anti-reflection to an injected replica upon. The mold was pro-duced with metallic nanoparticles as a mask in plasma etching. Controlling the size and space of the particles enables to reduce the reflection of the replica surface by 1%.

FMC6 - 2 13:50 **Novel Surface Treatment Film of Polarizer to Improve Optical Properties of 32-inch OCB Mode LCD TV**

J.-T. Lien[,**], S.-F. Chen[*,***], C.-L. Pan[*], C.-C. Chang[*],*
T.-Y. Lin[**], C.-L. Tsou[*], C.-N. Mo[*]
[*]Chunghwa Picture Tubes, Taiwan
[**]Nat. Taiwan Ocean Univ., Taiwan
[***]Nat. Chiao Tung Univ., Taiwan

We have developed OCB mode LCD panel possess fast response time about 0.98 ms and low color washout. To use novel surface-treatment film of polarizers is useful to reduce Chroma difference (ΔCu'v') of horizontal viewing direction. The value of ΔCu'v' is lower than 0.02.

FMC6 - 3 14:10 **Printable Thin Birefringent Film Retarders for LCD**

A. Lazarev, A. Geivandov, I. Kasianova, E. Kharatiyan,
P. Lazarev, S. Palto[*]
Crysoptix, Russia
[*]Inst. of Crystallography RAS, Russia

Crysoptix Ltd. has developed Thin Birefringent Films (TBF™) retarders with negative C-plate and biaxial plate functions for manufacturing via printing technology from liquid self-assembling materials. The new coatable sub-micron retarders exhibit high optical anisotropy, low depolarization, high temperature stability, and environmental durability. The commercialization of TBF™ retarders on-TAC and as in-cell LCD retarders is discussed.

FMC6 - 4 14:30 **The Relationship of Adhesive Property for Optical Film to Uniformity of TN-Mode LCD**

K. Yano, T. Chiba, A. Ogasawara, N. Nitta, T. Shouda
Nitto Denko, Japan

One important issue of TN-mode LCD is the uniformity is decreased due to the light leakage after a heating test. We found that the strain generated in a polarizing film was changed by the physical property of an adhesive, and thereby appearance of MURA was changed.

----- Break -----

15:10 - 16:30 **Main Hall B**

FMC7: Backlight Systems (1)

Chair: P. C. -P. Chao, Nat. Chiao Tung Univ., Taiwan
Co-Chair: M. Shinohara, Omron, Japan

FMC7 - 1
15:10

Medium Power LED for LCD Backlighting

T. Sakamoto, K. Bando
Nichia, Japan

Nichia has prepared white LED which achieved 150lm/W luminous efficacy. Nichia have also realized mass production levels of high luminous efficacy 100lm/W LEDs. Nichia's other advanced technology of long operating life is applied to medium power LCD backlighting LEDs.

FMC7 - 2
15:30

High Efficiency Ultra-Thin Direct View RGB LED Backlight Unit Using New LED Lens

C.-W. Chiu[*], C.-Y. Shen, C.-P. Chao[*], J.-S. Huang, C.-L. Wang[**], H.-W. Lin[**], S. Chi[**], S.-Y. Tsai[**]
Chung Yuan Christian Univ., Taiwan
[*]Nat. Chiao Tung Univ., Taiwan
[**]AU Optronics, Taiwan

The objective of this study is to design a novel cone-shaped lens for achieving high optical efficiency for an ultra-thin, direct type RGB LED backlight unit (BLU). The usage of the novel lens could replace the commonly used diffuser plate for gaining higher efficiency and providing satisfactory uniformity of BLU.

FMC7 - 3
15:50

RGB LED Backlight with Dynamic Gamma Correction System

M.-D. Chou, T.-P. Lin, F.-C. Lu, M.-C. Kao, T.-C. Shen, C.-L. Tsou, C.-N. Mo
Chunghwa Picture Tubes, Taiwan

Combination different RGB LED chip size method, WBA, area luminous control & dynamic gamma correction applied in 37" LCD TV. The 37" LCD TV is had not only better light efficiency, but reaching 500nits brightness and 105% NTSC. Moreover, 1M:1 high contrast ratio and reducing 30% power consumption is also arrived.

FMC7 - 4
16:10 **A High-Luminous Cold Cathode Fluorescent Lamp for a Wide-Color-Gamut LCD**

T. Kusunoki, T. Igarashi
Sony, Japan

For the first time, the phosphor combination of SCA, BAM:Mn, and YOX has been introduced into CCFLs for consumer LCDs. A CCFL using these phosphors simultaneously achieves a wide color gamut (WCG) and high luminance. This new WCG-CCFL has a 17% higher luminance than that of the previous WCG-CCFL.

----- Break -----

16:50 - 17:50 **Main Hall B**

FMC8: Backlight Systems (2)

Chair: K. Käläntär, Nippon Leiz, Japan
Co-Chair: Y. Fujimura, Nitto Denko, Japan

FMC8 - 1
16:50 **Round LCD Backlight for Multi-Functional Distinctive Digital Instrument in Automotive/Avionics Applications**

K. Käläntär, H. Horiuchi, H. Ishiko
Nippon Leiz, Japan

A round backlight has been developed to combine with a newly prototyped round LCD for multi-functional digital indicator instrument in automotive/avionics applications. The power consumption of the unit is about 1.43 W. The diameter and total thickness of the backlight are 74 mm and 3.52 mm, respectively.

FMC8 - 2
17:10 **High Brightness and Low Sparkling Prism Sheet for LCD Backlight**

K. Hayashi, T. Yamashita, Y. Murayama, O. Numata
Mitsubishi Rayon, Japan

New commercial grade prism sheets (C series) have been developed. The C series prism sheets use matte surfaces newly developed have low sparkling features. Furthermore, the high-diffusing grade of C type prism sheet can be established the excellent backlight units cost-lower and thinner than conventional, owing to remove a diffuser.

FMC8 - 3
17:30 **Compact Design of Light Guides Using Metal Grating Based Polarizing Optical Controller Element**

S. Banerjee, K. Nakatsuka
Sumitomo Chems., Japan

We discuss the design and simulation of metal grating based polarizing optical elements for use in the visible portion of the electromagnetic spectrum. We propose to integrate such elements onto the top surface of the light guides to polarize and control the transmitted light output. Such elements in combination with diffusing reflectors are able to recycle light efficiently.

Author Interviews
18:10 – 19:10

Supporting Organizations:
The Japan Society for Printing Science and Technology
Japan Society of Color Material
The Technical Association of Photopolymers, Japan
Society of Photographic Science and Technology, Japan
The Society of Radtech, Japan
The Japanese Research Association of Organic Electronics Materials
Japan Printed Circuit Association

IDW Best Paper Award

This new award will go to the most outstanding paper selected from those presented at IDW ’07. The 2007 award winners will be announced on the IDW web site:
http://www.idw.ne.jp/award.html

Workshop on CRTs

Wednesday, December 5

13:20 - 16:20 **Main Hall C**

Poster **CRTp: CRT Poster**

CRTp - 1 **Improvement in Productivity and Cost Reduction of Electron Gun**

M. W. Tang, V. K. Yap, C. T. Chan, C. C. Hwong
Chunghwa Picture Tubes, Malaysia

With the trend of high competition in CRT TV market, the production cost played an important role in this survival battle. The major production costs were raw material and manpower. Therefore, by applying techniques of automation, process combination and grid parts simplification, the productivity able to improve by 18% and the cost reduced by 25%.

Thursday, December 6

10:40 - 10:45 **Small Hall**

Opening

Opening Remarks
10:40

H. Y. Chen, Chunghwa Picture Tubes, Taiwan

10:45 - 12:00 **Small Hall**

CRT1: History and Future of CRT

Chair: M. Maeda, Consult., Japan
Co-Chair: Y. Wada, MT Picture Display, Japan

CRT1 - 1: ***Invited*** **History of CRT Development**
10:45

E. Yamazaki
Consultant, Japan

Reviewing the development history of CRTs since the invention of K. F. Braun in 1897, it is discussed here how the CRT contributed to the current information society in the 20th century. However, as history changes, the CRT is giving way to newly developed FPDs which will play an important role in the digital TV era of this century.

CRT1 - 2: 11:15 ***Invited*** **History of Lighthouse Optical System for Dot Mosaic Printing**

T. Fujimura
Samtel Color, India

In elimination of mis-landing, the correction lens of the lighthouse encounters a theoretical performance limitation. To compensate the deficiency, many devices have been tried. Among them, a typical device called 'Parallax Method' is reviewed with a brief history and the theoretical background.

CRT1 - 3: 11:40 ***Invited*** **The CRT Industry Needs a Coordinated Effort for Long Term Survival**

H. Y. Chen
Chunghwa Picture Tubes, Taiwan

It is a well-known fact that the demise of the CRT monitor market is unavoidable. However, it is possible to slow, or even reverse, the CRT TV market's declining trend. This would require the CRT industry to look beyond conventional thinking and develop a coordinated strategy to ensure long-term survival.

----- Lunch -----

13:30 - 14:40 **Small Hall**

CRT2: CRT Deflection System

Chair: T. Saito, Tokyo Cathode Lab., Japan
Co-Chair: K. B. Son, LP Displays, Korea

CRT2 - 1: 13:30 ***Invited*** **History and Future of Deflection Yoke**

S. Hattori, J. K. Song
MIR E&DS, Korea

As we are fully understood, CRT is one of the most distinguished display devices ever since made, which highly performs not only in quick responding speed but also high brightness. And there is Deflection Yoke that enables CRT to bring out the best condition to perform on display.

CRT2 - 2 14:00 **Advanced Algorithm for DY/Tube Matching**

H. Meershoek
LP Displays, The Netherlands

We describe the design of an advanced real time algorithm for an automated DY/tube match system, which minimizes screen errors according to least squares-, minmax- or a mixture-norm. A Robust Design Study has been performed to find the algorithm parameters that deliver a good compromise between picture quality, yield and speed.

CRT2 - 3 14:20 **Development of Compact DY System without Field Correction Coil**

Y. S. Ling, C. C. Chao, C. H. Lim
Chunghwa Picture Tubes, Malaysia

Since copper is the main material of Deflection Yoke (Abbreviated as DY) which contribute over 65% of DY cost, a lighten weight and without Field Correction Coil (Abbreviated as FC Coil) has been developed; this paper only concentrated on 20V RF TV, in which the elimination of FC Coil is the most difficult part in DY & CRT design.

----- Break -----

15:10 - 16:20 **Small Hall**

CRT3: Super Slim CRT

Chair: J. Henrichs, LP Displays, The Netherlands
Co-Chair: H. Y. Chen, Chunghwa Picture Tubes, Taiwan

CRT3 - 1: 15:10 ***Invited*** **From Vision to Reality: the Path to Super Slim CRT**

J. Meijer, J. van der Heijden
LP Displays, The Netherlands

SuperSlim CRT are defined by a much reduced tube length, but without any deterioration of performance and under strict compatibility with older CRT. Computer simulation models predicted SuperSlim to be unfeasible. These problems have been overcome by an integral design approach, involving multidisciplinary study of the principal design choices.

CRT3 - 2 15:40 **Ultra Short-Length Gun Design for 21-in. Ultra Vixlim CRT**

K. Sung, S. Lee, Y.-H. Jeong, S. Back, M. Bae
Samsung SDI, Korea

We have designed Ultra Short-length Gun (USG), the length is shortened drastically, Result in we could develop 21" Ultra Vixlim (UX) CRT, allover length is diminished less 300mm. This gun shows good focus performance and moiré characteristics with high reliability.

CRT3 - 3 16:00 **Optimized Methods of Reducing doming for AK Shadow Mask of 29-in. Super Slim CRT**

J. I. Jang, J. E. Choi, J. C. Park
LP Displays, Korea

No abstract was submitted.

----- Break -----

16:30 - 18:00 **Small Hall**

CRT4: CRT Technologies

Chair: S. Shirai, Hitachi Displays, Japan
Co-Chair: M. Bae, Samsung SDI, Korea

CRT4 - 1: 16:30 ***Invited*** **History and Future of CRT Phosphor Technologies**

H. Yamamoto
Tokyo Univ. of Tech., Japan

This talk begins with a review of transition of CRT phosphors in the early stage. Then it discusses the most important efficiency issue, particularly on luminance saturation and degradation, in connection with FEDs or SEDs. A new group of phosphors, nitrides and oxynitrides, will be described with a hope that new useful cathode-ray phosphors may be invented after long blank.

CRT4 - 2: 16:55 ***Invited*** **Development of Advanced Phosphor Screening Technologies for an Ideal CRT**

K. Ohno, T. Kusunoki[*]
Ohno Advanced Phosphor Consult., Japan
[*]Sony, Japan

PDP and LCD are increasingly edging into the market because of the disadvantage of CRT-TV regarding weight and depth. However, the picture qualities of CRT-TV are better excellent than those of PDP and LCD. This report will explain development of advanced phosphor screening technology for an ideal CRT.

CRT4 - 3 17:20 **A CAE Method for Shadow Mask of CRT**

Y. Ye, M. Yu, J. Zhao
IRICO Group Elect., China

The shadow mask is a important part of CRT. The doming, microphony effect and drop resistance is the important characteristics of shodow mask. The 3D model which contains nearly all parts of CRT were done with Pro/Engineer and were transformed to ANSYS. The doming, microphony effect and drop resistance analysis were done using the FEM through the ANSYS.

CRT4 - 4
17:40 **Development and Application of Structural Design Techniques for CRT Embodiment**

H. Sakamoto, J. Itoh, S. Takada, M. Miyazaki
Mitsubishi Elec., Japan

This paper summarizes newly developed structural design techniques which involve accurate simulation techniques, strength characteristics and structural optimization technique, for CRT design. These techniques were applied to a highly reliable, light weight 51 cm flat-face CRT.

Author Interviews
18:10 – 19:10

Supporting Organizations:
Technical Group on Information Display, ITE
Technical Committee on Electronic Information Displays, Electronics Society, IEICE

Workshop on Plasma Displays

Wednesday, December 5

13:20 - 16:20 **Main Hall C**

Poster **PDPp1: Plasma Displays (1)**

PDPp1 - 1 **Development of Electron Emission Simulator for Protective Layer's Surface of PDP**

H. Tsuboi, K. Serizawa, H. Kikuchi, R. Sahnoun, M. Koyama, H. Hatakeyama, A. Endou, H. Takaba, M. Kubo, C. A. Del Carpio, H. Kajiyama[*]*, T. Shinoda*[*]*, A. Miyamoto*
Tohoku Univ., Japan
[*]*Hiroshima Univ., Japan*

To investigate the electronic structure and electrical conductivity of MgO protecting layer, our original tight-binding quantum chemical molecular dynamics program "Colors" and electrical conductivity evaluation simulator have been successfully applied. Furthermore we have also succeeded in the development of an electron emission simulator for protecting layer of a PDP.

PDPp1 - 2 **Development of Electrical Conductivity Simulator for Metal Oxides Based on Tight-Binding Quantum Chemistry Theory**

Z. Zhu, K. Serizawa, A. Chutia, H. Kikuchi, R. Sahnoun, M. Koyama, H. Tsuboi, N. Hatakeyama, A. Endou, H. Takaba, M. Kubo, C. A. Del Carpio, H. Kajiyama[*]*, T. Shinoda*[*]*, A. Miyamoto*
Tohoku Univ., Japan
[*]*Hiroshima Univ., Japan*

A novel electrical conductivity simulation approach has been developed and applied to investigate electrical properties of metal oxide. This approach is based on tight-binding quantum chemistry theory and Monte Carlo simulation. Both bulk MgO and SnO_2(110) surface were investigated. Our results were agreement with experimental observations and provide valuable insight into studying of oxides conductivity.

PDPp1 - 3 **Development of Large-Scale Quantum Chemical Molecular Dynamics Simulator and Its Application to PDP Materials**

A. Endou, K. Serizawa, K. Ogiya, H. Onuma, T. Onodera, C. Lv, H. Kikuchi, H. Tsuboi, M. Koyama, N. Hatakeyama, H. Takaba, M. Kubo, C. A. Del Carpio, H. Kajiyama[*], T. Shinoda[*], A. Miyamoto
Tohoku Univ., Japan
[*]Hiroshima Univ., Japan

We have developed a new tight-binding quantum chemical molecular dynamics code, 'New-Colors', based on tight-binding quantum chemical molecular dynamics code, 'Colors'. We demonstrated that New-Colors code was successfully accelerated by the comparison of computation time. This program is expected to be effective in performing large-scale quantum chemical molecular dynamics simulations.

PDPp1 - 4 **Surface Potential and Secondary Electron Yield of MgO Thin Film of 50 nm Thickness under Ion Irradiation**

T. Nagatomi, K. Yoshino[*], Y. Morita[*], M. Nishitani[*], M. Kitagawa[*], Y. Takai
Osaka Univ., Japan
[*]Matsushita Elec. Ind., Japan

The ion-induced secondary electron emission from a 50 nm-thick MgO film on a Si substrate was investigated. The energy distributions of secondary electrons confirmed that the positive surface potential of the order of several hundreds V, which depends on only the collector voltage, significantly decelerates primary ions, and induces the ballistic electron emission from the substrate through the MgO film.

PDPp1 - 5 **Withdrawn**

PDPp1 - 6 **Measurement of Secondary Electron Emission Coefficient with External Applied Voltage in AC PDP**

C. G. Son, E. Y. Park, S. S. Lee, S. H. Hong, S. J. Jung, J. H. Kim, Y. J. Hong, S. H. Cho, Y. G. Han, K. B. Song, M. W. Moon, B. H. Hong, G. S. Cho, E. H. Choi
Kwangwoon Univ., Korea

We measured ion-induced secondary electron emission coefficient in the 4 inch test panel with external applied difference voltage. In this research, we located 4inch test panel in Gamma-FIB (Focused Ion Beam) system and inflicted positive bias to the panel and used neon ion beam which has accelerative voltage between 120V and 200V, and measured secondary electron emission coefficient. The γ value is found to be decreased when the positive voltage is applied to the AC-PDP.

PDPp1 - 7 **Secondary Electron Emission Coefficient and Discharge Characteristics with Temperature in AC PDP**

E. Y. Park, C. G. Son, S. H. Hong, S. S. Lee, E. H. Choi
Kwangwoon Univ., Korea

It is noted that the temperature is an important factor which can change the discharge characteristics in AC-PDP. We measured firing voltage, brightness and IR response time according to the various temperatures in the AC-PDP. It is found that the secondary electron emission coefficient (γ) is increased as in creasing the temperatures, which results in lower breakdown voltages and faster response time for IR peak intensity during discharges.

PDPp1 - 8 **Characteristics of MgO Protective Layer with Deposition Rate in AC PDP**

S. H. Hong, E. Y. Park, C. G. Son, S. J. Jung, S. S. Lee, S. H. Cho, J. H. Kim, Y. J. Hong, Y. G. Han, K. B. Song, M. W. Moon, G. S. Cho, E. H. Choi
Kwangwoon Univ., Korea

In alternating current plasma display panels (AC-PDPs), the ion-induced secondary electron emission coefficient (γ) has effect on breakdown voltage. In order to find out optimized deposition condition of MgO, we have measured the ion-induced secondary electron emission coefficient with deposition rate of MgO by using Gamma Focused Ion beam (γ-FIB) system.

PDPp1 - 9 **Improvement of Optical Simulation by Using New UV Source in PDP Cells**

C. W. Eom, J. W. Kang
Dankook Univ., Korea

For improving the accuracy of simulated results, new UV source was designed. Previously the optical simulation was performed with the symmetric planar UV source. To design new UV source, UV distribution from the plasma fluid code was implanted to the 3-dimensional optical code to generate the visible light distribution.

IDW Best Paper Award

This new award will go to the most outstanding paper selected from those presented at IDW '07. The 2007 award winners will be announced on the IDW web site:
http://www.idw.ne.jp/award.html

PDPp1 - 10 Measurement of Spatiotemporal Distribution of Excited Xe Atom Density in $1s_5$ with Various ITO-Shape in AC PDP

S. H. Cho, P. Y. Oh, J. H. Kim, Y. J. Hong, S. J. Jung, S. S. Lee, S. H. Hong, C. G. Son, Y. G. Han, K. B. Song, M. W. Moon, G. C. Kwon, B. H. Hong, G. S. Cho, E. H. Choi
Kwangwoon Univ., Korea

In this study, we have measured the spatiotemporal behavior of the excited Xe atoms density in the $1s_5$ metastable states by laser absorption spectroscopy in accordance with various ITO-shapes. The maximum density of excited Xe atoms in the $1s_5$ state in discharge cell for Fish-bone typed, T typed and Square typed ITO electrodes has been measured to be 3.01 x 10^{13} cm^{-3} , 2.66 x 10^{13} cm^{-3} and 2.06 x 10^{13} cm^{-3}, respectively.

PDPp1 - 11 Measurement of Spatiotemporal Behavior of Excited Xe Atom Density in $1s_5$ with Gas Pressure in AC PDP

J. H. Kim, S. H. Cho, P. Y. Oh, S. J. Jung, Y. J. Hong, E. Y. Park, S. S. Lee, S. H. Hong, M. W. Moon, K. B. Song, C. G. Son, Y. G. Han, B. H. Hong, G. S. Cho, E. H. Choi
Kwangwoon Univ., Korea

We have measured the excited Xe atoms density in the $1s_5$ metastable states, and productive efficiency of excited Xe atom per one cell by laser absorption spectroscopy in accordance with the filling gas pressures. We have known that the excited Xe atom's productive efficiency has been gradually saturated.

PDPp1 - 12 Withdrawn

PDPp1 - 13L Effect of Secondary Electron Emission by Xe^+ on Firing Voltage in AC-PDPs

M. Kitagaki[,**], K. Uchida[*,***], K. Tsutsumi[**], G. Uchida[*], H. Kajiyama[*], T. Shinoda[*]*
[*]Hiroshima Univ., Japan
[**]Tateho Chems. Ind., Japan
[***]ULVAC, Japan

MgO based protective layers with finite secondary electron emission coefficient by Xe^+, $\gamma_{(Xe)}$, are synthesized and their effect on firing voltage is measured in AC-PDPs. It is measured that the slight increase of $\gamma_{(Xe)}$ by an order of 0.01 reduces the firing voltage and that the reduction becomes larger at higher Xe content.

PDPp1 - 14L **Kinetic Electron Emission from Insulator Surfaces and its Significance in Plasma Display Panel**

J. Y. Chun, J. Y. Moon, T. G. Kwon, J. Lee
Seoul Nat. Univ., Korea

The kinetic emission yield γ_{KE} of SrO by Xe^+ is large and sensitively depends on the concentration of O vacancy. When averaged over the energy distribution of Xe^+ in PDP, an effective γ_{KE} of ~0.1 was obtained. This can be a mean to significantly improve the discharge characteristics of PDP.

PDPp1 - 15L **Release Condition of Wall Electrons in AC-PDP**

T. Sakai, K. Tachibana[*]
Display Res. Labs., Japan
[*]*Kyoto Univ., Japan*

Wall electrons on the dielectric layer of the cathode are released if Es > Ed+Et , where Es : electric field of the discharge space, Ed: electric field of dielectric side, Et: electric field of a electron capturing site. This condition is possible if there is a projection part on the layer.

Thursday, December 6

9:00 - 12:00 **Main Hall C**

Poster **PDPp2: Plasma Displays (2)**

PDPp2 - 1 **Analysis of Sustain Wavefrom for Improving Luminance and Luminous Efficacy in AC PDPs**

N. W. Choi, C.-S. Min, S.-H. Yoon, B.-J. Shin[*]*, J. H. Seo*
Univ. of Incheon, Korea
[*]*Sejong Univ., Korea*

By controlling moderately the sustaining pulse width and the time interval between successive sustaining pulses, we could manipulate the wall voltage and priming particles. In this paper, two types of a sustain waveform, positive going pulse and negative going pulse, are investigated to analyze their effect on the luminance and luminous efficacy.

IDW Outstanding Poster Paper Award

The 2007 award winners will be announced on the IDW web site:
http://www.idw.ne.jp/award.html

PDPp2 - 2 **Proposed Driving Waveform for Improving Address Discharge Characteristics of AC PDP**

S. S. Lee, C. S. Son, Y. J. Hong, E. H. Park, S. H. Hong, Y. G. Han, J. H. Kim, S. J. Jung, S. H. Cho, M. W. Moon, K. B. Song, B. H. Hong, E. H. Choi
Kwangwoon Univ., Korea

A new reset driving waveform is proposed to improve an address discharge time lag in this research under the conventional address voltages. The new reset waveform can accumulate the more wall charges between address-scan (A-Y) electrodes than those for conventional waveform. In this experiment, it is found that the formative time lag and statistical time lags could be reduced by the new reset waveform.

PDPp2 - 3 **A Study on the Address Delay Time with Various Reset Ramp Waveforms in AC PDP**

Z. H. Li, S. J. Hong, S. H. Im, S. J. Kwon
Kyungwon Univ., Korea

In this paper, the address delay time was investigated with various slopes ramp waveform during a reset period in AC PDP. The results showed that the address delay time wildly varied with different slopes of the ramp waveforms. The relationship between priming particles and ramp waveforms was also analyzed.

PDPp2 - 4 **Studies of New Waveform with Negative Ramp Pulse and Various Sustain Pulses**

S. H. Eom, J. W. Kang, H. I. Park[*]*, S. H. Mun*[*]
Dankook Univ., Korea
[*]*LG Elect., Korea*

A new reset waveform with negative ramp pulse was proposed to improve addressing discharge in alternating current ac PDP. A modified negative waveform having positive address pulse was discussed. With the modified negative waveform, the address and sustain discharges were successfully ignited. A negative and alternating sustain pulses were also studied with combined with the negative reset pulse.

PDPp2 - 5 **Compensation of Luminous Efficiency Relative to Displayed Area in AC PDP**

J. K. Lim, B.-T. Choi, H.-S. Tae, H. J. Kim[*]*, M. Hur*[*]*, M. Yoo*[*]*, E. G. Heo*[*]
Kyungpook Nat. Univ., Korea
[*]*Samsung SDI, Korea*

The decrease in the luminous efficiency in the range of 50%-less displayed area is related to the increase of the applied sustain pulse number under the 50%-less displayed area. As a result, by properly controlling the rising slope of ERC depending on the displayed area, especially 50%-less displayed area, the luminous efficiency can be improved by about 6 - 10% under the 50% less-displayed area.

PDPp2 - 6 **Study on the Discharge Characteristics of AC PDP at High Temperature**

D. H. Kim, W. J. Jeon, T. Y. Song, S.-H. Lee
Inha Univ., Korea

Unstable sustain discharges can occur at the bottom cells of the panel at high temperature. It seems that the resultant wall charge loss during address period increased with increase of temperature as well as the addressing stress pulse voltage. Therefore it results in unstable discharge during sustain period.

PDPp2 - 7 **Ghost Image Analysis of Contrast-Enhancement Film for PDPs**

T. W. Beom, H. Cui, D. H. Lee, W. J. Jeong[*], K. C. Yoon[,**], S. T. Kim[*], J. R. Park*
Chosun Univ., Korea
[*]Samsung Fine Chems., Korea
[**]KAIST, Korea

We have performed analysis of the ghost image phenomenon induced by a contrast-enhancement film (CEF) used for plasma display panels (PDPs). A conventional CEF, composed of a base film and black-stripes embedded in ultra-violet (UV) resin, is analyzed using an illumination design tool, LightTools (Optical Research Associates).

PDPp2 - 8 **Reduction of Temporal Dark Image Sticking in AC PDP Using Vacuum Sealing Method**

C.-S. Park, H.-S. Tae, Y.-K. Kwon[*], E. G. Heo[*]
Kyungpook Nat. Univ., Korea
[*]Samsung SDI, Korea

Minimizing the residual impurity gas is the key factor for reducing temporal dark image stickings. In this paper, the vacuum-sealing method is adopted to minimize the residual impurity gas by enhancing a base vacuum level, and the resultant change in the temporal dark image sticking was examined in comparison with that of the conventional sealing method in the 42-in. ac-PDP with a high Xe content.

PDPp2 - 9 **Diagnostics of PDP Micro-Discharge Plasmas Using Infrared Laser Thomson Scattering System**

Y. Sonoda, A. Akune, K. Tomita, S. Hassaballa, K. Uchino, K. Ishii[*], Y. Hirano[*], Y. Murakami[*]
Kyushu Univ., Japan
[*]NHK, Japan

In order to avoid laser perturbations for Xe containing discharges, the laser Thomson scattering (LTS) system having an infrared laser at a wavelength of 1064 nm as a light source has been developed. The basic behavior of electrons in the Ne/Xe discharges was investigated by using the infrared LTS system.

PDPp2 - 10 Direct Observation of Vacuum Ultraviolet Emission in AC PDP

G. Uchida, H. Kajiyama, T. Shinoda
Hiroshima Univ., Japan

Here is presented direct observation of vacuum ultraviolet radiation from alternating-current plasma display (AC-PDP). Measurement shows that high ultraviolet-radiation efficiency is attained especially for high Xe contents. The change of electron energy is also analyzed from emission spectra. There is considerable effect of Xe contents on electron energy. Our experiment shows that electron energy directly affects the ultraviolet-radiation efficiency.

PDPp2 - 11 Measurements of Surface Charge and Voltage in a Discharge Cell with 100-μm Gap Coplanar Structure Using Electro-Optic Crystal

K. Ishii, Y. Murakami, Y. Hirano, S. Kubota[*], T. Sakurai[*], H. Yoda[**]
NHK, Japan
[*]Univ. of Yamanashi, Japan
[**]Tokyo Electron AT, Japan

The surface voltages on the dielectric barrier in a 100-μm gap discharge cell of coplanar structure were measured using an electro-optic crystal for various gas mixture conditions. The surface voltage increased with the amount of xenon gas at low total gas pressures. However, for high gas pressures, the estimated wall voltages gradually decreased for xenon gas contents exceeding 20%.

PDPp2 - 12 Direct Patterning of Indium Tin Oxide Layer in PDP Using Nd:YVO_4 Laser

K. H. Kim, M. H. Ahn, S. J. Kwon
Kyungwon Univ., Korea

Maskless laser direct patterning ITO films was experimented using a Q-switched Nd:YVO_4 laser (λ=1064 nm) for the fabrication of plasma display panel (PDP) bus electrodes. The laser ablated ITO patterns showed the formation of shoulders at the edge of the ITO lines and the ripple-like structure with the etched bottom compared with the chemically wet etched ITO patterns. We changed pulse repetition rate and examined damage degree of PDP glass.

PDPp2 - 13 Synthesis of Low Temperature Burnable P(MMA-BMA) Binder and Control of Carbon Residue during Baking Process of BAM Phosphor Paste

S. W. Kim, S. Lee, W. B. Im, J.-S. Lee, H. S. Jang, H. S. Yoo, D. Y. Jeon*
KAIST, Korea
**Samsung SDI, Korea*

In order to reduce thermal degradation of PDP BAM phosphor ($BaMgAl_{10}O_{17}:Eu^{2+}$), it is desirable to develop low temperature burnable binder instead of using the commercial cellulose type binder, which need high temperature baking process. Therefore, we synthesized and adopted P(MMA-co-BMA) binder for PDPs applications.

PDPp2 - 14L Influence of Wall Charge on Image Sticking Phenomena in AC PDP

M. J. Jeon, M. S. Chung, B. K. Kang
Pohang Univ. of S&T, Korea

This paper investigates the cause of the image sticking phenomenon in AC PDP and proposes an efficient way to reduce the phenomenon. Experimental results indicate that image sticking is caused mainly by the wall charges accumulated on the sustain electrodes. A few face discharges equate the wall voltages on the sustain electrodes and set all cells of the PDP at the same external voltage for firing a surface discharge.

PDPp2 - 15L An Algorithm to Compensate for the Load Effect of AC PDP

G. H. Hur, S. H. Kim, J. H. Kim, B. K. Kang
Pohang Univ. of S&T, Korea

This paper proposes an algorithm to compensate for the load effect of PDP, which causes a decrease of luminance with an increase of the number of ON pixels. The proposed algorithm modifies the gray level and changes the number of sustain pulses for each subfield. The luminance errors due to the load effect were reduced by ~70% after compensation.

PDPp2 - 16L Characteristics of Fence-type Aluminum Electrode via Anodic Bonding with Soda Lime Glass Substrate

M.-Y. LEE, W.-Y. Choi, Y.-S. Kim
Hong-ik Univ., Korea

A fence-type aluminum electrode on soda lime glass substrate was formed via anodic bonding followed by patterning with chemical etching. The electrode pattern was anodized to form the dielectric layer on its surface. Test panels were prepared using the front plate with the electrode pattern and their luminance and discharge characteristics were examined. The results demonstrated a possibility of using aluminum electrode for ac-PDP.

PDPp2 - 17L **Effect of Auxiliary Pulse on Address for Overlapped Scan Method in AC PDP**

O. K. Kwon, T. G. Kim, B. H. Lim, D. H. Cho, K. H. Kim, J. S. Oh, S. G. Yang, D. H. Lee
Kyungpook Nat. Univ., Korea

Now AC-PDPS are widely used for large size TV displays. In order to improve the address method, the overlapped scan waveform has been proposed recently. In this paper, a new overlapped scan waveform with an auxiliary pulse is presented. The proposed waveform allows more stable addressing than conventional overlapped scan waveform.

13:30 - 14:50 **Mid-sized Hall A**

PDP1: Protective Layer (1)

Chair: H. Tolner, Southeast Univ. , China
Co-Chair: H. Kajiyama, Hiroshima Univ., Japan

PDP1 - 1: 13:30 ***Invited*** **Perspective for Near Future Technology and Industry on PDPs**

R. Murai, M. Kitagawa
Matsushita Elec. Ind., Japan

In recent years, PDPs growth rate has been slower than LCDs. This occurred when LCD TV makers introduced large size, 1080p and bright LCDs to the world market. PDP makers have developed and advanced the technology to overcome these items. In this paper, we will discuss this in detail.

PDP1 - 2 13:50 **Effect of Surface Contamination on Destruction and Recrystallization Dynamics of MgO Protecting Layer in PDP by Molecular Dynamics Simulation Method**

M. Kubo, K. Serizawa, H. Kikuchi, R. Sahnoun, M. Koyama, H. Tsuboi, N. Hatakeyama, A. Endou, H. Takaba, C. A. Del Carpio, H. Kajiyama[*], T. Shinoda[*], A. Miyamoto
Tohoku Univ., Japan
[*]Hiroshima Univ., Japan

Our original molecular dynamics code was applied to the destruction and recrystallization dynamics of MgO protecting layer in PDP by Xe sputtering. We elucidated that adsorbed water molecules are dissociated and hydrogen atoms are intruded into the MgO surface. These phenomena were suggested to degrade its second electron emission ability.

PDP1 - 3
14:10

Reconstruction Characteristics of MgO (111) Textured Protective Layer by Over-Frequency Accelerated Discharge in AC PDP

S. K. Kwon, J. H. Kim, S. K. Moon, H. H. Kim, K. H. Park, Y.-J. Cho, S.-T. Kim, K.-R. Lee
LG Elect., Korea

The reconstruction characteristics of MgO (111) textured protective layer in AC-PDP were investigated by over-frequency accelerated discharge and these were correlated to the variations of electronic structures. The reconstruction and exaggerated grain growth (EGG) were explained by defect-assisted 2-D nucleation and growth of charged clusters during discharge under electric field in AC-PDP.

PDP1 - 4
14:30

Electron Emission Characteristics of Hydrogen Doped $12CaO \cdot 7Al_2O_3$ Electride for PDP

S. Webster, M. Ono, S. Ito, H. Kajiyama[*], T. Shinoda[*], H. Hosono[**]
Asahi Glass, Japan
[*]Hiroshima Univ., Japan
[**]Tokyo Inst. of Tech., Japan

Secondary electron emission by Xe^+ was observed for H^--containing $12CaO \cdot 7Al_2O_3$ electride after an ultraviolet light irradiation to form mid-gap states through photo-dissociations of H^- ions ($H^- \rightarrow H^0 + e^-$). The γ was found to be ~0.1 and was not seriously decreased after a heat-treatment in air.

----- Break -----

15:10 - 16:40 **Mid-sized Hall A**

PDP2: Protective Layer (2)

Chair: G. Oversluizen, Philips Res. Labs., The Netherlands
Co-Chair: M. Uchidoi, Pioneer, Japan

PDP2 - 1
15:10

Proposal of Auger Ion Spectroscopy for Direct Observation of Midgap States of MgO

H. Kajiyama[*], M. Kitagaki[,**], K. Tsutsumi[*,**], G. Uchida[*], T. Shinoda[*]*
[*]Hiroshima Univ., Japan
[**]Tateho Chems. Ind., Japan

Photoemissions induced by Auger reaction between incident inert ions and MgO surface are measured. It is shown that the midgap states such as F-type centers could be observed.

PDP2 - 2
15:30

High Performance MgO Thin Film for PDP with High Rate Sputtering Deposition Process

M. Terauchi, J. Hashimoto, H. Nishitani, Y. Fukui, M. Okafuji, H. Yamashita, H. Hayata, T. Okuma, H. Yamanishi, M. Nishitani, M. Kitagawa
Matsushita Elec. Ind., Japan

A high rate sputtering deposition process of MgO thin film was developed. The deposition rate of MgO thin film attained was about 300 nm/min. The MgO film deposited in this work has a larger density than Electron Beam deposition and shows good discharge characteristics including firing voltage and discharge formation.

PDP2 - 3
15:50

Discharge Probability Model for Analyzing Formative Delay Time and Electron Emission Properties of MgO in PDPs

S. Ho, N. Uemura, S. Nobuki, T. Miyake, K. Suzuki, Y. Mikami, M. Shiiki, M. Uehara[*]
Hitachi, Japan
[*]*Hitachi ULSI Syss., Japan*

A new discharge probability model is proposed to analyze average and standard deviation of formative delay time, and the emission time constant of a priming electron from MgO. The activation energy and effective number of electron emission source are determined to be about 729 meV and 4.17×10^5 per cell, respectively.

PDP2 - 4L
16:10

Wall Charge Holding Characteristics of Doped MgO Thin Film for AC PDP

S. H. Yoon, H. S. Yang
Hong-ik Univ., Korea

Wall voltage holding characteristics of doped MgO were evaluated using VT close curve measurement. The results revealed that the holding characteristics are poor with the doped film. The causes of such poor characteristics were examined using FTIR measurements. The results indicated that shallow defects levels formed by doping may be responsible for such poor wall voltage holding characteristics.

PDP2 - 5L
16:25

Discharge Characteristics of a Color PDP with SrCaO Protective Layer

Y. Motoyama, M. Seki, K. Ishii, Y. Hirano, Y. Murakami
NHK, Japan

We have reproduced video content on a PDP with an SrCaO protective layer. The sustain pulse voltage was lower than that needed with the MgO protective layer. The discharge current was also lower than when using an MgO protective layer, and 1.9 times higher luminous efficiency could be obtained. The luminance of the two panels was almost the same.

----- Break -----

16:50 - 18:10 **Mid-sized Hall A**

PDP3: Cell Technology

Chair: L. S. Park, Kyungpook Nat. Univ., Korea
Co-Chair: Y. Murakami, NHK, Japan

PDP3 - 1
16:50

Effect of Groove Structures for Front Dielectric Layer on High Xe Content PDPs

T. Yamada, T. Togashi, T. Akiyama, Y. Noguchi, K. Shinohe, M. Kitagawa, T. Shinoda
Advanced PDP Development Ctr., Japan

This study describes the groove structures of a dielectric layer in high Xe PDPs. We found that the voltages of the groove structures were much lower than that of the flat without reducing the luminous efficacy. Additionally, the groove shape has influences on the luminous efficacy.

PDP3 - 2
17:10

Novel Fabrication Method of Barrier-Ribs for PDP by UV-Assisted Roll Embossing Process

S. M. Ryu, D. J. Kim[*], D. Y. Yang, L. S. Park[*]
KAIST, Korea
[*]Kyungpook Nat. Univ., Korea

Rapid fabrication technology of barrier-ribs based on a UV-assisted roll forming process is proposed. UV curable paste is coated on the soft mold by a paste supplier, continuously pressed against a roller with a soft mold, and cured with UV irradiation, resulting in fine barrier ribs as well as a uniform dielectric layer for a PDP.

PDP3 - 3
17:30

Effects of Plasma Loss on Luminous Efficacy in Full HD AC PDP

H. S. Bae, K.-W. Whang
Seoul Nat. Univ., Korea

We investigated the effect of cell resolution on the luminous efficacy through 3D numerical simulation. The increase of electrode gap, the adoption of SDE type with 4:3 aspect ratio, and the optimization of barrier rib height show the high luminous efficacy of Full HD, due to the reduced plasma loss.

PDP3 - 4
17:50

Self-Assembled Electrode of Microcavity Plasma Arrays: Discharge Properties of Large Scale Array and Device Fabrication by Wet Chemical Processing

S.-J. Park, K. S. Kim, A. J. Price, T. L. Kim, J. G. Eden, K. D. Kang[*], W. J. Yi[*]
Univ. of Illinois, USA
[*]Samsung SDI, Korea

Self-assembled, linearly interconnected microcavity plasma electrodes have been fabricated by wet chemical processes. Dielectric encapsulated aluminum microcavity electrodes having emissive cavities with a diameter of 50-200 μm are formed and fabricated to yield large scale arrays. This presentation reports device structures and cell designs for high pressure Xe microplasmas.

Author Interviews
18:10 – 19:10

Friday, December 7

15:10 - 16:30 **Main Hall A**

PDP4: Driving Technology

Chair: L. F. Weber, Consult., USA
Co-Chair: T. Shinoda, Shinoda Plasma/Hiroshima Univ., Japan

PDP4 - 1
15:10

Use of Self-Erase Discharges for High-Speed, Low-Voltage Addressing of PDPs

M. Shimura, T. Yamaguchi, T. Shiga, S. Mikoshiba
Univ. of Electro-Commun., Japan

A self-erase-discharge addressing is employed to drive a PDP which operates in an address-while-display, contiguous subfield, erase addressing scheme. With abundant priming charges created by the self-erase discharges a stable control of address discharges can be accomplished, resulting in low voltage (30V) and high speed (0.66μs) addressing of a Ne+Xe (10%) PDP.

PDP4 - 2 **Observation of Wall Charge Leakage during Address**
15:30 **Period under Variable Panel Temperature**

S.-K. Jang, H.-S. Tae, E.-Y. Jung, J.-C. Ahn*, J.-H. Oh*, E.-G. Heo*, B.-H. Lee**
Kyungpook Nat. Univ., Korea
**Samsung SDI, Korea*

To explain the address discharge fail at a high temperature, the wall charge leakage phenomenon during an address-period was investigated relative to the number of applied address and sustain pulses under variable panel temperatures based on the Vt closed-curve analysis. The wall charge leakages were increased with an increase in the number of the applied address and sustain pulse, and this tendency are intensified as the panel temperature increased.

PDP4 - 3 **Cost Effective Multi-Level Single Sustaining Driver**
15:50 **with Dual Energy Recovery Paths for AC PDP**

S.-W. Choi, K.-H. Yi, G.-W. Moon
KAIST, Korea

Conventional single sustaining driver suffers from heat problem caused by large conduction loss of sustain switches. But, since proposed driver lowers the voltage stress of sustain switches by series-connected configuration of switches and floating capacitor, it uses half voltage rating of sustain switches and reduces the conduction loss of switches.

PDP4 - 4 **Digital Power Amplifier for Generating Reset and**
16:10 **Scan Driving Waveforms of AC PDP**

S.-W. Choi, W.-J. Lee, G.-W. Moon
KAIST, Korea

Since conventional driving circuit has multiple voltage sources and power switches to generate reset and scan driving waveforms, it has complex structure and high cost. However, the proposed digital power amplifier is operated by only one voltage source and has fewer devices. Thus, its size and cost is greatly reduced.

----- Break -----

16:50 - 18:10 **Main Hall A**

PDP5: PDP TV

Chair: K.-W. Whang, Seoul Nat. Univ., Korea
Co-Chair: R. Murai, Matsushita Elec. Ind., Japan

PDP5 - 1
16:50

Development of New 42-in. WXGA Resolution SMPDP

Y. M. Tang[,**], X. Zhang[*,**], B. P. Wang[*,**], Q. Y. Lin[**], L. F. Zhu[**]*
[*]Southeast Univ., China
[**]Nanjing Huaxian High Tech., China

To meet the requirements of Chinese HDTV standard and complete SMPDP product design, a SMPDP with WXGA resolution was developed. The panel output has been carefully designed to fit the great data electrode number and to be compatible for Dual/Single Scan mode. Driver system was re-designed with low cost solution.

PDP5 - 2
17:10

Measurement of Critical Flicker Frequency at Extremely Low Luminance Levels and Flicker-Less 20Hz Reset Drive of PDPs

S. Sakai, T. Shiga, S. Mikoshiba
Univ. of Electro-Commun., Japan

Critical flicker frequency (CFF) was measured under luminance as low as 0.002cd/m^2. Together with the measurements of a ramp reset pulse frequency vs. background emission, it was found that the reset frequency could be reduced to 20Hz without flickering of the background luminance. The background luminance then could be reduced to 0.036cd/m^2 with a dark room contrast of 35,000:1.

PDP5 - 3
17:30

World's First 42-in.1080p HD PDP

H. Tachibana, K. Ogawa, T. Nakajima, T. Nakagawa, M. Fujitani, K. Sumida
Matsushita Elec. Ind., Japan

We have developed a new fine width rib material and process technology that can increase the aperture ratio. A new fine pitch cell stabilized driving technology also has been developed to suppress cross-talk. This has enabled us to introduce to the market the World's First 42-inch 1080p HD PDP.

EXHIBITION

13:00–17:00 Wednesday, Dec. 5
9:00–17:00 Thursday, Dec. 6
9:00–14:00 Friday, Dec. 7

Main Hall C
Sapporo Convention Center

Free admission with your registration name tag.

PDP5 - 4: 17:50 ***Invited*** **Technology for High Quality Image**

M. Uchidoi
Pioneer, Japan

The image quality of PDPs is largely improved by recent progress of PDP technology. Further improvements especially on high resolution, high contrast and smooth gradation are required. High speed discharging is the key technology improving them. CEL technology is the optimum one for the reason that it's high speed discharging characteristic is stable along the long term driving of PDPs.

Author Interviews
18:10 – 19:10

Sponsor:
Plasma Display Technical Meeting

Workshop on EL Displays and Phosphors

Thursday, December 6

9:00 - 12:00 **Main Hall C**

Poster **PHp: Phosphors**

PHp - 1 **Color Conversion Hybrid Devices Composed of Organic Fluorescent Films Excited by Inorganic Electroluminescent Panels**

T. Uchida, S. Kawamura, M. Kobayashi, T. Tamura, Y. Masakura, T. Satoh
Tokyo Polytech. Univ., Japan

We fabricated hybrid color conversion devices (Hyb-CCM) composed of organic fluorescence films exited by inorganic electroluminescence (IOEL) panels, and also fabricated organic dye dispersed IOEL panels. Hyb-CCM and organic dye dispersed IOEL method is useful not only for OLEDs but also for IOEL systems for high luminance and color adjustment.

PHp - 2 **White Powder Electroluminescent Device with ZnS:Cu,Cl and $Tb_3Al_5O_{12}:Ce^{3+}$ Phosphors Using Layered Structure**

B. J. Park[,**], H. S. Jang[*], H. S. Seo[**], J. T. Ahn[**], W. J. Chung[***], D. Y. Jeon[*]*
[*]KAIST, Korea
[**]ETRI, Korea
[***]Kongju Nat. Univ., Korea

White light was generated by ACPEL device with ZnS:Cu,Cl and TAG:Ce phosphors using layered structure. Maximum luminance was 96 cd/m^2 and its CRI was 72. CaS:Eu was screen-printed additionally between TAG:Ce layer and ITO glass to improve CRI. Maximum CRI was 89 and its luminance was 78.5 cd/m^2.

PHp - 3 **Improvement in Electroluminescent Characteristics of Ba_2ZnS_3:Mn Devices by Employing Y_2O_3 Cap Layer for Annealing**

T. Ohashi, T. Sasaki, T. Kotani, M. Nitta, K. Ohmi
Tottori Univ., Japan

Improvement in both luminance and red color purity of Ba_2ZnS_3:Mn thin film electroluminescent (TFEL) devices has been achieved by combining the deposition temperature of 400°C and the post-deposition-annealing with a Y_2O_3 cap layer. The improved Ba_2ZnS_3:Mn TFEL device shows a red luminescence with the CIE color coordinates of (x, y) = (0.62, 0.38). The luminance and efficiency at 1 kHz are 320 cd/m^2 and 0.12 lm/W, respectively.

PHp - 4 **Local Structures around Ba^{2+} and Eu^{2+} Ions in Blue Luminescent $BaAl_2S_4$:Eu Thin-Films**

S. Okamoto, T. Honma, K. Tanaka, R. Guo**, N. Miura***
NHK, Japan
**Japan Synchrotron Radiation Res. Inst., Japan*
***Meiji Univ., Japan*

Local structures around Ba^{2+} and Eu^{2+} ions in bright blue luminescent $BaAl_2S_4$:Eu thin films have been analyzed by X-ray absorption fine structure measurement. Thin films were prepared by two methods: multi-source deposition using molecular beam epitaxy system and electron beam deposition with post-annealing.

PHp - 5 **Fabrication of Bendable Inorganic Thin-Film Electroluminescent Devices**

T. Miyata, H. Fukada, S. Matsui, T. Minami
Kanazawa Inst. of Tech., Japan

New bendable see-through inorganic thin-film electroluminescent (TFEL) devices were fabricated on transparent bendable glass sheets with a thickness of approximately 100μm. High-luminance and bendable see-through TFEL lamps are demonstrated. Stable operation at high temperatures up to 250°C was obtained in such TFEL lamps fabricated using $Zn_2Si_{1-x}Ge_xO_4$:Mn oxide phosphors.

PHp - 6 **Blue-Emitting $Ba_3MgSi_2O_8$:Eu Phosphors for Thin-Film EL Devices**

H. Fukada, S. Matsui, T. Miyata, T. Minami
Kanazawa Inst. of Tech., Japan

Blue-emitting $Ba_3MgSi_2O_8$:Eu phosphor thin films were newly developed by investigating $((Ba_2SiO_4)_{1-X}$-$(Mg_2SiO_4)_X)$:Eu multicomponent oxide thin-film phosphors using combinatorial r.f. magnetron sputtering deposition. Blue PL emission peaking at around 435 nm was observed from $Ba_3MgSi_2O_8$:Eu thin films postannealed at a high temperature in an Ar+H_2(5%) atmosphere. A $Ba_3MgSi_2O_8$:Eu TFEL device exhibited blue-green EL emission corresponding to CIE chromaticity coordinates of (x=0.24, y=0.29).

PHp - 7 **Bi-Activated Phosphors Using Various Oxide Host Materials for Thin-Film EL Devices**

H. Fukada, S. Matsui, T. Miyata, T. Minami
Kanazawa Inst. of Tech., Japan

Blue-emitting oxide phosphors for thin-film electroluminescent (TFEL) devices were newly developed using various Bi-activated multicomponent oxides. Blue photoluminescence and EL emissions were observed from Bi-activated oxide phosphor thin films prepared using host materials such as $LaInO_3$ and $((LaGaO_3)_{0.49}$-$(CaGa_2O_4)_{0.51})$. A good color purity in blue EL, corresponding to the CIE color coordinates of (x=0.15, y=0.09), was obtained in $LaInO_3$:Bi TFEL devices.

PHp - 8 **Optimising YAG:Ce Phosphors as Colour Converters of Blue-Emitting LEDs for the Production of White Light**

R. Withnall, J. Silver, T. Ireland, A. Lipman, G. Fern, E. Barrett
Brunel Univ., UK

It is found that the luminous efficiency of YAG:Ce under 470 nm excitation increases up to a firing temperature of 1500°C, then drops appreciably on going to 1650°C. This is accompanied by a red shift of the wavelength maximum in the emission spectrum and an increase in the absorbance in the blue region of the spectrum.

PHp - 9 **Preparation of Strontium Zinc Aluminate Phosphors and Their Luminescence Properties under Long-Wavelength UV Illumination**

H.-K. Jung, M. S. Yang, S. Choi
Korea Res. Inst. of Chem. Tech., Korea

The $(Sr,Zn)_{0.9}Al_2O_4:0.1Eu^{2+}$ as a green phosphor for white emission using UV-LED was synthesized. The blue shift conducted during a reducing process could effectively prevent by the addition of excess Zn source. The optimized green phosphor exhibited 125% in emission intensity for the YAG:Ce phosphor.

PHp - 10 **Synthesis and Luminescent Properties of Submicron $SrGa_2S_4$:Eu for LED Application by Solvothermal Method**

H. S. Do, E. J. Kim, S.-H. Hong
Seoul Nat. Univ., Korea

This study is focused on submicron-sized SrS:Eu by solvothermal to decrease particle size of $SrGa_2S_4$:Eu. The powders were synthesized at the various heating schedules. The phases were characterized by XRD. Morphologies were obtained by FE-SEM. PL of obtained $SrGa_2S_4$:Eu were measured by spectrometer and compared with sample by solid-state reaction.

PHp - 11 **Synthesis and Photoluminescence Properties of $BaGa_2S_4:Eu^{2+}$ Phosphor for White Light-Emitting Diodes**

H. S. Yoo, B. J. Park, W. B. Im, J. S. Lee, D. Y. Jeon
KAIST, Korea

$Ba_{1-x}Eu_xGa_2S_4$ phosphor was prepared for white LEDs application. The main emission wavelength was increased from 501 nm to 530 nm with increase of the Eu^{2+} concentration from 0.05 to 0.5 mol. In addition, the excitation band was broadened and enlarged to the longer wavelength, which result in increase of the PL intensity under blue excitation.

PHp - 12 **Luminescence Property of Eu^{2+}-Doped $KBaPO_4$ Phosphor under Ultraviolet and Vacuum Ultraviolet Excitation**

W. B. Im, H. S. Yoo, V. Sivakumar, K. H. Kwon, H. J. Park, Y.-I. Kim, D. Y. Jeon*
KAIST, Korea
**Korea Res. Inst. of Standards & Sci., Korea*

An intense blue-emitting phosphor $KBaPO_4:Eu^{2+}$ was synthesized. Under 147, 254, and 365 nm excitation, it showed an intense emission, corresponding to a relative intensity of 60, 122, and 108 % of a commercial $BaMgAl_{10}O_{17}:Eu^{2+}$ phosphor (Nichia). This is a very promising candidate phosphor for PDP, CCFL, and white LEDs.

PHp - 13 **F-Codoped $BaGd_4Si_3O_{13}$:Tb Green Phosphor for VUV Excitation**

A. Kobayashi, T. Kunimoto, A. Yamane, Y. Nakashima, K. Ohmi*
Tottori Univ., Japan
**Tokushima Bunri Univ., Japan*

We have developed F-codoped $BaGd_4Si_3O_{13}$:Tb phosphors prepared at low temperature and investigated their luminescent characteristics. It is concluded that F-incorporation for $BaGd_4Si_3O_{13}$:Tb phosphors provides drastic increase of PLE intensity in VUV region.

PHp - 14 **Temperature Dependency of Host Emission from $BaMgAl_{10}O_{17}$ and Its Relationship with Geometrical Structure**

H. Onuma, H. Tanno, R. Sahnoun, M. Koyama, H. Tsuboi, N. Hatakeyama, A. Endou, H. Takaba, M. Kubo, C. A. Del Carpio, H. Kajiyama*, T. Shinoda*, A. Miyamoto*
Tohoku Univ., Japan
**Hiroshima Univ., Japan*

We have investigated the host-emission from $BaMgAl_{10}O_{17}$ and $SrMgAl_{10}O_{17}$ experimentally and theoretically. Experiments showed that the intensities of their host-emission decrease by rising the temperature. Calculation results suggested that their temperature dependency can be attributed to the increase of the thermal vibrations of Ba and Sr atoms.

PHp - 15 **B_2O_3 ($B_2O_{3-x}F_{2x}$, Al_2O_3-B_2O_3) Nano-Sized Coatings on $BaMgAl_{10}O_{17}:Eu^{2+}$ Phosphor**

K. T. Jung, S. K. Evstropiev, K. Y. Lee, H. B. Yoon, Y. W. Choi, K. D. Lee, D. H. Lee, S. M. Ban, H. S. Ha, K. S. Lee
Samsung Corning, Korea

New nano-sized B_2O_3 ($B_2O_{3-x}F_{2x}$; Al_2O_3-B_2O_3) coatings on $BaMgAl_{10}O_{17}:Eu^{2+}$ phosphor have been developed. The coatings were deposited on phosphor surface from ethanol solutions of inorganic compounds with following thermal treatment. The measurements of the luminance at both UV (254 nm) and VUV (174 nm) excitation showed high effectiveness of these coatings. Developed nano-sized coatings fully cover phosphor surface and carefully protect BAM phosphor core from thermal degradation, providing high luminance of coated phosphor.

PHp - 16 **Synthesis of ZnMgO Powder and ZnMgO Coating on ZnO by Sol-Gel Method**

N. Koketsu, T. Sano, H. Kominami, Y. Nakanishi, K. Hara
Shizuoka Univ., Japan

Synthesis of ZnMgO and surface treatment of ZnO by ZnMgO thin layer by sol-gel method were studied. The exciton emission of ZnMgO were shifted to higher energy according to increase of Mg contents. Moreover, PL intensity of exciton emission from ZnO was improved by ZnMgO coating because of suppression of carrier diffusion at surface or improvement of surface crystallinity.

PHp - 17 **Synthesis of GaN:Zn Phosphors by the Two-Stage Vapor-Phase Method Using ZnO as a Zn Source**

T. Mori, H. Komoda, H. Kominami, Y. Nakanishi, K. Hara
Shizuoka Univ., Japan

GaN:Zn powders have been synthesized by the two-stage vapor phase method. The sample showed blue photoluminescence characteristic to the Zn center in GaN. The most intense emission was observed at a lower supply rate for the reaction temperature of 1000 °C than 1050 °C. The peak of the emission band shifted towards longer wavelength with increasing the supply rate.

PHp - 18 **Photoluminescence Characteristics of $Y_3Al_5O_{12}:Tb^{3+}$ Phosphors Synthesized with Different Tb Concentration**

H.-H. Kwak, S.-J. Kim, S.-J. Park, H.-H. Yoon, H.-W. Choi
Kyungwon Univ., Korea

For this study, terbium-doped yttrium aluminum garnet (YAG:Tb) phosphor powders were prepared via the combustion process using the 1:1 ratio of metal ions to reagents. The characteristics of the synthesized nano powder were investigated by means of X-ray diffraction (XRD), photoluminescence (PL), scanning electron microscope(SEM) at various Tb concentration.

PHp - 19 **Luminescent Characteristics and Its Enhancement of Pr^{3+}-Doped $BaTiO_3$ Phosphor**

S. Y. Kang, S. D. Ahn, K. S. Suh, D. J. Lee, D. W. Ihm*, J. B. Kim*, S. G. Kang**
ETRI, Korea
**Hoseo Univ., Korea*

We have investigated Pr^{3+}-doped $BaTiO_3$ phosphor with various Pr concentrations and the effect of the co-dopant Ga. The phosphor has the maximum luminescent intensity of Pr at 0.01mol%, which is the relatively low concentration. The incorporation of Ga 1.0 mole% resulted in remarkable enhancement of the luminescence of the phosphor.

PHp - 20 **Luminescent Properties of LiF-Doped $Y_2O_3:Eu^{3+}$ Thin-Film Phosphors by RF-Magnetron Sputtering Technique**

H. K. Park, K.-Y. Ko, Y. R. Do
Kookmin Univ., Korea

We have proposed the rf-magnetron sputtering technique utilizing a co-deposition process of utilizing both an additional LiF disk and a $Y_2O_3:Eu^{3+}$ target. $Y_2O_3:Eu^{3+}$ films annealed above 900°C were cubic structures. But, both as-deposited and post-annealed Li-doped $Y_2O_3:Eu^{3+}$ films were cubic phase. An improved PL intensity of $Y_2O_3:Eu^{3+}$ films were obtained by a doping of LiF (fluxing effect).

PHp - 21 **White Light Emission from Two-Phosphor Systems for the Application to a Carbon Nanotube Field Emission Backlight Unit**

H. S. Jang, J. H. Kang, D. Y. Jeon*
KAIST, Korea
**Samsung Elect., Korea*

Although $Tb_3Al_5O_{12}:Ce^{3+}$ (TAG:Ce) and $Sr_3SiO_5:Eu^{2+}$ (SS:Eu) showed weak yellow emission under electron irradiation respectively, both TAG:Ce and SS:Eu mixed with ZnS:Ag,Cl showed stronger yellow emission ascribed to secondary blue light excitation. Bright white light was generated from the blend of ZnS:Ag,Cl and yellow phosphors (TAG:Ce or SS:Eu) under electron irradiation.

PHp - 22 **Phase Formation and Luminescence of Zinc Silicate Phosphor Synthesized in Supercritical Water**

M. Takesue[,**], K. Shimoyama[**], A. Suino[***], K. Shibuki[*], Y. Hakuta[***], H. Hayashi[***], Y. Ohishi[****], R. L. Smith Jr.[*]*
[*]Tohoku Univ., Japan
[**]Bando Chem. Inds., Japan
[***]Nat. Inst. of Advanced Ind. S&T, Japan
[****]Japan Synchrotron Radiation Res. Inst., Japan

Phase formation and luminescence of Mn-doped zinc silicate (ZSM) synthesized in supercritical water was studied. Two shapes of α-ZSM particles were formed finally. Needle-like shape particles formed through homogenous nucleation in supercritical water, while irregular shape particles formed by phase transition with passing through an intermediate β-ZSM via a solid diffusion.

PHp - 23L **Optical Properties of the $BaMgAl_{10}O_{17}:Eu^{2+}$ Phosphor Coated with ZnO for a Plasma Display Panel**

J. H. Seo, S. M. Lee, S. H. Sohn
Kyungpook Nat. Univ., Korea

The surface of $BaMgAl_{10}O_{17}:Eu^{2+}$ phosphor was coated with ZnO-nanoparticles with a simple surface treatment way. It was found that the surface coating of phosphors with ZnO leads to a decrease in luminance intensity, due to the shielding effect. However, according as stirring time increases, PL-intensity tends to increase. These increasing intensities do not exceed the PL-intensity of the noncoated phosphor.

PHp - 24L **Highly Efficient Phosphor-Embedded Quartz Substrate Grown by Vaporization-Diffusion Process of Metal Oxides**

J. H. Park, H. J. Pyo, Y. T. Jeong, J. T. Kim, J. S. Kim
Pukyong Nat. Univ., Korea

Highly efficient $Zn_2SiO_4:Mn^{2+}$ phosphor film is embedded into quartz substrate through a thermal vaporization-diffusion process of metal oxides (ZnO, and MnO) in a vacuum tube. The thickness of the phosphor film is controlled by the annealing time and temperature. The phosphor film shows a high extraction efficiency and chemical stability in comparison with a conventional powder phosphor.

PHp - 25L **Development of Ultrafine $Y_2O_3:Eu^{3+}$ Nanophosphor for Inkjet Printing**

S. J. Hong, J. I. Han
Korea Elect. Tech. Inst., Korea

In this work, ultrafine $Y_2O_3:Eu^{3+}$ nanophosphor with ultrafine size of 8 nm and cubic crystal structure was developed for inkjet printing. Also, 20 wt% $Y_2O_3:Eu^{3+}$ ink was well formulated. By applying the nanophosphor ink to inkjet printing, nanophosphor thin film was well printed with good photoluminescence properties.

PHp - 26L **Synthesis and Photoluminescent Properties of La_2O_2S:Eu by Citric Acid Gel Method**

S. Yamashita, H. Kominami, Y. Nakanishi, K. Hara, Y. Shimomura, M. Yoshino**
Shizuoka Univ., Japan
**Mitsubishi Chem., Japan*

La_2O_2S:Eu is known as a red phosphor, and it is suggested that it shows good luminescence in the NUV excitation. In this study, synthesis of La_2O_2S:Eu using the citric-acid-gel method has been studied. As the result, for single phase preparation, it is necessary to control and optimize the amount of sulfide flux.

PHp - 27L **Effect of Micron-Sized Circle Array Patterns on the Improvement of YVO_4:Eu^{3+} Thin Film Phosphors**

J. Y. Han, J. H. Kang, H. S. Jang, H. S. Yoo, D. Y. Jeon
KAIST, Korea

The optical properties of YVO_4:Eu^{3+} thin film phosphors were improved by introducing micron-sized circle array patterned SiO_2 layer between substrate and phosphor. We investigated the reasons for enhancement of PL intensity to determine the factors affecting the optical properties of YVO_4:Eu^{3+} thin film phosphor deposited on the patterned substrates.

PHp - 28L **Synthesis of $ZnAl_2O_4$:Mn Phosphors by the Citric Acid Gel Method**

T. Nagura, H. Kominami, Y. Nakanishi, K. Hara
Shizuoka Univ., Japan

We investigated synthesis parameters of citric acid gel method, which lead to the improvement in brightness of $ZnAl_2O_4$:Mn phosphors. It was found that not only Zn/Al molar ratio of the source but also drying time of precursor had significant effects on crystal formation and luminescent properties of the synthesized phosphors.

13:30 - 14:50 **Mid-sized Hall B**

PH1: Phosphors for FEDs, LEDs & Lighting

Chair: R. Withnall, Brunel Univ., UK
Co-Chair: T. Miyata, Kanazawa Inst. of Tech., Japan

PH1 - 1: 13:30 ***Invited*** **Blue-Emitting AlN:Eu^{2+} Phosphors for Field Emission Displays**

*R.-J. Xie, N. Hirosaki, K. Inoue, T. Sekiguchi, B. Dierre, K. Tamura**
Nat. Inst. for Materials Sci., Japan
**Futaba, Japan*

Here we report on a novel blue-emitting AlN:Eu^{2+} powder phosphor which was synthesized by the solid state reaction. This phosphor emits a strong blue color at an accelerating voltage of 3 kV, and exhibits high brightness, low saturation, long lifetime, enabling it to use in field emission displays.

PH1 - 2: 14:00 ***Invited*** **Advances in Sulfide Phosphors for Displays and Lighting**

D. Poelman, J. E. Van Haecke, P. F. Smet
Ghent Univ., Belgium

Currently, there is a great interest in phosphors for LED wavelength conversion. Oxide phosphors cannot yield the broad band red emission needed for illuminants with good colour rendering. In Eu-doped sulfides, red emission can easily be obtained. This overview focuses on two classes of phosphors: $Ca_{(1-x)}Sr_{(x)}S$:Eu microcrystals and thiosilicate powders.

PH1 - 3 14:30 **Synthesis and Characterization of New Green Phosphor for White LED**

K. Uheda, S. Shimooka, M. Mikami, H. Imura, N. Kijima
Mitsubishi Chem. Group S&T Res. Ctr., Japan

A new host material doped with rare-earth element, $(Ba,Eu)_3Si_6O_{12}N_2$, was synthesized under a reducing atmosphere. The crystal structure of the host lattice was determined by a new protocol combining XRD analysis with first-principles calculation. The compound exhibits potential as an efficient green phosphor with high color purity for white LED.

----- Break -----

15:10 - 16:30 **Mid-sized Hall B**

PH2: Phosphors for EL

Chair: D. Poelman, Ghent Univ., Belgium
Co-Chair: S. Okamoto, NHK, Japan

PH2 - 1: 15:10 ***Invited*** **A 34-in. Flat-Panel TV Fabricated by Combining Inorganic EL and Color Conversion Technologies**

H. Hamada, I. Yoshida, D. Carkner[*], X. Wu[*], M. Kutsukake[**], K. Oda[**]
Sanyo Elec., Japan
[*]iFire Tech., Canada
[**]Dai Nippon Printing, Japan

A 34 inch inorganic EL panel for HD-TV with a simple structure has been successfully developed by combining the color-conversion materials and $BaAl_2S_4$:Eu blue-phosphor. The panels, which were fabricated using these technologies, were shown a peak luminance of 400cd/m^2 over, wider color gamut of 95% over, and wide-viewing angle.

PH2 - 2: 15:40 ***Invited*** **Novel Flexible EL Powder Displays**

J. Silver, R. Withnall, G. Fern, P. Marsh, T. Ireland, P. Harris
Brunel Univ., UK

The macrostructures of very flexible ACEL displays panel layers are presented and compared to those of conventional EL display panels. The very flexible layers are made up of a single binder layer that not only carries the electroluminescent phosphor particles that can be up to 30 μm or more in size, but also carries the ferroelectric nanometer size particles.

PH2 - 3 16:10 **Surface, Structural and Luminescent Properties of ZnS Phosphors**

M. M. Sychov, V. V. Bakhmetiev, V. G. Korsakov
St. Petersburg State Inst. of Tech., Russia

Model of acid-basic centers on ZnS phosphors surface is developed. In pK_a 2…5 range centers represent Cu_XS-H; pK_a-5…0 represent sulfur atoms located near to vacancies of zinc; pK_a 12…15 represent OH-groups connected to zinc atoms near sulfur vacancies. Surface characteristics have good correlation with phosphors' electrooptical properties.

Author Interviews
18:10 – 19:10

Friday, December 7

9:00 - 10:10 **Mid-sized Hall B**

PH3: Synthesis & Theory of Phosphors

Chair: R.-J.Xie, NIMS, Japan
Co-Chair: N. Matsuda, Toshiba, Japan

PH3 - 1: 9:00 ***Invited*** **Low Temperature Wet Chemical Synthesis of Nanophosphors in the Presence of Coordinating Molecules**

T. Isobe
Keio Univ., Japan

We report low temperature wet chemical synthesis of nanophosphors of $LiEuW_2O_8$ and YVO_4:Bi^{3+},Eu^{3+} in the presence of coordinating molecules, 1,4-butylene glycol and citrate, respectively. The role of PO_4 units on the formation of sheelite-type structure is discussed in $LiEuW_2O_8$. The aging effects of colloidal solution are discussed in YVO_4:Bi^{3+},Eu^{3+}.

PH3 - 2 9:30 **Electroluminescent Device Utilizing Chemically Synthesized ZnS:Mn Nanocrystals: Weak Thermal Quenching of Luminance**

D. Adachi, T. Hama, D. Yamaguchi, T. Toyama, H. Okamoto
Osaka Univ., Japan

We present EL properties of chemically synthesized ZnS:Mn nanocrystals (NCs) with a crystallite size of 4 nm utilizing EL devices with a structure of glass/ITO/Si_3N_4/ZnS:Mn NC/Al. Orange EL due to Mn^{2+} 3d-3d transitions was observed at the electric field > 3 MV/cm. Thermal quenching of luminance was not observed until approximately 400 K.

PH3 - 3 9:50 **New Inorganic Phosphor Synthetic Method by Microwave Thermo-Catalysis**

N. Taguchi, T. Matsumura-Inoue[*], M. Fujii[**], Y. Uraoka[**]
Image Tech, Japan
[*]Minerva Light Lab., Japan
[**]Nara Inst. of S&T, Japan

A new synthetic method for inorganic phosphors by a microwave thermo-catalysis has been developed. II-VI group compound semiconductors such as ZnS were used as mother materials for phosphors. It was found that the raw materials have changed into phosphors, and the crystal structure has also changed.

----- Break -----

10:40 - 12:10 **Mid-sized Hall B**

PH4: Phosphors for PDPs

Chair: J. Silver, Brunel Univ., UK
Co-Chair: K. Ohmi, Tottori Univ., Japan

PH4 - 1: 10:40 ***Invited*** **Theoretical Investigation on Electronic Structure of Phosphors Using the DV-Xα and DVME Methods**

H. Yoshida[,**], K. Ogasawara[**]*
[*]NEC Lighting, Japan
[**]Kwansei Gakuin Univ., Japan

We introduce the electronic structures of host crystals used for phosphors and rare-earth-doped phosphors using the computational programs of the relativistic discrete-variational Xα (DV-Xα) and discrete-variational multi-electron (DVME) method. They are one of the powerful tools for the study of the optical properties of conventional and novel phosphors.

PH4 - 2 11:10 **Defect Levels in $BaMgAl_{10}O_{17}$ and $SrMgAl_{10}O_{17}$ - Theoretical and Experimental Approach**

H. Onuma, H. Tanno[*], R. Sahnoun, M. Koyama, H. Tsuboi, N. Hatakeyama, A. Endou, H. Takaba, M. Kubo, C. A. Del Carpio, H. Kajiyama[*], T. Shinoda[*], A. Miyamoto
Tohoku Univ., Japan
[*]Hiroshima Univ., Japan

We have studied defect levels in $BaMgAl_{10}O_{17}$ and $SrMgAl_{10}O_{17}$ both experimentally and theoretically. Shallow and deep traps in $BaMgAl_{10}O_{17}$ and shallow traps in $SrMgAl_{10}O_{17}$ were found by thermo-luminescence measurements. Calculations showed similar defect levels in both materials. The absence of the deep trap in $SrMgAl_{10}O_{17}$ is attributed to large thermal-quenching.

PH4 - 3 11:30 **Plasma Treatment of RGB Phosphors for PDP Application**

H. Tanno[,**], T. Fukasawa[***], G. Uchida[*], S. Zhang[*,**], T. Shinoda[*], H. Kajiyama[*]*
[*]Hiroshima Univ., Japan
[**]Dyden, Japan
[***]Adtec plasma Tech., Japan

The suppression of plasma degradation of RGB phosphors is tried using hydrogen plasma treatment. It is shown that BAM:Eu^{2+}(B)and Zn_2SiO_4:Mn^{2+} (G) gets higher resistance against for Ne+Xe plasma irradiation, while the lifetime of (Y, Gd)BO_3:Eu^{3+} (R) is unchanged by hydrogen plasma treatment.

PH4 - 4
11:50 **New Explanation for Luminance Saturation**

T. Kurai, Y.-K. Kim, S.-R. Lee, S.-Y. Lee
Samsung SDI, Korea

We introduced Nonradiative Transition as new explanation of Luminance Saturation for PDP and formulated simulation equation of Saturation. Although parameter was fixed by end point of BAM:Mn, remained data points and other phosphors' cases also showed good agreement.

Author Interviews
18:10 – 19:10

Sponsors:
The 125th Research Committee on Mutual Conversion between Light and Electricity, JSPS
Phosphor Research Society, The Electrochemical Society of Japan

Workshop on Field Emission Display

Friday, December 7

9:00 - 9:10 **Small Hall**

Opening

Opening Remarks
9:00

M. Takai, Osaka Univ., Japan

9:10 - 10:20 **Small Hall**

FED1: FEDs & Novel Devices

Chair: H. Mimura, Shizuoka Univ., Japan
Co-Chair: Y. Iguchi, FE Techs., Japan

FED1 - 1: 9:10 ***Invited*** **High-Luminance CNT-FED for Color Character-Displays**

J. Yotani, S. Uemura, T. Nagasako, H. Kurachi, T. Maesoba, T. Nakao, M. Ito, A. Sakurai, H. Shimoda, T. Ezaki, Y. Saito[*]
NORITAKE, Japan
[*]Nagoya Univ., Japan

A high-luminance CNT-FED character-display using practical rib-structure was performed. The display-panel had 48x480-dots and the sub-pixel pitch was 1mm. The 2mm-tall-ribs as spacer were formed by using innovative production processes. In this work, we present a compact package device for the application of multiple-device-display board.

FED1 - 2 9:40 **Study of Optimal Design Simulation for Diode Type CNT-FED**

C.-C. Kuo, Y.-Z. Chen, C.-C. Kao, J.-S. Fang, K. Cheng, D. Yeh[*], C.-Y. Hsiao[*], T.-F. Chan[*]
TECO Elec. & Machinery, Taiwan
[*]TECO Nanotech, Taiwan

FEM is used to simulate the diode type CNT-FED for design improvements. Fining emitter patterns can improve the electron emission efficiency. Moreover, there is an optimal condition for balancing uniformity and performance according to gap variation. The diode type 32x32 pixels 8.9" panel as an information indicator is designed accordingly.

FED1 - 3
10:00

Low Voltage and High Speed Operation of 640x480 Pixel Active-Matrix HEED (High-Efficiency Electron Emission Device) Array for HARP Image Sensor

Y. Okuda, T. Satoh, Y. Matsuba, R. Tanaka, T. Nakada, K. Sakemura, N. Negishi, A. Watanabe, T. Yoshikawa, K. Ogasawara, M. Nanba[*], S. Okazaki[*], K. Tanioka[*], N. Egami[*], A. Kobayashi[**], N. Koshida[***]
Pioneer, Japan
[*]NHK, Japan
[**]Hamamatsu Photonics, Japan
[***]Tokyo Univ. of A&T, Japan

An advanced active-matrix HEED has been developed for an ultra-highly sensitive compact HARP image sensor. The HEED has 640×480 pixels, and the pixel size is 20×20μm. The HEED with pixel-drivers and scanning driver circuits were fabricated as an image pickup beam source for the HARP target. The prototyped device operates well as a high-sensitivity VGA image sensor.

----- Break -----

10:40 - 12:30 **Small Hall**

FED2: CNT Emitters for FEDs (1)

Chair: M. Sasaki, Univ. of Tsukuba, Japan
Co-Chair: J. Yotani, NORITAKE, Japan

FED2 - 1
10:40

Field Emission from Metal-Deposited CNTs: Emission Stability Improvement and Atomic Images of Metal Clusters

Y. Saito, T. Matsukawa, T. Yamashita, K. Asaka, H. Nakahara, S. Uemura[*]
Nagoya Univ., Japan
[*]NORITAKE, Japan

Field emission from carbon nanotubes deposited by aluminum and gold with mean thicknesses from 1 to 11nm were studied. Aluminum significantly suppressed emission fluctuation, and even gold reduced the fluctuation in a limited mean thickness. Atomic images of an Al cluster were revealed by field emission microscopy.

FED2 - 2
11:00

The Variation of RAMAN Spectra in CNT Cathodes Treated by Plasma and Laser

W. S. Kim, H. Oki, A. Kinoshita, K. Murakami, S. Abo, F. Wakaya, M. Takai
Osaka Univ., Japan

The relationship between field emission characteristics and defects measured by Raman scattering was investigated for CNT cathodes treated by plasma and laser. The I_D/I_G increased after both treatments, improving the field emission characteristics. This result indicates that dangling bonds in CNTs play an important role in the field emission intensity.

FED2 - 3
11:20

Field Emission Profiles of CNT Cathodes with Surface Treatment Using KrF Eximer Laser or Adhesive Tape

A. Kinoshita, W. S. Kim, K. Murakami, S. Abo, F. Wakaya, M. Takai
Osaka Univ., Japan

CNT cathodes were treated by KrF (248 nm) excimer laser irradiation and pulse aging with a high electric field of 8.8 V/μm. The uniformities of emission patterns in CNT cathodes before and after pulse aging with a high electric field were evaluated by the distribution of emission current density measured by a field emission profiler.

FED2 - 4
11:40

CNT Field Emission Cathodes for Micro FEDs

A. Prudnikava, J. Shaman, B. Shulitski, V. Labunov, A. Smirnov, A. Navitski[*], G. Müller[*]
Belarusian State Univ. of Informatics & Radioelect., Belarus
[*]Bergische Univ., Germany

Field emission cathodes (FECs) on the basis of carbon nanotube arrays synthesized by the atmospheric thermal CVD method on the top of SiO_2 surface with Ti interdigital electrodes have been developed. The geometrical parameters, structure and emission properties of FECs have been investigated. FECs demonstrated low onset electric fields and moderate uniformity of emission.

FED2 - 5L
12:00

Electron-Beam-Pumped Ultraviolet Light Sources Using Graphite Nanoneedle Field Emitters

H. Mimura, K. Shiozawa, Y. Neo, M. Okada, G. Hashiguchi
Shizuoka Univ., Japan

We have fabricated a sputter-induced graphite nanoneedle field emitter and a Si .electron-transparent film for application to an electron-beam-pumped vacuum ultraviolet light source. Vacuum ultraviolet light emission from Xe gas was successfully demonstrated in the electron-beam-pumped light source.

FED2 - 6L
12:10 **A Study on Inverse Dynamics for High Performance Driving 20 inch Carbon Nanotube Backlight Units**

S.-Y. Chung, C.-C. Liang, C.-N. Huang, C.-M. Lai*, C.-T. Pan**
ITRI, Taiwan
**Nat. Tsing Hua Univ., Taiwan*

For high performance driving carbon nanotube backlight units (CNT-BLUs), the RC-delay-like relationship between the applied gate-cathode voltage and the induced light from anode should be coped with. This paper studies the dynamics and inverse dynamics of the relationships. High performance inverse dynamics driving schemes can then be developed. The inverse dynamics are experimentally evaluated and satisfactory results are obtained.

FED2 - 7L
12:20 **Development of Highly Bright Field Emission Lamp for Dynamic Back Light Unit in LCD**

J.-W. Jeong, D.-J. Kim, J.-T. Kang, J.-S. Kim, Y.-H. Song
ETRI, Korea

Field emission lamp for a BLU was developed by using the printed CNT emitters with the metal-TMG. Local dimming was achieved by a novel driving method. The fabricated FEL showed a very high luminance over 12,000 cd/m^2 with an anode voltage of 15kV. We, also, expect good efficiency and reliability.

----- Lunch -----

13:30 - 14:50 **Small Hall**

FED3: CNT Emitters for FEDs (2)

Chair: N. Nakane, Muroran Inst. of Tech., Japan
Co-Chair: S. Uemura, NORITAKE, Japan

FED3 - 1
13:30 **Nano-Welding of Freestanding CNT on Metal Electrode and Its Field Emission Properties**

K. Asaka, H. Nakahara, Y. Saito
Nagoya Univ., Japan

Multi-walled carbon nanotubes (MWNTs) were manipulated inside a transmission electron microscope combined with functions of scanning tunneling microscopy, and fabricated into a single freestanding MWNT-emitter on a platinum electrode surface. The electron field emission properties of the single freestanding MWNT were *in-situ* measured simultaneously with the observation of structural dynamics.

FED3 - 2
13:50
Simulation Study of Bundle CNT Emitter Arrays for Field Emission Devices

H. Furuta, M. Furuta, S. Honda, M. Katayama*, K. Oura*, T. Hirao*
Kochi Univ. of Tech., Japan
**Osaka Univ., Japan*

The emission properties of the pillar-shaped CNT bundle emitter arrays were simulated using finite element method. The decrease of threshold voltage for emission was caused by the field enhancement on the pillar-shape edge. The optimum spacing to the height ratio for the emission of the emitter arrays was two.

FED3 - 3
14:10
Fabrication of Triode CNT-FEA Lamp on Glass Substrate with RAP Process

K. W. Min, J. H. Ryu, I. O. Jeong, C. S. Lee, K. S. Kim, S. Manivannan, J. Jang, K. C. Park
Kyung Hee Univ., Korea

We developed a novel growth method of CNTs on glass substrate for device applications. With resist-assisted patterning (RAP) method, we had grown CNTs on glass substrate, which were strongly bonded with glass substrate. The electron emission current showed a current density 14μA/cm^2 at 7 V/μm field.

FED3 - 4
14:30
Enhanced Electron Emission Poroperties of CNT by Post Growth Treatment

K. S. Kim, J. H. Ryu, C. S. Lee, S. Manivannan, J. H. Moon, J. S. Ahn, J. Jang, K. C. Park
Kyung Hee Univ., Korea

We studied the effect of post treatment on field emission from carbon nanotubes field emitter arrays (CNT-FEAs) selectively patterned by the resist-assisted process. Three kinds of post treatment processing for enhanced electron emission properties namely electrical aging, thermal annealing and HF wetting on CNT-FEAs were performed. The field emission property was remarkably improved by the post treatments.

----- Break -----

15:10 - 16:30 **Small Hall**

FED4: FE Materials & Structures

Chair: F. Wakaya, Osaka Univ., Japan
Co-Chair: N. Egami, NHK, Japan

FED4 - 1
15:10

Potential Surface-Conduction Electron Emission from ZnO Thin Film

S. L. Wu, J. T. Zhang, C. L. Wang, H. B. Sun, W. B. Hu, Y. L. Sun, C. L. Liu
Xi'an Jiaotong Univ., China

In this paper, we propose to deposit ZnO film with sputter and form surface-conduction electron emitters with the electro-forming process. The emission characteristics and luminescence of ZnO film are obtained experimentally. The results show that Zn can be a potential SED cathode material instead of Pd for FPD application.

FED4 - 2
15:30

Fabrication of Vertical Thin Film FEA Using Ion-Induced Bending Technique

T. Yoshida, C. Yasumuro, M. Nagao, S. Kanemaru, A. Baba[*], T. Asano[**]
AIST, Japan
[*]Kyushu Inst. of Tech., Japan
[**]Kyushu Univ., Japan

We propose a vertical thin film (VTF) formed by ion-induced bending technique to realize a FED. The bending technique can form micro-meter sized high-aspect ratio emitting tip from 100-nm-thick thin film by ion irradiation without thick film deposition. We fabricated gated VTF emitter and confirmed electron emission from sharpened tip.

FED4 - 3
15:50

Properties of Insulating Layer of Gated FEAs with Transition Metal Nitride Cathode

Y. Gotoh, Y. Miyata, N. Setojima, H. Tsuji, J. Ishikawa
Kyoto Univ., Japan

Properties of the insulating layer of gated FEA with transition metal nitride cathodes were investigated. As an insulating layer, we adopted SiO_2 thin film. The current-voltage characteristics of the TaN- and HfN-FEAs were investigated. The insulating properties were largely reduced. Some characteristics of the insulating layer will be reported.

FED4 - 4
16:10

Emission Properties of Nanocrystalline Silicon Planar Cathodes

H. Shimawaki, Y. Neo[*], H. Mimura[*], K. Murakami[**], F. Wakaya[**], M. Takai[**]
Hachinohe Inst. of Tech., Japan
[*]Shizuoka Univ., Japan
[**]Osaka Univ., Japan

A planar cathode based on nanocrystalline Si covered with a thin oxide film deposited by using a pulsed laser ablation technique was fabricated and the emission properties were investigated. Emission stability and divergence were improved by controlling the thickness of nanocrystalline silicon layer and metal film for extraction electrode.

----- Break -----

16:50 - 17:10 **Small Hall**

FED5: FE Materials & Devices

Chair: Y. Gotoh, Kyoto Univ., Japan
Co-Chair: H. Shimawaki, Hachinohe Inst. of Tech., Japan

FED5 - 1
16:50

Work Function Measurement of Zr-O/Mo(100) by Using of Photoemission Electron Microscope

H. Kawahara, Y. Nakano, H. Nakane, H. Adachi
Muroran Inst. of Tech., Japan

We are investigating the thermal field emission cathode of high brightness for electron beam systems such as an electron microscope. The work function of ZrO/Mo(100) has been successfully estimated by use of the photoelectron emission microscope (PEEM) to be 2.5 eV with Fowler plot. Further investigation is necessary.

Author Interviews
18:10 – 19:10

Sponsor:
158th Committee on Vacuum Nanoelectronics, JSPS

Workshop on Organic LED Displays

Wednesday, December 5

13:20 - 14:30 **Mid-sized Hall A**

OLED1: Display

Chair: K. Matsuo, Sony, Japan
Co-Chair: R. Hattori, Kyushu Univ., Japan

OLED1 - 1: 13:20 ***Invited*** **Views on the Promise of AM-OLED Displays for Mobile Through TV Use**

M. Kobayashi, T. Uemura, M. Ohta, J. Hanari, T. Ishida, N. Kamiura, S. Okutani, N. Ibaraki
Toshiba Matsushita Display Tech., Japan

We have developed three prototypes of small-sized AM-OLED using small molecule evaporation technology, and 20.8-inch AM-OLED using ink jet printing technology which is the largest polymer-based display. The advantages and issues were discussed for these two technologies. A newly developed outcoupling structure was applied to a 20.8-inch WXGA display.

OLED1 - 2 13:50 **15.0-in. XGA AMOLED Display with Advanced SPC TFT Based Back-Plane Structure**

H. K. Lee, S. H. Jung, T. J. Ahn, J. S. Yoo, C. Y. Kim, C. D. Kim, I. B. Kang
LG.Philips LCD, Korea

A 15.0 inch full color XGA AMOLED display has been developed. In addition to good luminance uniformity by an Advanced Solid Phase Crystallization (a-SPC) method and a novel compensating pixel circuit, picture quality and device characteristics were improved by using double gate insulator and optimized process structure.

OLED1 - 3 14:10 **Organic Light Emitting Diode Luminous Compensation System with Optical Sensor Composed of Low Temperature Poly Silicon**

H. Shirouzu, K. Masumoto, N. Matsuo, T. Hamano, S. Yamamoto, Y. Ejima, T. Mitsuse, K. Suyama, T. Nakamura, K. Sakanoue
Panasonic Commun., Japan

We demonstrated the luminous compensation system for organic light emitting diodes (OLEDs). The system is composed of the poly-silicon (p-Si) sensor fabricated in the p-Si TFT backplane. The luminous uniformity of this system achieved less than ±1% deviation. We applied this system to the print-head for electro-photography.

----- Break -----

14:50 - 16:20 **Mid-sized Hall A**

OLED2: Process

Chair: Y. Tsubata, Sumation, Japan
Co-Chair: Y. Sato, JST, Japan

OLED2 - 1: 14:50 ***Invited*** **LIPS (Laser-Induced Pattern-Wise Sublimation) Technology for Manufacturing Large-Sized OLED Displays**

K. Matsuo, K. Hanawa, T. Hirano, T. Sasaoka, T. Urabe
Sony, Japan

We have developed a novel laser transfer technology for full-color OLED displays. OLED materials are transferred from glass donors to a substrate by laser-induced patternwise sublimation (LIPS). LIPS has several advantages such as stable transfer quality and scalability to large-sized mother glass. Using this technology, we fabricated 27.3-inch OLED display.

OLED2 - 2 15:20 **Patterning of OLED Materials with Laser Induced Thermal Imaging**

W. A. Tolbert, S. Lamansky, M. B. Wolk
3M, USA

We have developed a high resolution patterning method for OLED materials -Laser Induced Thermal Imaging (LITI). The process is compatible with high throughput OLED manufacture on large format display glass. OLED devices fabricated using LITI technology have attained a level of performance that is acceptable for commercial applications.

OLED2 - 3 15:40 **Ink Jet Printable Phosphorescent Organic Light-Emitting Devices**

T. Sonoyama, M. Ito, R. Ishii, S. Seki, S. Miyashita,
S. Xia[*], J. Brooks[*], R. C. Kwong[*], M. Inbasekaran[*],
J. J. Brown[*]
Seiko Epson, Japan
[*]Universal Display, USA

We discuss a novel method for the fabrication of ink jet printed organic light-emitting devices. Unlike previously reported solution processed OLEDs, the emissive layer of the OLEDs reported here doesn't contain polymeric materials. We show the latest spin-coated phosphorescent RGB-OLEDs performances. And we demonstrate the emission of the ink-jetted Red-P^{2}OLED.

OLED2 - 4
16:00 **Reliable OLED Device Covered with Film Encapsulation**

A. Kidokoro, K. Kitamura, N. Koide, Y. Kato
Toyota Ind., Japan

We demonstrate OLED device covered with film encapsulation and investigate a relationship between saturated vapour pressure and formation of point degradation/defects, called DS: Dark Spot(s) on the OLED. The reliability in the severe testing condition of 85°C/85%RH storage is over 1,000 hrs.

----- Break -----

16:30 - 18:00 **Mid-sized Hall A**

OLED3: Material

Chair: M. Kobayashi, Toshiba Mastushita Display Tech.,Japan
Co-Chair: A. Mikami, Kanazawa Inst. of Tech.,Japan

OLED3 - 1: ***Invited*** **Recent Progress on Polymer LED Materials**
16:30

Y. Tsubata
Sumation, Japan

Efficiency, lifetime, and color of Light emitting polymers have been improved by new classes of emitters as well as new backbone. Combination of emitters and backbones leads to stabilities not only of emission but also of charge injection/transporting. The performance of new materials and degradation mechanism are discussed.

OLED3 - 2
17:00 **PIN OLEDs - Enhanced Voltage Stability for AM Display Applications -**

S. Rentenberger, J. Birnstock, M. Burghart, T. Canzler, G. He, P. Wellmann, A. Werner, O. Zeika, S. Murano
Novaled, Germany

For the growing market of active-matrix OLED displays, apart from long lifetimes and high efficiencies, a stable operating voltage and better temperature stability gain in importance. We show that highly efficient PIN technology combined with newest materials already meet these requirements.

OLED3 - 3 17:20 **Device Characteristics of OLED with Benzodifuran Derivatives as Hole-Transporting Layer**

Y. Sato[*], C. Mitsui[**], H. Tsuji[**], E. Nakamura[,**]*
[*]JST, Japan
[**]Univ. of Tokyo, Japan

Novel hole transport materials are developed based on benzodifuran (BDF) unit. BDF without aromatic amine group is found to function as HTL of OLED device. Introducing aromatic amine groups into BDF structure, further improvement of hole mobility is achieved. EL characteristics of BDF derivatives exhibit higher efficiency than α-NPD.

OLED3 - 4 17:40 **Electrode Materials for Low Electron/Hole Injection Barrier Formation in OLED**

H. Hosono[,**], K. Kim[*,**], H. Yanagi[*], T. Kamiya[*,**], H. Hiramatsu[**], M. Hirano[*,**]*
[*]Tokyo Inst. of Tech., Japan
[**]ERATO-SORST, JST, Japan

Electron-doped 12CaO・$7Al_2O_3$ ($C12A7:e^-$) with the work function of 2.4eV was applied to the cathode of OLED to reduce the electron-injection barrier height. The value for Alq_3/$C12A7:e^-$ was reduced to ~1/2 of that of Alq_3/LiF/Al. The inverted OLED ($C12A7:e^-$/Alq_3/NPB/ITO) fabricated exhibited excellent performances among the same structured devices reported.

Author Interviews
18:00 – 19:00

Thursday, December 6

9:00 - 10:30 **Main Hall A**

AMD4/OLED4: Organic TFT & OLED

Chair: J. Jang, Kyung Hee Univ., Korea
Co-Chair: Y. Fujisaki, NHK, Japan

AMD4/ OLED4 - 1: 9:00 ***Invited*** **A Flexible, Full-Color and Top-Emission AM-OLED Display Driven by OTFTs**

I. Yagi, N. Hirai, Y. Miyamoto, M. Noda, A. Imaoka, R. Yasuda, N. Yoneya, K. Nomoto, J. Kasahara, A. Yumoto, T. Urabe
Sony, Japan

We have demonstrated a flexible, full-color and top-emission AM-OLED display driven by an organic TFT backplane. Organic insulators, including a newly-developed gate insulator, are utilized for all the insulating layers of the backplane, which remarkably enhance both mechanical flexibility and specifications of the display.

AMD4/ OLED4 - 2: 9:25 ***Invited*** **Active Matrix Drive of Flexible Sheet Displays Using MIS-Type Organic Light-Emitting Transistors**

K. Kudo, K. Nakamura[*]*, T. Hata*[*]*, A. Yoshizawa*[*]
Chiba Univ., Japan
[*]*Pioneer, Japan*

We have developed novel metal-insulator-semiconductor-type organic light-emitting transistors (MIS-OLETs), and have improved the characteristics of the MIS-OLETs by optimizing the device structure. In addition, we have demonstrated an active matrix display using these MIS-OLETs fabricated on a plastic substrate.

AMD4/ OLED4 - 3 9:50 **High-Resolution AM-OLED Display with Top-Emitting Smart White and Overall Unified Brightness (OUB) Technology**

D.-Z. Peng, H.-L. Hsu, S.-C. Wang, P.-K. Su, R. Nishizawa
TPO Displays, Taiwan

A 2-inch QVGA (200 PPI) full-color AM-OLED display with top emission technology has been developed by WOLED with color filters. To improve the uniformity of the brightness, an Overall Unified Brightness (OUB) approach has been applied. With these technologies, a high-resolution AM-OLED display with better front-of-screen performance for mobile applications could be achieved.

AMD4/ OLED4 - 4 10:10 **New Fast Threshold Voltage Detecting Pixel Scheme for High Resolution and Large Area AMOLED Display**

H.-S. Shin, W.-K. Lee, S.-G. Park, T.-J. Ha, M.-K. Han
Seoul Nat. Univ., Korea

We propose a new polycrystalline silicon pixel scheme, which detects a threshold voltage rapidly by clock signal, for active matrix organic light emitting diode displays. We have fabricated the pixel circuit on the glass substrate and verified that the proposed pixel circuit could successfully compensate the threshold voltages variation.

----- Break -----

13:30 - 16:30 **Main Hall C**

Poster OLEDp: OLED Poster

OLEDp - 1 **Improvement of OLED Performance by Using Alkali Metals as Electron Injection Layer Evaporated from Highly Stable Source**

A. Bonucci, J. Mio Bertolo, M. Riva, C. Carretti, S. Tominetti, S. H. Kim[*], J. Y. Lee[**]
SAES Getters, Italy
[*]Seoul Nat. Univ., Korea
[**]DanKook Univ., Korea

One of the key issues for Organic Light Emitting Diodes (OLEDs) is to achieve high power efficiency (ηE), that can be improved by using an Electron Injection Layer of Alkali metal. A comparison of EIL based on Li and Cs layers, with respect to the LiF has been carried out.

OLEDp - 2 **Flexible Organic Light-Emitting Diodes with a Co-Sputtered Platinum-Indium Tin Oxide Anode**

C. M. Hsu, J. Y. Huang, W. T. Wu
Southern Taiwan Univ., Taiwan

Platinum (Pt) doped indium tin oxide (ITO) anodes were fabricated to study their effects on OLED devices. Devices with a 2 nm Pt-doped ITO anode reduced threshold and turn-on voltages by 20.9% and 10.5%, respectively. O_2 plasma on ITO anode minimized surface contaminants and largely lowered the device operating voltages.

OLEDp - 3 **White Organic Light Emitting Devices with High Color Stability by Using Thin Codoped Layer**

C. H. Hsiao, C. F. Lin, J. H. Lee
Nat. Taiwan Univ., Taiwan

The thin codoped layer with red and sky-blue emission in the WOLED eliminates carrier-trapping effect and reduces driving voltage by 2.3V from recombination current enhancement. The commercial fluorescent WOLED exhibited 243 cd/m^2 at 4.5V and 8.2 cd/A (5.71 lm/W). CIE coordinates variation from 243 to 14000 cd/m^2 is (-0.009, -0.001).

OLEDp - 4 **Laser Thermal Printing Device Using Passive Beam Shaping Optics**

I. Park, J. H. Kwon, J. Yi
Yeungnam Univ., Korea

A laser thermal printing device was developed. The laser beam was focused on an organic material coated donor plate and the beam profile was transformed to square shape by an acousto-optic modulator for clean patterning. To replace expensive acousto-optic modulator, hollow fiber beam shaping optics was devised.

OLEDp - 5 **Fabrication of Thin Film from Benzene Monomer Using Plasma Polymerization and Application to Organic LED**

S. Tanaka, R. Koyama, S. Yoshikado
Doshisha Univ., Japan

Polymerized thin films used for organic light emitting devices were fabricated from a benzene monomer by plasma polymerization. Thin films without pinholes were deposited. The thickness of the film was proportional to discharge time. The aromatic structure of the film remained at a small discharge current. Operating voltage, at which electroluminescence was observed, was directly proportional to film thickness.

OLEDp - 6 **Solution Processed White OLEDs Based on Orange Phosphorescent Dye Doping to Spiropolyfluorine Blue Polymer**

J. J. Park, T. J. Park, W. S. Jeon, S. Y. Kim, Y. K. Lee, J. Jang, J. H. Kwon
Kyung Hee Univ., Korea

A series of white polymer light-emitting devices has been fabricated by using a spiropolyfluorine (SF) blue polymer with an orange Ir complex. A good color coordination of (0.34, 0.36) with a good current efficiency of 1.52 cd/A was obtained at 2 % doped condition in a CBP mixed co-host system.

OLEDp - 7 **Fabrication of High-Efficiency Phosphorescent Polymer OLEDs & Color Pattern by Using Screen Printing**

D. H. Lee, J. S. Choi, S. M. Cho
Sungkyunkwan Univ., Korea

We demonstrate highly efficient phosphorescent organic light-emitting devices based on a green-emitting $Ir(ppy)_3$ and a host polymer PVK fabricated by screen printing. The best screen-printed single-layer device exhibits very high peak luminous efficiency over 100cd/A with a luminance of 1,000cd/m^2 at an operating voltage of 15V.

OLEDp - 8 **Microdisplay System Using Field-Sequential Color LCD with 3-Primary Colors OLED Backlight**

S. H. Woo, D. H. Kim, Y. S. Do, Y. S. Han, B. D. Choi
Daegu Gyeongbuk Inst. of S&T, Korea

A field-sequential color (FSC) LCD micro display using newly designed three primary colors organic light-emitting diode (OLED) device as a backlight unit (BLU) has been developed. The OLED backlight consists of three primary color emitters parallel to each other. The operating frequency is 255Hz. The 0.7" prototype FSC LCD system using OLED BLU successively demonstrates color display and moving picture image.

OLEDp - 9 **Viewing Angle Performances of the Photon-Recycled Black-Cathode Organic Light-Emitting Device**

T. Chiu, K. Chuang, C. Lin, Y. Ho, J. Lee, C. Chao, M. Leung, D. Wan, C. Li, H. Chen
Nat. Taiwan Univ., Taiwan

We demonstrate a photo-sensitively OLED with a 12-times decrease in reflection for the entire visible range and at wide viewing-angles by using a broadband absorptive and photo-sensitive MPPDI, combined with a semitransparent structure, Al/Ag, inserted between the MPPDI and electron transporting layer to enhance the destructive interference.

OLEDp - 10 **A Bus Electrode of Low Resistance and Simplified Process**

S. Yi, Y. S. Shin, D. W. Ihm, J. H. You[*]*, T. H. Lee*[*]*, J. H. Kim*[*]
Hoseo Univ., Korea
[*]*Daewoo Elect., Korea*

We have developed a simplified process for the formation of bus electrodes of low resistance in PMOLEDs using cathode separators. Using this method, a single and bi-layer of aluminum and copper were tried out for bus and cathode electrodes. This method reduces the fabrication process, and lowers the manufacturing cost.

OLEDp - 11 **Bi-Directional OLED Microdisplay**

U. Vogel, D. Kreye, B. Richter, G. Bunk, S. Reckziegel, R. Herold, M. Scholles, M. Tker, J. Amelung
Fraunhofer Inst. for Photonic MicroSyss., Germany

A first prototype of a bi-directional OLED microdisplay device has been designed, that combines both display and camera functionality on a single CMOS chip (OLED-on-CMOS). Major aim of this integration is to provide small form-factor display and eye-tracking for see-through HMD applications (augmented reality).

OLEDp - 12 **White Organic Electroluminescence from Electroplex Based on the Solution-Processible Blue Aluminum Quinolate Complex**

J.-A. Cheng, C. H. Chen, H.-P. D. Shieh
Nat. Chiao Tung Univ., Taiwan

A saturated white device was obtained by using a blue $Al(Saq)_3$ with doping TMQA. Due to the electroplex formation during the electroluminescence process, a white light emission was achieved. In optimized devices, the saturated white emission was observed at CIE1931 (0.33,0.35). Its maximum brightness was 25.4 cd/m^2 at 13.4 V.

OLEDp - 13 Withdrawn

OLEDp - 14 High Efficiency Red Light Emitting Phosphorescent Organic Devices Having a Very Thin Polymer Layer

A. Imamura, S. Takeda, A. Mikami
Kanazawa Inst. of Tech., Japan

A high efficiency phosphorescent deep red OLED has been developed in the device consisting of light-emitting small molecule and carrier transporting polymer. The optimized device showed 20.2% in EQE and 17.6-lm/W in power efficiency by employing very thin polymer layer on the anode side and optically designed cathode structure.

OLEDp - 15 Low Voltage Operating Organic Light-Emitting Devices with New Electron Transport Layer

M. Y. Ha, S. Y. Kim, D. G. Moon
Soonchunhyang Univ., Korea

We have developed low voltage operating OLEDs with new electron transport layer. The device having a structure of ITO/2-TNATA/DPVBi doped rubrene(1%)/DPVBi/new ETL/LiF/Al has been used. The brightness rapidly increases as the driving voltage. The voltage for achieving 1,017 cd/m^2 was 3.0 V, whereas the turn on voltage for the brightness of 1 cd/m^2 was 2.1 V.

OLEDp - 16 A New Quinoxaline Derivatives Containing Arylamine for Application in Red Emitting Electroluminescent Device

J.-S. Kim, S. J. Park, Y.-H. Kim, J.-T. Je[*], S. O. Jung, S.-K. Kwon
Gyeongsang Nat. Univ., Korea
[*]SFC, Korea

The new red-light emitters were synthesized. Optical properties of compounds were characterized by UV-visible and PL spectra measured in chloroform solution and film, respectively. The multi-layered light-emitting diodes exhibited the EL brightness and current density were reached at 7253 cd/m^2 (7.78 V) and 4.55 cd/A (4.02 V), respectively.

OLEDp - 17 Synthesis and Electroluminescent Properties of Phenanthridine Derivatives

K.-S. Kim, S.-H. Han, S.-H. Park[*], K. R. Ha[*], B.-D. Choi
DGIST, Korea
[*]Keimyung Univ., Korea

New emitting materials, DCzP ($C_{43}H_{27}N_3$), DPoP ($C_{43}H_{27}N_3O_2$), and DAnP ($C_{47}H_{29}N$), containing phenanthridine scaffold were synthesized. The optical and electro-optical properties such as absorption, photoluminescence (PL), electro-luminescence (EL), and electronic band structure were investigated. The OLED devices containing the synthesized materials as emitting layer were fabricated.

OLEDp - 18 **Synthesis and Characterization of Novel Red-Light-Emitting Materials Based on Benzo[1,2,5]thiadiazole Containing Arylamine as Electron Donor and Cyanide as Electron Acceptor**

J.-U. Ju, S.-O. Jung, J. W. Park, D. M. Kang, J. K. Park, Y.-H. Kim, J.-T. Je[*]*, S.-K. Kwon*
Gyeongsang Nat. Univ., Korea
[*]*SFC, Korea*

We designed a highly efficient red emitter that has short π-conjugation length and inhibits intermolecular π-stacking due to its asymmetric bulky structures. The red emitter was composed of benzo[1,2,5]-thiadiazole (BTD) as a core unit, and a triphenylamine electron donating group and malonitrile electron withdrawing group as side units.

OLEDp - 19 **Synthesis and Electro-Optical Property of Blue Emitting Copolymer with Non-Conjugated Spacers for Polymer Light-Emitting Devices**

L. S. Park, E. J. Park, H. Q. Wang, E. J. Lyu, J. H. Kim, K. H. Choi, G. D. Song, S. K. Jung
Kyungpook Nat. Univ., Korea

Several new polymers, with carbazole as pendant group, were synthesized by palladium-catalyzed poly condensation reaction. These polymers with conjugated chromophores separated by non-conjugated spacers were characterized in UV-Visible spectrum and photoluminescence properties in solution and film state. The electro-optical properties of the polymers were also studied for the PLED devices.

OLEDp - 20 **Blue Light-Emitting Diodes Based on Naphtylanthracene Derivatives**

J.-Y. Baek, S.-O. Jung, Y.-H. Kim, S.-K. Kwon
Gyeongsang Nat. Univ., Korea

Novel blue-light-emitting material, 9-(3,5-di(naphthalen-2-yl)phenyl)-10-(naphthalen-2-yl)-anthracene, which was composed of an anthracene molecule as the main unit and a naphtyl group side unit, was synthesized by Suzuki coupling. It showed excellent thermal stability and emitted bright blue light.

OLEDp - 21 **New Fluoranthene Derivatives for Application in Orange Emitting Electroluminescent Device**

S. O. Jung, S. J. Park, J.-S. Kim, J. K. Park, Y.-H. Kim, J.-T. Je, S.-K. Kwon*
Gyeongsang Nat. Univ., Korea
**SFC, Korea*

The new orange-light emitter, fluoranthene derivative, was synthesized and showed good thermal stabilities. Optical properties of compound were characterized by UV-visible and PL spectra measured in chloroform solution and film, respectively. The multi-layered light-emitting diode exhibited the EL brightness and efficiency at 18600 cd/m^2(7.8 V), 11.75 cd/A(4.09 V), respectively.

OLEDp - 22 **Electrical Characterization of Bathophenanthroline Doped with Phthalic Acis, Dipotassium Salt**

M.-T. Hsieh, C.-C. Chang, M.-H. Ho, C.-J. Chen, J.-F. Chen, M.-T. Chen, C. H. Chen
Nat. Chiao Tung Univ., Taiwan

Bathophenanthroline (BPhen) doped with dipotassium phthalate (PAK2) was electrically characterized using current-voltage (I-V) and temperature-dependent admittance spectroscopy measurements. From experimental results, great enhancements were observed with doping devices. Accordingly, PAK2 is an alternative n-type organic dopant for n-type doping device.

OLEDp - 23 **White Light-Emitting Organic Electroluminescent Device Based on a Compound Fluorescent-Phosphor Emission Layer**

T.-S. Shieh, H.-L. Huang, P.-C. Liu, M.-T. Chu, M.-R. Tseng, J.-M. Liu
ITRI, Taiwan

We develop WOLEDs combined with fluorescent-phosphor emission layer. The WOLED has an efficiency of 19.3 lm/W at 1000Cd/m^2, and a CIE coordinates of (0.43, 0.44), when the emission layer, fluorescent-phosphor (*F/P*), double one. The WOLED has an efficiency of 14.7 lm/W at 1000Cd/m^2, and a CIE coordinates of (0.46, 0.45), when the emission layer is, fluorescent-phosphor- fluorescent (*F/P/F*), triple one.

OLEDp - 24 **Development of Monta Program for Material and Process Design in Organic Electroluminescence and Plasma Display Panel**

H. Takaba, H. Setogawa, H. Kikuchi, Y. Hayashi, K. Ogiya, H. Onuma, C. Lv, S. Riadh, M. Koyama, H. Tsuboi, N. Hatakeyama, A. Endou, M. Kubo, C. A. Del Carpio, H. Kajiyama[*]*, T. Shinoda*[*]*, A. Miyamoto*
Tohoku Univ., Japan
[*]*Hiroshima Univ., Japan*

We present a novel computational chemistry simulator based on Monte Carlo, namely “Monta” and “Monta-polymer”, for modeling a micro-scale structure of industrially interested materials. These simulators enable to model hole/electron transport layer and to simulate contamination phenomena at various environmental conditions. The application results will be presented.

OLEDp - 25 **Optics Characteristics of a Transparent Organic Light-Emitting Device**

Y. T. Chang, H. C. Chen, J. H. Lee, Y. W. Kiang, C. C. Yang
Nat. Taiwan Univ., Taiwan

We studied theoretically optical characteristics of a transparent organic light-emitting device. A simulation program was established based on the rigorous electromagnetic wave theory which helped us to design a transparent OLED. The maximum ratio of light intensity between two sides achieves 1.52 when the device transmission was kept at 80%.

OLEDp - 26 **Luminescent Properties in Emission Layer of White Polymer Light-Emitting Devices**

F.-C. Wu, H.-L. Cheng, Y.-W. Wang[*]
Nat. Cheng Kung Univ., Taiwan
[*]*Nat. Changhua Univ. of Education, Taiwan*

White organic light-emitting devices (WOLED) using a polymer-dopant system as an emission layer were fabricated. Photoluminescence and electroluminescence spectra of the WOLED were very different because an extraordinary energy transfer mechanism may exist between used light-emitting materials.

OLEDp - 27 **High Efficiency Tandem Device with Novel Connecting Layers**

H. L. Hsu, Y. M. Chiang, R. Nishikawa
TPO Displays, Taiwan

In this paper, the non-doping system of connecting layer to fabricate two EL units in one device, which consists of a common electrode Al and non-dopant hole injection/non-dopant electron injection layer on two opposite sides. The efficiency is double with respect to the single unit device, and the driving voltage is less than double voltage of single unit device.

OLEDp - 28 **Top Emission Organic Light Emitting Devices with Outcoupling Enhancement Layer**

S.-Y. Kim, C.-J. Lee[*], M.-Y. Ha, D.-G. Moon, J.-I. Han[*]
Soonchunhyang Univ., Korea
[*]Korea Elect. Tech. Inst., Korea

We have developed outcoupling enhancement layer for top emission organic light emitting devices (TEOLEDs) using CsCl layer. The CsCl outcoupling enhancement layer improves the optical transmittance of Ca/Ag double layer which have used as a semitransparent cathode, resulting in substantial increase of the luminance by the enhanced light extraction out of the cathode surface of the TEOLEDs.

OLEDp - 29 **Study on Carrier Transport Phenomenon in OLEDs at Low Temperature**

J. H. Youn, Y. I. Lee, W. S. Jeon[*], J. J. Park[*], Y. K. Lee[*], T. J. Park[*], H. T. Moon, J. Jang[*]
KAIST, Korea
[*]Kyung Hee Univ., Korea

We have studied the carrier transport phenomenon in OLED [ITO/ PEDOT/Green-EML polymer/LiF/Al] at low temperature by investigating mobility, color stability and EL spectrum change. With decreasing temperature,the mobility decreases until 210K but increases below 210K, somewhat like band-like and hopping transport of polaron. At 60K the EL spectrum shows a second peak, which appears to be due to phosphorescence emission.

OLEDp - 30 **White Organic Light-Emitting Diodes with Color-Conversion-Material as a Hole Injection Layer**

C. Li[,**], B. Wei[***], M. Ichikawa[**], K. Sakurai[*], K. Kawaguchi[*], Y. Taniguchi[**], H. Kimura[*]*
[*]Shinshu Univ., Japan
[**]Fuji Elec. Advanced Tech., Japan
[***]Shanghai Univ., China

We have fabricated white OLED with a blue EML and a color conversion material HIL. The HIL can emit red photoluminescence through host material absorbs electroluminescence emission and transfer energy to guest dye. The drive voltage of device is only 11.5 V at 0.8A/cm^2, and emissive chromatic-stability white emitting of three peaks at 470, 510 and 600 nm.

OLEDp - 31 **Determination of Charge-Carrier Mobility in Organic Light-Emitting Diodes by Impedance Spectroscopy**

T. Okachi, T. Nagase, T. Kobayashi, H. Naito
Osaka Pref. Univ., Japan

A new method has been proposed for the determination of charge-carrier mobility in OLEDs by impedance spectroscopy. It is found that the mobility of carrier injected from the Schottky contact whose barrier height is less than 0.38 eV can be correctly determined by the method.

OLEDp - 32 **High Performance OLEDs for Color Conversion Method**

Y. Terao, N. Kanai, R. Makino, M. Kobayashi,
K. Kawaguchi, Y. Kawamura, H. Kimura
Fuji Elec. Advanced Tech., Japan

A highly power efficient wide-spectrum OLED for CCM-OLED display was made by reducing the potential barrier for hole transportation in addition to using the new electron-transporting material. The result is attributed to the better balance between electron and hole. The device achieved an operating voltage of 3.4V and a power-efficiency of 15.4lm/W at 10mA/cm^2.

OLEDp - 33 **Experimental Study of Ag/LiF/PFO Interface for Top Emitting PLEDs by Synchrotron Radiation Photoemission Spectroscopy**

S. H. Chou, Y. H. Lu, C. W. Teng, K. C. Liu, T. W. Pi[*]
Chang Gung Univ., Taiwan
[*]*Nat. Synchrotron Radiation Res. Ctr., Taiwan*

No abstract was submitted.

OLEDp - 34 **Optical Simulation for Top Emission PLEDs of Microcavity Structure with Sliver Anode and Metal/TCO Cathode**

C. C. Chen, Y. C. Tsai, K. C. Liu, Y. T. Chang[*]*, J. H. Lee*[*]
Chang Gung Univ., Taiwan
[*]*Nat. Taiwan Univ., Taiwan*

The optical characteristic for top polymer light-emitting devices (PLEDs) of microcavity structure with various thicknesses of metal and TCO cathode was studied by simulation methodology. It demonstrated that electroluminescence (EL) intensity varies periodically with the changing of TCO thickness. By simulations, an optimized enhancement can be obtained by tuning the thickness and material of cathode.

OLEDp - 35 Organic Bilayered Green Phosphorescent OLEDs

W. S. Jeon, T. J. Park, J. J. Park, S. Y. Kim, Y. K. Lee, J. Jang, J. H. Kwon
Kyung Hee Univ., Korea

We present a high efficiency green phosphorescent device with organic bilayered structure by the application of the novel host that have a good electron transporting and energy transfer characteristics. The use of bi-layered device simplified a complicated PHOLED, lead to low driving voltage and high efficiency characteristic.

OLEDp - 36L Blue Glassy-Nematic OLED Oligomers for Polarized Electroluminescence

H.-L. Huang, T.-C. Chao, M.-R. Tseng
ITRI, Taiwan

Novel aligned glassy-nematic OLED materials (MCL-OF) films on thin layers of mechanically rubbed PEDOT:PSS allows the OLED devices that emit blue light with high dichroic ratio of 13.44, a high current efficiency of 1.15 cd/A and maximum brightness of 1240 cd/m^2.

OLEDp - 37L Novel High Energy Gap OLED Host Materials for Green and Blue PHOLED Materials

C.-J. Lin[*]*, H.-L. Huang, M.-R. Tseng, C.-H. Cheng*[*]
ITRI, Taiwan
[*]*Nat. Tsing Hua Univ., Taiwan*

We developed novel host materials with high energy gap and compatible HOMO, LUMO levels for green and blue phosphorescent emitters. We demonstrated the green PHOLED with a low driving voltage of 3V and a high efficiency of 38.5 lm/W. We also demonstrated blue PHOLED with a low driving voltage of 2.5V and a efficiency of 7.3 cd/A.

OLEDp - 38L Nano-Dot Enhanced High Efficiency Pure-White Organic Light-Emitting Diodes

J. H. Jou, C. C. Chen, W. B. Wang, M. H. Wu, S. M. Shen, Y. C. Chung, M. F. Hsu
Nat. Tsing Hua Univ., Taiwan

High-efficiency pure-white organic light-emitting diodes (OLEDs) were fabricated using polysilicic acid nano-dot embedded polymeric hole-transporting layer (HTL). By incorporating nano-dots into the HTL, a mixed-host composed fluorescent white OLED showed a high efficiency of 17.1lm/W. While the same concept applied on a solution-processed phosphorescent white OLED, the efficiency had increased from 6.8 to 23.7 lm/W, an improvement of 250%.

OLEDp - 39L **Characterization of Co-Doped Organic Light Emitting Diodes by Graded Doping Profile**

Y. W. Park[*], Y. M. Kim[,**], J. H. Choi[*], J. W. Huh[*], B. K. Ju[*]*
Korea Univ., Korea
[*]Opto Elect. Materials Res. Ctr., Korea

The versatile dye-dopants of OLEDs have their optimal doping concentrations of different range. In this paper, we've studied the doping concentration of co-doped emissive layer. With applying graded doping profile, optimal co-doping concentration was clearly derived. The host was Alq_3 and the two dopants were C545T and DMQA respectively.

OLEDp - 40L **Simulation and Suppression for the Moiré Phenomenon for an OLED Display with Hollow Microlens Array**

H. Y. Lin, C.-C. Chen, K.-Y. Chen, J.-H. Lee, M.-K. Wei[*]
Nat. Taiwan Univ., Taiwan
[*]Nat. Dong Hwa Univ., Taiwan

For OLED display application, a hollow microlens array has been proposed for out-coupling efficiency enhancement and image blur reduction. However, the moiré phenomenon has been observed whenever the hollow microlens array is slightly rotated with respect to the pixelated OLED array. By designing the array arrangement, it is shown that the moiré phenomenon can be suppressed.

Author Interviews
18:10 – 19:10

EXHIBITION

13:00–17:00 Wednesday, Dec. 5
9:00–17:00 Thursday, Dec. 6
9:00–14:00 Friday, Dec. 7

Main Hall C
Sapporo Convention Center

Free admission with your registration name tag.

Workshop on 3D/Hyper-Realistic Displays and Systems

Thursday, December 6

13:30 - 16:30 **Main Hall C**

Poster **3Dp: 3D and Hyper Realistic Display**

3Dp - 1 **Design of Parallax Barrier for Large Stereoscopic Display by Use of a Fine-Pitch LED Panel**

H. Nishimura, H. Yamamoto, Y. Hayasaki
Univ. of Tokushima, Japan

We investigate directivity of parallax barrier for a fine-pitch and wide-viewing angle LED panel. We analyze the directivity of a conventional parallax barrier and an aperture grille. We have developed an aperture grille for a stereoscopic display by use of a 4-mm pitch LED panel with 110-degrees horizontal viewing angle.

3Dp - 2 **3D/Hyper-Realistic Graphic Systems and Interactive Virtual Art Education Strategy**

N. Youssef
Helwan Univ., Egypt

Visual systems consider a very fast developed technology. Day after day it becomes more sophisticated, and it is our duty to know, study, and analyze new Systems for new applications. Paper discusses the applications which evolving utilizing of 3D/hyber realistic systems in the educational process. The research presumes that using interactive visual systems could help establishing effective art educational strategy.

3Dp - 3L **3D Imaging on Virtual Display Using Polarized Glasses**

M. Adachi, K. Sakamoto
Shimane Univ., Japan

The authors proposed an enlarging method of display area using a mirror last year. But this display provides only 2D image. In this report, we present an extension method using a unidirectional diffusing image screen and an improvement for displaying a 3D image using orthogonal polarized image projection.

3Dp - 4L **Extension of 3D Screen Region with LC Shutter Glasses**

H. Fukuda, K. Sakamoto
Shimane Univ., Japan

The authors have researched optical techniques for the virtual display using mirror image. In this report, we present an enlarging method of 3D display area using LC shutter glasses. Our extension method enables the observers to show the virtual stereoscopic image plane and to enlarge a screen area twice.

3Dp - 5L **6-band Computer Graphics Rendering Software for Interactive Accurate Coloring Simulation**

M. Hashimoto
NTT Data, Japan

Real-time 6-band CG rendering software for coloring simulation was developed. 6-band CG is rendered using measured reflectance of color samples. Rendered 6-band CG is converted into RGB image using illumination and display characteristics. These processes are carried out using GPU of graphics board on PC for showing simulation result interactively.

----- Break -----

16:50 - 16:55 **Mid-sized Hall B**

Opening

Opening Remarks
16:50

I. Yuyama, Utsunomiya Univ., Japan

16:55 - 18:05 **Mid-sized Hall B**

3D1: Hyper Realistic Display and Acquisition Systems

Chair: W. J. Tam, CRC, Canada
Co-Chair: S. Yano, NICT, Japan

3D1 - 1: ***Invited*** **Evaluation of Hyper-Realistic Image with Smell**
16:55

A. Tomono
Tokai Univ., Japan

Smells were coordinated with images using an olfactory display that released various smells near the user's nose, and the psychology of the subject viewing the image was examined. We found that smell presentation reinforces both the realistic sensation and the understanding of the content of the image.

3D1 - 2
17:25 **3-Dimensional Displaying in Liquid**

A. Chekhovskiy[,**], Y. Ohira[*,**], H. Toshiyoshi[*,**]*
[*]Univ. of Tokyo, Japan
[**]Kanagawa Ac. of S&T, Japan

A displaying of 3D dynamic images inside of transparent liquid was demonstrated experimentally for the first time. Laser breakdown micro-flashes were used as 3D pixels. Tap water was found to be the optimal liquid medium. Electronic color filter was used for dynamic coloring of flashes.

3D1 - 3
17:45 **Hybrid TOF and Stereoscopic 3D Video Acquisition**

S. Gurbuz[,**], N. Inoue[*,**]*
[*]NICT, Japan
[**]ATR, Japan

This paper describes the motivation, goal and methods for the hybrid approach of 3D video acquisition. The system is based on a time-of-flight (TOF) range camera and a conventional CCD stereo cameras enabling virtually parallel image channels for improving the disparity calculation of a dense 3D video acquisition system.

Author Interviews
18:10 – 19:10

Friday, December 7

13:30 - 15:00 **Mid-sized Hall B**

3D2: 3D Display

Chair: J.-Y. Son, Daegu Univ., Korea
Co-Chair: M. Hashimoto, NTT Data, Japan

3D2 - 1:
13:30 ***Invited*** **Recent Research and Development on High Resolution Stereoscopic Display Based on LCD Panel**

D.-S. Kim, S. Chestak
Samsung Elect., Korea

We have developed a high resolution stereoscopic display used by the conventional LCD panel driven up to 120Hz frame rate. This display is capable of switching 2D and 3D applications simultaneously without loss of resolution. Left and right images are sequentially formed by using a fast LC shutter for autostereoscopic display as well as stereoscopic display.

3D2 - 2
14:00

128-Directional SVGA Display for Generating Natural Three-Dimensional Images

Y. Takaki, K. Kikuta
Tokyo Univ. of A&T, Japan

A 128-directional display having SVGA resolution is developed as a natural 3D display. It consists of 128 small projectors employing LCOS devices. A double lenticular sheet is used as a display screen. The image distortion is less than 1.5%. A 3D image can be interactively manipulated using a PC cluster.

3D2 - 3
14:20

A Viewer-Tracking-Based 2D/3D Switchable Autostereoscopic Display with Motion Parallax

W. L. Hsu, C. S. Wu, L. C. Lin, C. L. Wu, C. H. Tsai, K. Lee
ITRI, Taiwan

A viewer-tracking-based 2D/3D switchable autostereoscopic display of fast tracking response and smooth motion parallax is developed. By inserting a micro-retarder plate and a PDLC panel, a 2D/3D switchable autostereoscopic display is made. Integrated with viewer-tracking system, a multi-view autostereoscopic display capable of very high number of views for single user can be achieved.

3D2 - 4L
14:40

Auto-Stereoscopic 30-View 3D Displays in Mobile Applications

S. M. Jung, H. J. Im, B. J. Lee, H. K. Hong, H. H. Shin
LG.Philips LCD, Korea

Auto-stereoscopic 3D of 30-view number was made using slanted lenticular lens array and 2.4" LCDs having VGA resolution. Due to its large view number, smooth motion parallax is observed and the visual fatigue was reduced. From the results, it was revealed that the 30-view 3D displays can be feasible to mobile displays.

3D2 - 5L
14:50

Quadruple Extension of Display Area Using Mirror Image

K. Sakamoto, M. Adachi, H. Fukuda
Shimane Univ., Japan

The authors have researched optical techniques for an enlarging method of display area using a mirror image. This extension method enables observers to show the virtual image plane and to enlarge a screen area twice. In this report, we present a new extension method to enlarge a screen area quadruple.

----- Break -----

15:10 - 16:20 **Mid-sized Hall B**

3D3: Holography

Chair: I. Yuyama, Utsunoimiya Univ.
Co-Chair: T. Mishina, NICT, Japan

3D3 - 1: 15:10 ***Invited*** **Natural Three-Dimensional Display System Based on Wavefront Reconstruction**

O. Matoba, K. Nitta
Kobe Univ., Japan

A natural three-dimensional display system based on wavefront reconstruction is presented. The presented system consists of a recording system of capturing three-dimensional data, a data processing system to manipulate three-dimensional objects, and a reconstruction system of three-dimensional object based on wavefront reconstruction. Numerical and experimental results are presented.

3D3 - 2 **Withdrawn**

3D3 - 4L 15:40 **Three-Dimensional Image Reconstruction of Real Objects with Electronic Holography using 4K2K Liquid Crystal Panels**

T. Mishina, R. Oi, J. Arai[*], F. Okano[*], M. Okui
NICT, Japan
[*]NHK STRL, Japan

This paper described electronic holography that can record and reconstruct real objects. Holograms were obtained by calculation from images captured using integral photography. The viewing zone was enlarged by three high-resolution liquid crystal panels. Autostereoscopic images of real, moving objects could be viewed at a distance of 40 cm.

3D3 - 3 16:00 **Electroholography for Object Image Composed of 100,000 Points**

Y. Ichihashi, T. Nakayama, A. Shiraki, Y. Abe,
T. Shimobaba[*], N. Masuda, T. Ito
Chiba Univ., Japan
[*]Yamagata Univ., Japan

We improved the HORN-5 system, originally developed in 2004 by our research group as a special-purpose computer, to handle an object consisting of 100,000 points. We modified the word length of the data in HORN-5, and we achieved reproduction speed of 10 frames per second by the improved HORN-5 system.

----- Break -----

16:50 - 18:10 **Mid-sized Hall B**

3D4: Human Factor and 3D Display

Chair: D.-S. Kim, Samsung Elect., Korea
Co-Chair: M. Hashimoto, NTT Data, Japan

3D4 - 1: 16:50 ***Invited*** **Human Factors and Content Creation for Three-Dimensional Displays**

W. J. Tam
CRC, Canada

The human visuo-cognitive system is exploited to obtain convincing stereoscopic depth from 2D images. Two techniques for generating depth maps, utilizing either edge information or the colour components of the 2D images, are described. The synthetic depth maps are then used in depth-image-based rendering to generate stereoscopic image pairs.

3D4 - 2 17:20 **Viewing Zones in Non-Integer Type Pixel Cells**

J.-Y. Son, V. V. Saveljev, S.-H. Kim, K.-H. Cha[*]
Daegu Univ., Korea
[*]*Samsung Elect., Korea*

A pixel cell is a basic unit of arranging multiview images on a display panel, The number of pixels in a direction of a pixel cell is not an integer but a non-integer duo to the design constraint. This is one factor of reducing the quality of image in contact-type multiview 3 dimensional imaging systems. To estimate the quality, the compositions of the images at different viewing regions of the systems are analyzed.

3D4 - 3 17:40 **A 2.4-in. 4-View 3D Display**

B. S. Kim, H. Nam, C. Y. Park, J. S. Ku, H. W. Jang, J. E. Park, H. D. Kim, H. K. Chung
Samsung SDI, Korea

We have developed a 2.4inch 4-view 3D display. Its resolution of 3D is only reduced to a half of resolution of 2D in spite of adoption a multi-view displaying system, because we have used the special time division method.

3D4 - 4L
18:00 **Adjustment of Viewing Conditions for Pitch of Large Stereoscopic LED Displays**

K. Yamaguchi, H. Yamamoto, Y. Hayasaki
Univ. of Tokushima, Japan

This paper describes a display method for each pitch of stereoscopic LED displays so that the object range corresponds to the allowable object range. The shift of stereoscopic images and the viewing distance are adjusted based on analysis on image-acquisition and stereoscopic display system.

Author Interviews
18:10 – 19:10

Supporting Organization:
Holographic Display Artists and Engineers Club (HODIC)

BANQUET

Wednesday, December 5
19:30–21:30
Palace Ballroom (3F)
Sheraton Sapporo Hotel

See page 10 for details

EVENING GET-TOGETHER WITH WINE

Tuesday, December 4
18:00–20:00

Restaurant “Sora”, Sapporo Convention Center
(Sponsored by Merck Ltd., Japan)

See page 10 for details

Workshop on Applied Vision and Human Factors

Thursday, December 6

9:00 - 10:40 **Mid-sized Hall B**

VHF1: Motion Blur

Chair: J. S. Lee, Samsung Elec., Korea
Co-Chair: C. Teunissen, Philips Consumer Elec., The Netherlands

VHF1 - 1: 9:00 ***Invited*** **Measurement and Evaluation of Moving Picture Resolution: From Milliseconds to TV-Lines**

I. Kawahara[,**], M. Kasahara[*,**], T. Shinoda[*]*
[*]Advanced PDP Development Ctr., Japan
[**]Matsushita Elec. Ind., Japan

Innovative measurement on moving picture resolution has been established. Unlike previous approaches for motion blur, This method scrolls 4-cycled sine bursts to detect the limit resolution in TV lines. Subjective test and automated system are developed, showing excellent coincidence to each other. The method, being simple and also powerful, clearly discriminates the performances of high-end TVs in the market.

VHF1 - 2: 9:30 ***Invited*** **Subjective Evaluation of Motion Blur by Using a Stationary Image**

Y. Enami, M. Okawauchi, M. Kikuchi[*]
Otsuka Elect., Japan
[*]Osaka, Japan

Presently, MPR is being used as an LCD blur edge evaluation method. On the other hand, an evaluation method that uses the CSF is also discussed as it is assumed to have a visual correlation with other devices. We performed a subjective tests using a blur edge model and based on this result, examined and compared these evaluation methods.

VHF1 - 3 10:00 **Motion Blur Analysis by Gabor Patch**

K. Oka, D. Oka
Nanosoftware, Japan

Motion blur of displays is analyzed by using Gabor patch. Normalized radius of patch at Fc*Ss=1 indicates motion blur. That of CRT monitor is unity indicating no motion blur. Those of LCD monitors are from 0.5 to 0.6. Panels with small motion blur are tested to be 0.9 to 1.0.

VHF1 - 4 10:20 **Correlation Analysis between Motion Blur Width and Human Perception**

K. Hirai, T. Nakaguchi, N. Tsumura, Y. Miyake
Chiba Univ., Japan

In this paper, the availability of perceived blur edge width (PBEW) was examined by analyzing the correlation between observer rating values and the physical properties that were extended blur edge width (EBEW) and PBEW. From our results, PBEW was correlated with observer rating values more than EBEW.

----- Break -----

11:00 - 12:10 **Mid-sized Hall B**

VHF2: Color Breakup

Chair: J. Bergquist, Nokia Japan, Japan
Co-Chair: I. Kawahara, Panasonic AVC Networks, Japan

VHF2 - 1: 11:00 ***Invited*** **Advanced Motion Induced Color-Artifact Analysis Methods in FPD**

J. S. Lee, J. H. Souk
Samsung Elect., Korea

Motion artifact of display has a huge interest from industries and users recently. Among those artifacts, color abberation (color break up and dynamic false contour) is the main degrading characteristic in field sequential type displays and plasma displays. Unfortunately, there are no objective measurement methods for those motion artifacts. We introduce advanced analysis methods for motion induced color abberation artifacts.

VHF2 - 2 11:30 **Spatio-Temporal Colour LCD-TV with LED Backlight**

G. Cennini, O. Belik, E. Langendijk, F. Vossen
Philips Res. Labs., The Netherlands

We report on the realization of a spatio-temporal colour LCD-TV based on LED backlight technology. Spatio-temporal synthesis of images is a technique in which two (instead of the three color filters) are used and two (or more) temporal color fields are generated to make a full color image.

VHF2 - 3
11:50

An Experimental Platform for Evaluating Color Breakup Phenomenon

C.-F. Hsu, C.-N. Wu, W.-C. Cheng
Nat. Chiao Tung Univ., Taiwan

An RGB-LED-backlit LCD was implemented for psychophysical study of color breakup phenomenon. The backlight module is capable of generating colors either sequentially or simultaneously to emulate a field sequential or conventional display. A new method of visual experiment is also proposed for assessing human subject's detectability of color breakup phenomenon.

----- Lunch -----

13:30 - 16:30 **Main Hall C**

Poster VHFp: Applied Vision and Human Factors

VHFp - 1

Preferred Color Reproduction for Image Color Enhancement and Skin Color Adjustment

P.-L. Hsieh, Y.-J. Lee, H.-T. Lin
Chunghwa Picture Tubes, Taiwan

In this paper, we propose an effective system for preferred color reproduction. In this system, color is transformed gradually according to different saturation for color enhancement and the skin area of image is processed specifically. The experimental results show that the proposed method can make image more vivid and the skin area of image can be adjusted very easily.

VHFp - 2

A Vivid Color Management for LCD TV Adjusting Skin Color with RGB Signal Reconstruction

M.-C. Kao, Y.-J. Lee
Chunghwa Picture Tubes, Taiwan

A faster algorithm for adjusting human skin color was proposed. The algorithm has two processes includes skin color detection and to Hue and Saturation adjustment. Additionally, it can reduce the contour artifacts between skin area and non-skin area. This novel technology was successfully implemented in 37" and 47" LED Backlight - LCD TV.

VHFp - 3

Image Color Gamut Enhancement Using Rich Color Method for Mobile Displays

J.-S. Li, C.-C. Lai, C.-F. Hsu
Wintek, Taiwan

A novel real-time pixel-level rich color method is presented to enlarge averagely 34% image color gamut without hue distortion, frame and line memory. Experimental results show the usefulness on a 2.2-inch mobile phone TFT LCD.

VHFp - 4 **Influence of Image Degradation on Accommodative Responses during Subjective Image Quality Evaluation**

T. Matsui, T. Fujita, S. Sakai, T. Shinozaki
Gunma Univ., Japan

We have clarified the relation between image quality degradation and accommodation lag by measuring accommodative responses during subjective evaluation for sharpness or noise. Images used here were three kinds of generalized knife-edge images. This suggests some possibility that the accommodative characteristic is influential in human subjective judgments about image quality.

VHFp - 5 **A Study on Temporal Properties of Surface Perception Using the Probing Method of Poggendorff Configuration**

Q. Wang, M. Idesawa
Univ. of Electro-Commun., Japan

Temporal properties are essential issues of surface perception; they were investigated by using the probing method of the Poggendorff configuration. We referred that illusory surface was necessary to keep remained for perceiving till the afterimage of real lines disappeared. The probing method is effective for detecting opaque surface perception.

VHFp - 6 **A New Method to Do Stereo Matching in Curved Surface**

Z. Xu, M. Idesawa
Univ. of Electro-Commun., Japan

Mask Scale Adjusting (MSA) stereo matching method: a new method for solving the scale difference problem, which is occurred on a curved surface and deteriorate correspondence accuracy in conventional method, is proposed and examined. By applying the MSA method in synthetic and real stereo images, we proved that the MSA method is effective to obtaining more precise correspondence.

VHFp - 7 **False Contour Decrease Method in Color Conversion for RGBW Primaries**

H. Ito, M. Takaya, Y. Shimodaira
Shizuoka Univ., Japan

False contours are often generated by the color conversion for multi primaries. In this research, it was confirmed that variety of the gamma values of the primaries influenced the cause of false contours. The false contours were reduced by averaging signals corresponding to conditions of minimum and maximum power consumption in our color conversion method based on the linear programming.

VHFp - 8 **Color Difference-Based Adaptive Noise Reduction for Images**

Y. Amano, Y. Shimodaira
Shizuoka Univ., Japan

We proposed a noise reduction method that keeps color and edge information correct, and reduces noise in images. And this method optimized color signal values by using color information of circumjacent pixels with Genetic Algorithm. As the results of the experiments, the proposed method is confirmed to be effective for reproducing high image quality.

VHFp - 9 **3D Object Reconstruction from Single 2D Line Drawings without Hidden Lines**

H. Suzuki, K. Shoji, M. Nagai, F. Toyama, J. Miyamichi
Utsunomiya Univ., Japan

We can perceive 3D objects including their hidden sides from their 2D line drawings without hidden lines in many cases. In this paper, we propose an approach to the 3D object reconstruction from single line drawings without hidden lines simulating our perceptual tendencies.

VHFp - 10 **Speaker Identification of Speech Balloons in Comic Images**

T. Tanaka, K. Shoji, F. Toyama, J. Miyamichi
Utsunomiya Univ., Japan

In this paper, a method for speaker identification of speech balloons by using opening operation of morphological processing is proposed. Experimental results show that 72 per-cent of 219 speech balloons within 90 pages in one print comic material successfully correspond to their correct speakers by the proposed method.

VHFp - 11 **Eye Movement in Reading Comics**

S. Chiba, T. Tanaka, K. Shoji, F. Toyama, J. Miyamichi
Utsunomiya Univ., Japan

In this research, the eye movement between scene frames is examined when reading comics. Experimental results show that subjects mainly read speech balloons or narrative texts. It is considered that forward jumping often occurs at scene frames without speech balloons. Backward jumping occurs followed by forward jumping.

VHFp - 12 **Evaluation for Indistinct Mura in LCDs Based on Human Vision**

Y. Masakura, T. Tamura, T. Satoh, T. Uchida
Tokyo Polytech. Univ., Japan

We examined subjective evaluations for indistinct Mura of LCD. It was revealed that three numerical indexes of 1) number of pixels which were 200 or less in 256 gray scale levels, 2) sum of Mura edge areas, and 3) sum of Mura edge lengths would be important for subjective evaluations.

VHFp - 13 **Conditions for Illumination Spectrum in Field Sequential Color Imaging that Achieve Hi-Fi Color Reproduction on Field Sequential Color Displays without Causing Side-Effective Color Breakup**

S. Uezono, G. Sugiura[*], Y. Suzuki, K. Sekiya, T. Miyashita, T. Uchida
Tohoku Univ., Japan
[*]Pentax, Japan

Combined systems of field sequential color cameras and field sequential color displays show a good performance against color breakup. We identified a condition for high fidelity color reproduction on the systems with preserving the color-breakup-free characteristics. We also estimated implementability of the condition with combinations of small numbers of different wavelength LEDs.

VHFp - 14L **Effects of Aging on the Legibility of Characters on Mobile Phone Displays**

S. Matsunuma, S. Hasegawa[*], K. Fujikake[**], M. Omori[***], M. Miyao[**], T. Umezaki
Nagoya Inst. of Tech., Japan
[*]Nagoya Bunri Univ., Japan
[**]Nagoya Univ., Japan
[***]Kobe Women's Univ., Japan

Nowadays, mobile phones are very popular in the world. The use of text email with short message service (SMS) is spreading. When characters are small, younger people assure readability by shortening the viewing distance. Conversely, elderly people find it far more difficult to see small characters beyond a given.

VHFp - 15L **Aberrations Study for Human Vision between Eyes Simulation and Images for Displays and Ophthalmic Optics**

Y.-C. Fang, C.-Y. Wang[*], W.-T. Lin, J.-L. Jon
Nat. Kaohsiung First Univ. of S&T, Taiwan
[*]I-Shou Univ., Taiwan

This study proposes a new method for investigating human eye anatomy via simulation and experiment. Eye models are studied and modified by ray-tracing program CODE V with MTF; which will be compared with statically experimental results of ECTF (Eyes Contrast Transfer Function); New proposed ECTF is expected to use in research for both Display and ophthalmic optics in the future.

Author Interviews
18:10 – 19:10

Friday, December 7

10:40 - 12:10 **Mid-sized Hall A**

VHF3: Display Image Quality

Chair: N. Hiruma, NHK, Japan
Co-Chair: Y. Hisatake, Toshiba Matsushita Display Tech., Japan

VHF3 - 1: 10:40 ***Invited*** **Display Technology Trends Perceived from a Consumer (Electronics) Point of View**

C. Teunissen, C. L. M. van der Klauw
Philips Consumer Elect., The Netherlands

Until recently, the form factor of flat panel displays was the main driver in TV applications. Still the motion performance and viewing angle of LCDs are subject for improvement, but in other areas they are, specification wise, superior over CRTs. Are all improvements perceived and appreciated by end-consumers? Perception studies can provide insight in the consumer value of technological developments.

VHF3 - 2 11:10 **A Comparison of the Quantitative Human Visual Evaluation of LCD and PDP**

H. Lee, K.-W. Whang
Seoul Nat. Univ., Korea

We studied the human visual evaluation with Flat Panel Displays to clarify the viewer preference and the related physical and physiological factors. Psychological method and eye motion tracking camera evaluation were carried out. In our research, the optimum display for viewers should show more soft and smooth image, not so bright one.

VHF3 - 3 11:30 **Effect of the Viewing Distance on Visual Fatigue for TV in a House**

K. Sakamoto, S. Aoyama, M. Matsuoka, S. Asahara, K. Yamashita[*], A. Okada[*]
Matsushita Elec. Ind., Japan
[*]Osaka City Univ., Japan

In this study, we tried the evaluation experiments that measured the effect of viewing distance on visual fatigue. It was found that at distances between 2 and 6 times the display height, visual fatigue was minimized but in some cases, the sympathetic nerve activity was highest at the same distance.

VHF3 - 4 11:50 **Image Quality Assessment for Displayed Color Halftone Images Based on Structural Similarity**

J. H. Lee, T. Horiuchi, S. Tominaga
Chiba Univ., Japan

We propose a new image quality assessment method based on the structural similarity measure for displayed color halftone images with considering the human visual characteristics. We apply this measure to the various kinds of color halftone images. Then, we confirm that the measure is coincident with the subjective evaluation well.

----- Lunch -----

13:30 - 14:55 **Mid-sized Hall A**

VHF4: Moving Image Quality

Chair: C. Teunissen, Philips Consumer Elec., The Netherlands
Co-Chair: J. Someya, Mitsubishi Elec., Japan

VHF4 - 1: 13:30 ***Invited*** **Signal Processing Technology for Improving Motion Picture on FPD-TV**

Y. Mizuhashi
Hitachi, Japan

Improving Motion picture quality is one of the major concerns of today's FPDs. PDPs in PAL format have a flicker problem and LCDs have a motion blur. This paper describes the improving motion picture technology to reduce them by frame rate conversion and motion compensated frame rate conversion LSI.

VHF4 - 2 14:00 **Measurements of Brightness and Moving Image Characteristics of Recent Flat Panel Displays**

T. Yamamoto, M. Kurozumi, M. Yamamoto, O. Tamaru, H. Arata[*]*, N. Otsubo, E. Nakasu, K. Ishii, T. Kurita, K. Minomo, T. Kikkawa*
NHK, Japan
[*]*NHK Integrated Tech., Japan*

The penetration of flat panel displays, or FPDs, has rapidly spread in recent years. FPDs have different image display characteristics with cathode ray tubes (CRTs). This paper outlines our FPD measurements and the basic characteristics for brightness, moving image characteristics, etc.

VHF4 - 3
14:20

Moving Picture Response Time Simulation by Accurate Luminance and Temporal Measurements for the LCD

D.-H. Pan, J.-F. Huang, Y.-H. Hung
ITRI, Taiwan

Many papers propose moving picture response time simulation by measuring response time of the LCD. Although it doesn't consider the angular field of view, we have presented our novel optical measurement system to acquire luminance, temporal response, and view angle measurement followed by VESA 2.0. Due to our accuracy luminance measurement, the MPRT could be simulated easily by our metrology.

VHF4 - 4L
14:40

Comparison PBET with BET for Liquid Crystal Display from the Viewpoint of HVS (Human Visual System)

S. A. Park, K. H. Shin, K. T. Kim, M. J. Lim, H. H. Shin
LG.Philips LCD, Korea

The measurement of motion blurs was performed by a pursuit camera, and the results were analyzed through the methods of BET & PBET. From experiments, it is concluded that PBET is not enough to reflect actual perceived motion blurs at lower gray levels in a specific type of LCDs.

----- Break -----

15:10 - 16:30 **Mid-sized Hall A**

VHF5: Color

Chair: Y. Shimodaira, Shizuoka Univ., Japan
Co-Chair: T. Matsumoto, Sony, Japan

VHF5 - 1
15:10

The Ergonomics Requirement for Reproducible Area of Color Chromaticity in Electronic Displays

Y. Hisatake, A. Ikeda, H. Ito, M. Obi, Y. Kawata, A. Murayama
Toshiba Matsushita Display Tech., Japan

We studied ergonomics requirements of color reproduction range of electronic displays and its shape in the chromaticity diagram through subjective evaluation for chroma using several pictures of objects or landscapes consisting of some memory colors with high chroma and various color hues.

VHF5 - 2
15:30 **Relationship between Color Appearance and Color Gamut of the Display**

M. Sakurai, R. L. Heckaman, M. D. Fairchild*, T. Nakatsue, Y. Shimpuku*
Sony, Japan
**Rochester Inst. of Tech., USA*

The effect of varying color gamut of display to color appearance was measured to investigate the relationship between color appearance and gamut volume in terms of psychophysical metrics. The interval scales for colorfulness perception monotonically increases with the gamut area in *xy* diagram while it becomes less sensitive with the gamut volume in color spaces.

VHF5 - 3
15:50 **Measurement of Color Reproduction Characteristics of Recent Flat Panel Displays**

K. Ishii, K. Masaoka, K. Kurozumi, T. Yamamoto, T. Kurita, M. Yamamoto, O. Tamaru
NHK, Japan

We measured color reproduction characteristics of recent flat panel displays or commercially available consumer devices. The green and cyan color reproduction areas are extended on some PDPs and LCDs, compared with the standard color gamut. Such displays show large color reproduction errors for those colors.

VHF5 - 4
16:10 **Proposal of Tile Palette as a Color Palette on a Display**

A. Chikawa, N. Hiruma, Y. Tada*
Univ. of Electro-Commun., Japan
**NHK, Japan*

Tile Palette is proposed for mixing colors freely on display like painting its user can set up the color space in the real world. It can also visually show quantity of the used color for mixing and process of mixing color by tile interface which doesn't need specialized knowledge.

----- Break -----

16:50 - 17:45 **Mid-sized Hall A**

VHF6: Display Characteristics & Vision

Chair: S. Clippingdale, NHK, Japan
Co-Chair: M. Sakurai, Sony, Japan

VHF6 - 1
16:50

A Modified Stripe-RGBW TFT-LCD with Image-Processing Engine for Mobile Phone Displays

C.-F. Hsu, C.-C. Lai, J.-S. Li
Wintek, Taiwan

A Modified Stripe-RGBW (MS-RGBW) color filter structure can keep high resolution, and obtain higher brightness in comparison with conventional RGB color filters. Image-process engine obtains a new RGBW image data without hue and saturation distortion and saturation and transfers RGBW data into a MS-RGBW color filter structure to achieve sharp text image.

VHF6 - 2
17:10

A New Type of 3D Visual Effect Produced by Cyclic Display of a Pair Images with Slight Disparity

M. Idesawa, X. Chen, Q. Wang
Univ. of Electro-Commun., Japan

The velocity field could be produced by cyclic display of three images including a pair image with slight disparity; 3D perception such as depth, surface, structure and volume perception are obtained almost the same as to that in the continuous real motion; and expected to be applied for generating special visual effect only using the three frame images.

VHF6 - 3L
17:30

Effects of LCD-TV's Polarizing Characteristics on Visual Fatigue

X. L. Yan, D. Fu, C. C. Zhu, X. W. Xie, X. W. Sun, H. Zhang, W. D. Huang
TCL, China

Effects of LCD-TV's polarizing characteristics on visual fatigue during a long time watching are investigated. Electrooculagram (EOG) and Grading-vision measurement are used to evaluate the visual fatigue of subjects before and after watching. Data indicate that circular polarized transmission light from LCD-TV causes less visual fatigue compared with normal LCD-TV.

Author Interviews
18:10 – 19:10

Supporting Organization:
Technical Group on Information Display, ITE

Workshop on Projection and Large-Area Displays, and Their Components

Thursday, December 6

13:30 - 16:30 **Main Hall C**

Poster **LADp: Projection**

LADp - 1 **Free Curvature Prism Lens Design and Manufacture for Eye Glass Display with 0.59-in. OLED Panel**

T. H. Kim, K. B. Park, M. J. Kim, H. C. Moon
Korea Elect. Tech. Inst., Korea

We designed a free curvature prism lens for Eye Glass Display (EGD) with 0.59" OLED panel, and applied it in micro display of organic light emitting device. It had a 42° field of view (FOV) and 25mm eye relief, which satisfied with the requirement of EGD.

LADp - 2 **The LCOS Single Panel Mini-Projector Using LED Light Source**

H. H. Lo, S. C. Chung, C. C. Lin
ITRI, Taiwan

A six lumens LED projector with non-telecentric illumination is demonstrated. The pin-fin heat sink can bring out the heat in a more effectively way, and keep the LED operating at low temperature.

LADp - 3 **High Collecting Efficiency and Light Recycling Illumination System for LEDs RPTV**

S.-C. Chung, C.-C. Lin, T.-Y. Chen, C.-H. Fan, L.-P. Chung
ITRI, Taiwan

A development of a 50 inch, 3-panel LEDs RP TV using LEDs as the light source. With the recycling and collecting illumination system, a prototype of LED RPTV is realized. The brightness of LEDs RPTV is over 200 nits and its color uniformity is around 85%.

Friday, December 7

9:00 - 10:20 **Conference Hall**

LAD1: Projection Components and Systems

Chair: D. Cuypers, Imec, Belgium
Co-Chair: S. Shikama, Mitsubishi Elec., Japan

LAD1 - 1
9:00

A Driving System for HTPS 3-LCD Projector Optimized for Double Frame Rate Video Source to Improve Motion Picture Image Quality

T. Nishimori, T. Toyooka, H. Iisaka, K. Takeda
Seiko Epson, Japan

A new driving system optimized for a double frame rate video source has been developed for an HTPS 3-LCD projector. A good balance between performance and circuit resources was achieved by implementing the Direct Driving method in which HTPS-TFT-LVs are directly driven by the double frame rate video source.

LAD1 - 2
9:20

Fast Switching Vertically Aligned Microdisplays

D. Cuypers, H. De Smet[*], A. Van Calster[*]
Imec, Belgium
[*]Ghent Univ., Belgium

Up to now, LCOS employing VAN are only used in three-panel configurations because the LC was considered not fast enough for color-sequential operation. This paper presents measurements of VAN cells using recent LC mixtures which indicate that color-sequential operation is possible, both for digital driving using PWM and for analog driving if color accuracy is not primordial.

LAD1 - 3
9:40

Compact Lamp with Sub Reflector and High Efficiency Illumination Optics for Projector

T. Hashizume, T. Takezawa, K. Akiyama
Seiko Epson, Japan

170-watt E-TORL (EPSON twin optimized reflector lamp) and the parallel and compact illumination optics are developed. E-TORL yields a small etendue. Its lifetime is long. The illumination transmits considerable light. A compact and bright projector with 0.7-in XGA LCDs has been developed using this system.

LAD1 - 4
10:00

Diffusing Property of a Display with High Brightness and Uniformity Considering with a Human Eye Property

B. Katagiri, T. Kawakami, Y. Kuratomi, K. Hiyama,
K. Takamura, Y. Suzuki, T. Uchida
Tohoku Univ., Japan

Projection displays, large PDP and LCD, consume large amounts of power because of their large screen. In this study, we examined the diffusion properties of such displays, focusing on the front brightness. We optimized the diffusion properties to permit the implementation of high-quality projection displays. This optimization decreases the total luminosity compared to uniform diffusion, and will reduce power consumption.

----- Break -----

10:40 - 12:30 **Conference Hall**

LAD2: Solid State Lightsources

Chair: M. Jansen, Novalux, USA
Co-Chair: K. Takeda, Seiko Epson, Japan

LAD2 - 1: 10:40 ***Invited*** **Light Emitting Devices Based on Semipolar-Oriented InGaN/GaN Quantum Wells**

Y. Kawakami, M. Ueda, M. Funato, Y. Narukawa[*]*, T. Mukai*[*]
Kyoto Univ., Japan
[*]*Nichia, Japan*

Two different types of light emitters based on InGaN/GaN quantum wells (QWs) are discussed; one is microfacet QWs and the other is semipolar light-emitting diodes (LEDs). We demonstrate the control of emission color including white in microfacet QWs and blue, green, and amber LEDs in planar structures.

LAD2 - 2: 11:05 ***Invited*** **High Efficiency Green Lasers for Mobile Projectors**

V. Bhatia, N. Sekiguchi[*]*, M. Hempstead, A. Okada*[*]*, J. M. Grochocinski*
Corning, USA
[*]*Corning Int., Japan*

Mobile projectors require high efficiency light sources. Our green laser achieves high efficiency in a compact form with excellent beam quality and high bandwidth. The infra-red output of a distributed Bragg reflector laser is coupled into a second harmonic generation device and converted to green. Efficiencies of 15% are achievable.

LAD2 - 3 11:30 **Large Venue Laser-Based Projectors**

M. Jansen, S. Brittain, G. Giaretta, J. Green, G. Niven, C. Stuart, W. Wu
Novalux, USA

High brightness fiber-coupled RGB laser sources offer an expanded color gamut, lifetimes in excess of 20,000 hours, scalable power (just add more lasers), reduced cost of ownership (no lamps to replace), as well as smaller system size and efficiency. We present the basic design and performance data for a laser-based projection system using Novalux Necsel™ lasers.

LAD2 - 4
11:50 **Improved Color Point Stability of High Brightness LEDs for Projectors**

*S. Bierhuizen, G. Weijers**
Philips Lumileds Lighting, USA
**Philips Lighting, The Netherlands*

Present-day commercially available LED arrays used in TV and pocket projection applications show a large thermal dependency requiring expensive active color feedback to maintain a stable white point. We demonstrate that using our novel LED arrays with improved thermal dependency can result in a much more stable white point, thereby significantly reducing light loss and need for active color feedback.

LAD2 - 5L
12:10 **Long-Life Dual Paraboloid Reflector Lamp System for Projection Display Applications**

K. K. Li, S. Inatsugu
Wavien, USA

The UHP-type of lamps provides the most cost-effective way for high-intensity illumination in projection displays. The lifetime of these lamps had been a disadvantage, but is overcome by the Dual Paraboloid Reflector lamp system. This article presents the operating principles and the lifetime extension results using this system.

Author Interviews
18:10 – 19:10

Supporting Organizations:
Technical Group on Information Display, ITE
Technical Committee on Electronic Information Displays, Electronics Society, IEICE
Liquid Crystal Display Forum, JLCS
Micro Device Display Consortium (MDDPC)

IDW Outstanding Poster Paper Award

The 2007 award winners will be announced on the IDW web site:
http://www.idw.ne.jp/award.html

Workshop on Electronic Paper

Wednesday, December 5

13:20 - 14:30 **Mid-sized Hall B**

EP1: Electronic Paper (1)

Chair: T. Fujisawa, Dainippon Ink & Chems., Japan
Co-Chair: H. Arisawa, Fuji Xerox, Japan

EP1 - 1: 13:20 ***Invited*** **A4 BiNem Display with 3.8 Mega-pixels**

J. Angelé, M. Elyaakoubi, F. Guignard, S. Jacquier, S. Joly, P. Martinot-Lagarde, J. Osterman, J. D. Laffitte, F. Leblanc
Nemoptic, France

An A4 (14.3-inch diagonal) reflective black and white BiNem® display module with 3.8 mega pixels and 200 dpi resolution has been developed. The white reflectance has been improved to 40%. The A4 display has a simple passive matrix structure and has been manufactured with standard LCD production equipments.

EP1 - 2: 13:45 ***Invited*** **Polymer Dispersed Liquid Crystal (PDLC) for Paper-Like Display Application**

A. Masutani, T. Roberts, B. Schüller, N. Hollfelder, F. Pleis, P. Kilickiran, A. Sakaigawa[*]*, G. Nelles, A. Yasuda*
Sony Deutschland, Germany
[*]*Sony, Japan*

Dichroic polymer dispersed liquid crystal (D-PDLC) offer a promising technology for future paper-like display. They posses high brightness, because polarizers are not required. This paper summarizes our unique D-PDLC fabrication method. It first creates a matrix template embedded with nano/microparticles which is then back-filled/infiltrated with dye doped liquid crystal.

EP1 - 3 14:10 **Novel Optical Rewritable Electronic Paper**

A. Muravsky, A. Murauski, V. Chigrinov, H.-S. Kwok
Hong Kong Univ. of S&T, Hong Kong

We developed new principle of electronic paper that is light printable rewritable matter for 2D or stereoscopic 3D image. It operates by Optical Rewritable alignment technology, uses bare plastic, polarizers as substrates. Continuous grey image maintains proper performance even when device is bent. Simple construction provides durability and low cost.

----- Break -----

15:00 - 16:15 **Mid-sized Hall B**

EP2: Electronic Paper (2)

Chair: M. Omodani, Tokai Univ., Japan
Co-Chair: Y. Toko, Stanley Elec., Japan

EP2 - 1
15:00

The Reflectance Improvement in Cholesteric Liquid Crystal Microcapsule Cells

N. Hiji, T. Kakinuma, C. Manabe, S. Yamamoto
Fuji Xerox, Japan

Methods for improving the reflectance in cholesteric liquid crystal microcapsule (CLC-MC) cells were investigated. The reflectance increased with the thickness of the CLC-MC layer and reached 55% exceeding a theoretical limit (=50%) in CLC cells. The effects of birefringence and mixing of right-handed and left-handed CLC-MCs were also investigated.

EP2 - 2
15:20

Full Color A6-Size Photo-Addressable Electronic Paper

H. Harada, M. Gomyo, Y. Okano, T. Gan, T. Urano, Y. Yamaguchi, T. Uesaka, H. Arisawa
Fuji Xerox, Japan

Full color photo-addressable electronic paper was developed. The electronic paper comprised of two stacked photo-address elements. The A6-size prototype had paper-like features, and showed full-color bi-stable images instantly written with a viewer-type writing apparatus. The results suggest a high feasibility of this technology for a color electronic document viewer.

EP2 - 3
15:40

The Design and Fabricating of Multi-Color Single Layer Cholesteric Liquid Crystal Display

J. C. Yang, Y. C. Liao, J. W. Shiu, K. L. Lo, S. H. Liu, Y. P. Chang, H. H. Lee, Y. S. Tsai
ITRI, Taiwan

The cholesteric liquid crystal display possess the bistability and simple structure that is suitable for e-paper application. A multi-color single layer cholesteric liquid crystal display is demonstrated by a new structure design. The colored liquid crystals are filled into the single layer structure by pixelized vacuum filling. A 10.4 inch display is realized for verifying the techniques.

EP2 - 4L 16:00 **Liquid Crystal Alignment on Random Planar-Homeotropic Patterned Substrates**

T. Yazawa, T. N. Oo, M. Kimura, T. Akahane
Nagaoka Univ. of Tech., Japan

Micropatterned alignment of nematic liquid crystals formed by stripes of alternating random planar and homeotropic anchorings was theoretically proposed by Qian and Sheng [Phys. Rev. Lett. 77 (1996) 4564]. We will present and discuss experimental results of alignment properties of nematic liquid crystals on this micropatterned surface. Moreover, we also investigated microscopic switching behavior of a micropatterned nematic liquid crystal cell.

----- Break -----

16:40 - 18:00 **Mid-sized Hall B**

EP3: Electronic Paper (3)

Chair: T. Kitamura, Chiba Univ., Japan
Co-Chair: G. Zhou, Philips Res. Labs., The Netherlands

EP3 - 1: 16:40 ***Invited*** **Cell Structure of Mobile Fine Particle Display and Migration of Fine Particles in the Cell**

*T. Takahashi, K. Shimoyama, E. Kagami, S. Saito, Y. Toko**
Kogakuin Univ., Japan
**Stanley Elec., Japan*

The MFPD cell, the display changes because fine particles dispersed in the nematic LC were moved by applying the electric field. It is found that the fine particle migration of MFPD is different depending on the type of fine particle. In addition, novel structures of MFPD were proposed.

EP3 - 2 17:05 **A Transposed PWM Scheme for Unifiedly Driving a Single-Layered Colored Cholesteric Liquid Crystal Display**

C.-J. Chen, C.-W. Hsiao, T.-A. Chen, C.-C. Liang, C.-C. Hsu
ITRI, Taiwan

For reducing the cost of the driving system for a single-layered colored cholesteric LCD, a transposed PWM scheme is proposed in this paper to unify the driving voltages for each common (scan) line. Applying the proposed scheme, it is not necessary to generate different voltages for different colors in each traditional scan line; in spite of different colored cholesteric LC having different R-V curves. The performances of the proposed scheme are experimentally evaluated and satisfactory colored images can be obtained.

EP3 - 3
17:25 **The Gamut Versus Brightness Trade-Off in Reflective Displays**

T. Bert
Barco, Belgium

Simulations estimate the boundaries of the color gamut of multi-primary color displays based on the spectra of light source and light modulating components (color filters). This will provide a design guideline for optimization between color gamut and brightness on reflective multi-primary color displays.

EP3 - 4L
17:45 **High Performance Reflective PDLC Display with Prism Array Sheets**

H. Nagato, R. Hasegawa, H. Oh-oka, I. Amemiya, S. Uchikoga
Toshiba, Japan

By using a PDLC cell and two prism array sheets, a bright reflective display with paper-white appearance has been developed. The influence of prism apex angle was studied. By optimizing the angle and the cell gap, the high reflectivity of 53% and the high contrast ratio of 8:1 were achieved, which values are comparable to those of newspaper.

Author Interviews
18:00 – 19:00

Thursday, December 6

9:00 - 10:15 **Mid-sized Hall A**

EP4: Electronic Paper (4)

Chair: S. Maeda, Oji Paper, Japan
Co-Chair: A. Suzuki, Ricoh, Japan

EP4 - 1:
9:00 ***Invited*** **Modeling Electrophoretic Paper-Like Displays**

M. Müller, G. F. Zhou
Philips Res. Labs., The Netherlands

Electrophoretic displays are the most mature technology for electronic paper. However, their complex optical behavior with strong history dependency is still poorly understood and complicates driving. This is due to the complex interaction between the electrical field, the cavity, the charged particles and the fluid. In this paper we will discuss ways to simulate this behavior to improve display performance.

EP4 - 2: 9:25 ***Invited*** **A Flexible Color A4 Size e-Paper Fabricated on a Thin Metal Foil**

J.-K. Lee, C.-D. Kim, I. Kang, I.-J. Chung
LG.Philips LCD, Korea

A 14.1-inch flexible color e-paper was developed using electronic inks between Thin-Film Transistors (TFT) fabricated on a thin metal foil and Color Filter Array (CFA) coated onto the plastic substrate. The key technologies for developing this flexible display are described along with its good display performance.

EP4 - 3: 9:50 ***Invited*** **Development of Flexible E-Paper and its Applications**

N.-S. Roh
Samsung Elect., Korea

Mobile display requires reflective mode for readability in bright sunlight. And it should have thin & light, robustness, flexibility. We developed 3 kind of E-Paper suitable for mobile handset, e-book, and color application. Each E-paper uses suitable technologies such as circuit integration, precise dimension control, and flexible color filter fabrication.

----- Lunch -----

13:30 - 16:30 **Main Hall C**

Poster **EPp: Electronic Paper**

EPp - 1 **Withdrawn**

EPp - 2 **Formulation of Electronic Ink through the White Particle with High Electrophoretic Mobility**

C. A. Kim, S.-Y. Kang, G. H. Kim, S. D. Ahn, J. Oh, K. S. Suh
ETRI, Korea

A charge control agent affects the electrophoretic zeta potentials of white particle, which show the maximum value in zeta potential. The electronic ink panel fabricated with the charged white particles and the black particles exhibits more than 15:1 contrast ratio at 10V.

EPp - 3 **Colored Materials for Electrophoretic Displays Applications**

M. Fontana, M. Lanz, G. de Keyzer, P. Bugnon, M. Hahn, C. Auschra, K. Mistry, F. Prirrung
Ciba Specialty Chems., Switzerland

No abstract was submitted.

EPp - 4 **Improvement of Display Characteristics by Particle Surface Modification in Toner Display**

Y. Tanaka, S. Nakamura, N. Miyagawa, T. Kitamura
Chiba Univ., Japan

We studied on the effect of flowability and electric charge of particle on the display characteristics in a toner display. The surface of toner particle was modified with nanosized silica particles by using hybridization system. The surface modification is effective in improving the display contrast, threshold voltage.

EPp - 5 **Writable Cholesteric Liquid Crystal Display and the Algorithm Used to Detect Its Image**

D.-W. Lee, J.-W. Shiu, Y.-A. Sha, Y.-P. Chang
ITRI, Taiwan

Writable Cholesteric Liquid Crystal Display and the algorithm used to detect its image were developed. We could use any hard tip, ex: the tip of a forefinger, to directly write an image on the surface of Cholesteric Liquid Crystal Display (CHLCD). By measuring the capacitance of one pixel of test cell (12mm x 15mm/ 1x1), F-state or P-state could be detected. By measuring the capacitance of one pixel of 4.1" CHLCD (241um x 241um/ 320x320), F-state or P-state could not be detected, due to the effect of parasitic capacitance. Therefore, high frequency measurement and the algorithm were developed to detect the image on CHLCD.

EPp - 6 **A Driver for Modular Passive-Matrix Displays**

P. Bauwens, J. Doutreloigne, A. Monté
Ghent Univ., Belgium

A problem with Passive-Matrix Displays is that, depending on the used display-material, only a limited number of lines can be multiplexed. This limitation can be removed by using a modular display. This display is divided into smaller modules, each with its driver. This imposes some special properties on the drivers.

EPp - 7L **Flexible PDMLC Display for Price Tag with Wireless Control**

S.-H. Liu, A.-C. Chen, M. Guh, K.-L. Cheng
ITRI, Taiwan

We have developed the Polymer Dispersed Microencapsulated Liquid Crystals (PDMLC) and the resulting films can be easily generated via coating on ITO/PET. Using the PDMLC displays, we have implemented them into price tags for using an Infrared (IR) remote control, which is regulated under the Infrared Data Association (IrDA).

Author Interviews
18:10 – 19:10

Supporting Organization:
The Imaging Society of Japan

Workshop on MEMS for Future Displays and Related Electron Devices

Thursday, December 6

9:00 - 9:05 **Main Hall B**

Opening

Opening Remarks
9:00

M. Nakamoto, Shizuoka Univ., Japan

9:05 - 10:15 **Main Hall B**

MEMS1: Displays and Imaging (1)

Chair: W. I. Milne, Univ. of Cambridge, UK
Co-Chair: K. Hane, Tohoku Univ., Japan

MEMS1 - 1: ***Invited*** **MEMS Devices as Display**
9:05

I. Shimoyama
Univ. of Tokyo, Japan

MEMS has powerful tools to create optical devices, especially, ones that have array configuration. One important feature of MEMS arrays is that they can be made tunable by various readily available methods. This paper demonstrates a varifocal liquid lens and a liquid-based two-DOF mirror and discusses new types of display.

MEMS1 - 2: ***Invited*** **Tilt Compensated Laser Projection System for Handheld Devices with Motion Compensation and Input Device Function**
9:25

H. Grueger, M. Scholles, H. Schenk, H. Lakner
Fraunhofer IPMS, Germany

Miniaturized laser projection systems instead of build in displays may offer larger images with enhanced resolution for handheld devices. Tilt compensation using inertial measurement units stabilizes the image even when the user's hand is unstable. Furthermore the movement can be used actively to control software running on the device.

MEMS1 - 3 9:45 **Two-Dimensional Optical Scanner Having a Trenched SOI Movable Frame for Electrical Isolation between Inner and Outer Vertical Comb Actuators**

H. Noge, Y. Hagihara, K. Kawano, H. Ueda, T. Yoshihara
Matsushita Elec. Works, Japan

Two-dimensional resonant optical scanners having vertical electrostatic comb actuators with unique electrical isolation structure have been developed and applied to raster-scanning laser display. Its movable frame surrounding the gimbal mirror has trenched top silicon layer of SOI on thick bottom layers. 66.9 Hz resonant frequency of the frame is achieved.

MEMS1 - 4 10:00 **Novel Printing Processes for MEMS Fabry-Pérot Display Pixel**

C. Lo, O.-H. Huttunen[*], J. Petäjä[*], J. Hast[*], A. Maaninen[*], H. Kopola[*], H. Fujita, H. Toshiyoshi
Univ. of Tokyo, Japan
[*]VTT Tech. Res. Ctr. of Finland, Finland

Roll-to-roll gravure printing and lamination were used for successful demonstration of MEMS (Micro Electro Mechanical System) Fabry-Pérot display pixel on flexible polyethylene naphthalate (PEN) film. New spacer structure design also lowered operation voltage for future low cost mass production.

----- Break -----

10:35 - 12:20 **Main Hall B**

MEMS2: Displays and Imaging (2)

Chair: A. I. Akinwande, MIT, USA
Co-Chair: H. Grueger, Fraunhofer IPMS, Germany

MEMS2 - 1: *Invited* 10:35 **High Quality Field Emission Lamps from Electron-Emitting Carbon Films with Unique Carbon-Nano-Structure**

A. Hiraki[,**], H. Hiraki[*,**], M. Nakamoto[***], G. Sato[***]*
[*]Kochi Univ. of Tech., Japan
[**]Dialight Japan, Japan
[***]Shizuoka Univ., Japan

We have succeeded to fabricate a world-top-ranking electron-emitter from CVD carbon films with unique carbon-nano-structure which we name CNX (Carbon-Nano-eXit). Field Emission Lamp(FEL) using our emitter and the phosphor developed at Shizuoka University shows great ability for back-light-units for LCD.

MEMS2 - 2: 10:55 ***Invited*** **3-D Diffuser Lithography and Its Application to LCD/LED Backlight Unit and Flexible Front-light Unit**

J.-B. Yoon
KAIST, Korea

3-D diffuser lithography which simply introduces an optical diffuser in the conventional contact lithography was newly developed to fabricate various 3-D micropatterns which are strongly required in recent advanced optical components. We successfully applied this technique to fabricate high-quality microlens array and in-verse-trapezoidal micropatterns, which in turn played an important role in high-performance LCD/LED backlight unit and flexible front-light unit.

MEMS2 - 3 11:15 **White Color Flat Field Emission Lamps with Newly Developed High Luminance Green Phosphor**

M. Nakamoto, K. Shiratori, G. Sato, H. Kominami, Y. Nakanishi, H. Hiraki[*], M. Haba[*]
Shizuoka Univ., Japan
[*]Dialight Japan, Japan

High luminance, and high luminous efficacy white color flat field emission lamps have been studied by the usage of newly developed low acceleration voltage high luminance green color phosphor and nano carbon field emitters. The FELs can be expected as the first mercury-free fluorescent lamps to practical use.

MEMS2 - 4 11:30 **Triode Carbon Nanotubes Field Emission Display by Highly Precise Thick Film Printing Processes**

K.-C. Chen, L.-Y. Jiang, J.-H. Liao, W.-H. Wang, Y.-J. Shiau, P.-M. Tsai, K.-F. Chen, H.-F. Wei, S.-W. Lai, L.-H. Chan, M.-H. Lin, Y.-Y. Chang, C.-C. Lee
ITRI, Taiwan

In this work, a cathode structure of carbon nanotubes field emission display was fabricated by both the screen printing and photolithography processes. CNT emitters were printed into the dielectric holes after the whole triode structure was fabricated, in order to prevent dielectric material residues on CNTs. A highly precise printing technology was developed to print CNTs into our VGA cathodes.

MEMS2 - 5 11:45 **Numerical Analysis of Size Effect for Transfer Mold Field Emitter Arrays**

G. Sato, M. Nakamoto
Shizuoka Univ., Japan

The emitter size and density effects for the Transfer Mold field emitter arrays have been investigated by using a three-dimensional simulation. Electrons are emitted only from the pyramidal tip apex. The small emitters with the base length less than 0.4 μm can produce good uniformity of current density distribution.

MEMS2 - 6L 12:00 **The New Exposure Method for Acquiring Freer 3-D Structure by Using Synchrotron Radiation**

S. Kajita, M. Horade, S. Khumpuang, S. Sugiyama
Ritsumeikan Univ., Japan

Unlike the conventional exposure method, the new exposure method was established. The new exposure method is how to operate X-rays orthopedically and give energy distribution independently in the shape of a lattice without using a mask pattern. This result was able to find out the possibility of new X-ray lithography.

MEMS2 - 7L 12:10 **Spatial Optical Modulators (SOM) Analysis of Noise Characteristic for MEMS Projection Display Applications**

J. H. Yu, C. H. Yeo, J. C. Kim, J. H. Lim, D. J. Lee, H. W. Park[*], S. K. Yun[*], J. T. Chung, S. W. Hwang, B. K. Ju
Korea Univ., Korea
[*]Samsung Electro-Mechanics, Korea

A new type of diffractive spatial optical modulators, name SOM, has been developed by Samsung Electro-Mechanics for projection display and other applications. This paper presents a numerical analysis and experimental study on noise of the spatial optical modulators package and its preventing from thermal, Mechanical and electric noise.

----- Lunch -----

13:55 - 15:20 **Main Hall B**

MEMS3: Emerging MEMS Technologies

Chair: M. Nakamoto, Shizuoka Univ., Japan
Co-Chair: T. Komoda, Matsushita Elec. Works, Japan

MEMS3 - 1: 13:55 ***Invited*** **ZnO Films for Surface Acoustic Wave Microfluidic Device**

W. I. Milne[*], X. Y. Du[*], Y. Q. Fu[*], S. C. Tan[*], J. K. Luo[,**], S. Pisana[*], S. Maeng[***], S. H. Kim[***], Y. J. Choi[***], D. S. Lee[***], N. M. Park[***], J. Park[***], A. C. Ferrari[*], A. J. Flewitt[*]*
[*]Univ. of Cambridge, UK
[**]Univ. of Bolton, UK
[***]ETRI, Korea

SAW devices were fabricated on c-axis oriented ZnO films grown on Si substrates. Effects of film thickness on the film microstructure and acoustic frequencies were studied. Both Rayleigh and Sezawa mode waves were detected on the devices, and their resonant frequencies were found to decrease with increase in film thickness.

MEMS3 - 2: ***Invited*** **Recent MEMS Activities at Microsystems Technology Laboratories of MIT**
14:15

A. I. Akinwande
MIT, USA

This presentation will introduce several MEMS/NEMS devices being developed in the Microsystems Technology Laboratories at MIT that are focused on scaling laboratory instruments to smaller dimensions. We will illustrate this trend with three examples that result in the reduction of power consumption as well as improvements in performance.

MEMS3 - 3 **Liquid Optic Scanner Based on MEMS Technologies**
14:35

H.-H. Chen[,**], C. S. Chu[*], Y. T. Li[*], C. Fu[**]*
[*]ITRI, Taiwan
[**]Tsing-Hua Univ., Taiwan

We propose a new idea to fabricate a liquid optic scanner (LOS), which base on a SOI (Silicon on Insulate) wafer and MEMS technologies. The LOS combines two kinds of liquid, silicon oil and DI water. The light tuning mechanisms are based on electrowetting phenomena.

MEMS3 - 4 **Monolithic Fabrication of GaN/Si Structure for Optical MEMS**
14:50

R. Ito, F. R. Hu, M. Wakui, K. Hane
Tohoku Univ., Japan

MEMS with a GaN light source are proposed. The direction of light beam from the GaN light source can be changed by the stage with the comb drive actuators. GaN films were deposited on Si substrate by MBE and a movable stage was fabricated by Si micromachining.

MEMS3 - 5 **Horizontal & Vertical Interlaced Stereoscopic 3-D TFT-LCD**
15:05

S. J. Lee, S. K. Kim, M. J. Kim, K. H. Park, W. H. Park[*], J. H. Oh[*], D. H. Kang[*], B. S. Oh[*], K. W. Ahn[*], H. J. Kim[*], J. H. Hur[*], J. Jang[*]
Pavonine, Korea
[*]Kyung Hee Univ., Korea

We have developed a 5.5 inch, stereoscopic 3D display having vertical (480xRGBx640) and horizontal screen (640x480xRGB). This could be done by inserting the patterned polarizers on both TFT array and color filter array in TFT-LCD. This is the first 3D display with vertical/horizontal screen convertible.

----- Break -----

15:40 - 16:45 **Main Hall B**

MEMS4: Optical MEMS Devices

Chair: A. Hiraki, Kochi Univ. of Tech., Japan
Co-Chair: I. Shimoyama, Univ. of Tokyo, Japan

MEMS4 - 1: 15:40 ***Invited*** **Subwavelength Gratings Combined with MEMS**

K. Hane, J.-S. Ye, Y. Kanamori
Tohoku Univ., Japan

Subwavelength pitchvariable gratings were fabricated from silicon wafer and the optical characteristics were investigated. Combining with the MEMS actuator, the pitch and the reflectance of the gratings can be varied, and thus the color of the grating is modulated. Structural colors of subwavelength grating and their tunability were discussed.

MEMS4 - 2 16:00 **Fabricating of Vertical Thin Film Transistors Component Using Digital Mirror Device Maskless Pohotolithography System**

W.-K. Hsiao, J.-Y. Jeng
Nat. Taiwan Univ. of S&T, Taiwan

This study used self-developed Digital Micromirror Device (DMD) maskless photolithography system to fabricate vertical thin film transistor (VTFT) component. The channel length of this vertical structure is 90nm, and the gate electrode is fabricated by the surrounding channel mode. The experimental results proved that due to the high breadth length ratio of the channel.

MEMS4 - 3 16:15 **A Novel Design of Micro-Lens Array on Liquid Crystal Displays for the Backlight Efficiency Enhancement**

P. C.-P. Chao[*], R.-J. Chen[,**], L.-D. Liao[*,**], C.-W. Chiu[*,**]*
[*]Nat. Cheng Kung Univ., Taiwan
[**]Chung Yuan Christian Univ., Taiwan

No abstract was submitted.

MEMS4 - 4 16:30 **Design and Fabrication of Silicon Bulk Micromachined Optical Scanner for Medical Endoscope**

M. Nakada[,**], C. Chong[***], K. Isamoto[***], A. Morosawa[***], H. Fujita[*], H. Toshiyoshi[*,**]*
[*]Univ. of Tokyo, Japan
[**]Kanagawa Ac. of S&T, Japan
[***]Santec, Japan

A silicon micromachined electrostatic optical scanner has been developed by using the comb-drive electrostatic mechanism, and a prototype assembly of miniaturized fiber-optic endoscope was developed. Energy for electrostatically control the scanner was optically transmitted through the single mode fiber, and drive voltage was generated by the co-located photovoltaic cell.

----- Break -----

17:05 - 18:10 **Main Hall B**

MEMS5: Fundamental Mechanism, Materials and Process Technologies

Chair: J.-B. Yoon, KAIST, Korea
Co-Chair: M. Sasaki, Toyota Tech. Inst., Japan

MEMS5 - 1: *Invited* 17:05 **Micromirror Using Stretched Thin Film for Lower Electrostatic Driving Voltage and Higher Resonant Frequency**

M. Sasaki
Toyota Tech. Inst., Japan

The stretched thin film is applied for decreasing the electrostatic driving voltage and increasing the resonant frequency of the micromirror. The thin film torsion bar realizes 7 degrees of mirror rotation at 5V in the steady condition. The stretched membrane over the drum realizes the optical flatness reducing the inertia.

MEMS5 - 2 17:25 **Growth of Regular Carbon Nanotube Array Using Micro Contact Printing**

N. Y. Song, K. H. Kim, K. S. Kim, J. H. Ryu, C. S. Lee, B. K. Choo, K. C. Park, J. Jang
Kyung Hee Univ., Korea

We have developed a simple technique for the growth of regular array of carbon nanotubes (CNTs) using ink-stamping (IS) process. Pattern for the nucleation sites was fabricated on Ni/Si substrate by IS process. The CNTs array with current density of 17 $\mu A/cm^2$ at 1.5 V/μm can be grown directly on the patterned catalyst surface without diffusion barrier.

MEMS5 - 3
17:40 **Non-Contact Micro Key Using Novel Capacitive Sensing Method**

M. Ogata, K. Suzuki, H. Funaki
Toshiba, Japan

The authors proposed a proximity sensor employing a novel capacitive sensing method that functions as a micro-scale key. The capacitance between minutely patterned electrodes was measured based on the principle of superposition of two wave signals. The electrostatic coupling analysis and experimental results have indicated the possibility of a non-contact identification system.

MEMS5 - 4
17:55 **3-D Wafer-Level Packaging of MEMS Using Surface Activated Bonding and Through-Si Vias**

Y. Takegawa, M. Kamakura, T. Baba, T. Okudo, T. Taura, R. Tomoida, H. Shiroishi, K. Tone, T. Saijo
Matsushita Elec. Works, Japan

Wafer-level packaging (WLP) is increasingly important for MEMS devices. We have achieved Au/Au bonding using surface activated bonding (SAB), and have demonstrated low-resistant 3-D interconnections using through-Si vias (TSV) by WLP. The resistances indicate a good uniformity and high yield of Au/Au bonding and TSV.

Author Interviews
18:10 – 19:10

EVENING GET-TOGETHER WITH WINE

Tuesday, December 4
18:00–20:00

Restaurant “Sora”, Sapporo Convention Center
(Sponsored by Merck Ltd., Japan)

See page 10 for details

Workshop on Display Electronic Systems

Wednesday, December 5

13:20 - 13:25 **Small Hall**

Opening

Opening Remarks
13:20

H. Okumura, Toshiba, Japan

13:25 - 14:45 **Small Hall**

DES1: High Dynamic Range Display

Chair: K. Sekiya, Tohoku Univ., Japan
Co-Chair: H.-S. Koo, Minghsin Univ. of S&T, Taiwan

DES1 - 1: ***Invited*** **Recent Progress on Wide Dynamic Range**
13:25 **Image Sensors**

S. Sugawa
Tohoku Univ., Japan

Wide dynamic range image sensor technologies are accomplishing big evolution in various application fields such as digital-camera, security, automotive, medical and machine vision. This paper describes review on recent wide dynamic range image sensors and our new challenge to resolve a trade-off between sensitivity and full well capacity.

DES1 - 2: ***Invited*** **Quantifying Contrast Improvements and**
13:45 **Power Savings in Displays with a 2D-Dimming Backlight**

E. H. A. Langendijk, R. Muijs, W. van Beek
Philips Res. Labs., The Netherlands

(Local) dimming backlights can improve contrast and power consumption of LCDs substantially. In fact infinite dynamic contrast and >50% power savings have been claimed. In this paper we quantify the actual contrast gain and power savings as a function of the number of backlight segments.

DES1 - 3
14:05 **LCD Backlight Selection Through Distortion Minimization**

L. Kerofsky
Sharp Labs. of America, USA

We develop a backlight selection algorithm for an LCD using global backlight modulation. Distortion is defined between an ideal display, zero black level, and an LCD with finite contrast ratio using backlight modulation. Minimizing the distortion defines a backlight selection algorithm. The effect of different error measures is illustrated.

DES1 - 4
14:25 **Apply Dynamic Dimming Technology (DDT) with Distortion Rate Control (DRC) and RGB-Maximum Trend Collection Determination (RGB-MTCD) Schema to Save the Power Consumption at Battery Powered Electronics System**

C. L. Wu, K. H. Liu, J. S. Liao, Y. N. Chu, W. T. Tseng, H. T. Yu
Chunghwa Picture Tubes, Taiwan

Chunghwa Picture Tubes, LTD. (CPT) has successfully implemented the DDT (Dynamic Dimming Technology) technique into commercial 7 inch TFT-LCD module for portable and battery powered electronics system. The DDT algorithm we proposed can analyze the image distribution and control the backlight luminance automatically and adaptively according to the potential value of image content of pervious frame.

----- Break -----

15:00 - 16:20 **Small Hall**

DES2: High Quality Image Processing

Chair: M. Klompenhouwer, Philips Res. Labs., The Netherlands
Co-Chair: A. Nagase, Mitsubishi Elec., Japan

DES2 - 1:
15:00 ***Invited*** **Image Super Resolution and Related Techniques**

M. Okutomi
Tokyo Inst. of Tech., Japan

In the presentation, I will talk about our recent researches concerning “image super resolution”, which is the technique for generating a high resolution image from sequential images. I will introduce several important issues and approaches to solve them, and show many experimental results we have obtained.

DES2 - 2: 15:20 ***Invited*** **Advanced Video Processing for Full-HD High Frame Rate LCD-TV**

N. Balram, M. Biswas, V. Namboodiri[*], K. Patankar[*], S. Garg[*], T. Kim
Marvell Semiconductor, USA
[*]Marvell India, India

Motion-blur is a significant problem for Full-HD LCD where the size and resolution makes the impairment of the image very easy to see. Driving the LCDs at double frame-rate, 100 or 120 Hz, has the potential to remove this issue but it requires very complex processing. In this paper we will discuss the advanced video processing required for high frame rate driving of LCD TVs.

DES2 - 3 15:40 **Contrast Enhancement Method Using Edge Information and Saturation Improvement**

H. H. Cho, G. H. Park, J. H. Yun, M. R. Choi
Hanyang Univ., Korea

In this paper, a contrast enhancement method using edge information and saturation improvement is proposed. Histogram equalization with edge information makes higher contrast. Saturation is improved by using difference between original CDF (Cumulative Distribution Function) and edge information included CDF. The experimental results show that the proposed algorithm has higher contrast and more natural-look than the conventional methods.

DES2 - 4 16:00 **Dynamic Gamut LED Backlights in LCD-TV**

O. Belik, E. H. A. Langendijk, F. Vossen
Philips Res. Labs., The Netherlands

LCDs with colour LED backlights have wide colour gamut that can be dynamically adjusted to the content, allowing for significant power savings and higher contrast. In the paper we discuss recently built RGB and RGBW dynamic gamut displays with RGB LED backlights and provide backlight power and cost comparison.

----- Break -----

16:30 - 18:10 **Small Hall**

DES3: Novel Driver Application

Chair: N. Suzuki, Nokia Japan, Japan
Co-Chair: Y. Kudo, Hitachi, Japan

DES3 - 1: 16:30 ***Invited*** **Novel LCD Driver ICs with Built-In Automatic Control Functions for Gamma-Curve and Backlight Power**

T. Nose, H. Furihata, H. Hayama
NEC Elect., Japan

We have developed a novel driver IC which can automatically control backlight brightness and adjust display gamma curves according to the input image data. By using our proposed driver IC, the backlight power can be reduced about 30-50% keeping almost the same display image quality as the original.

DES3 - 2 16:50 **A Panel Embedded DC-DC Converter for n-MOS LTPS-TFT LCDs**

N. Mamba, H. Kajiwara, M. Maki[*], T. Miyazawa[*]
Hitachi, Japan
[*]Hitachi Displays, Japan

We have developed a panel-embedded DC-DC converter and a level shifter by using an n-MOS LTPS-TFT. We adopted a bootstrap capacitor for the level shifter to allow fast operation, and to achieve high current output capability, the DC-DC converter contains switches with a self-cutoff function. We applied these technologies to a 2.54-inch VGA+ panel and confirmed its good display quality.

DES3 - 3 17:10 **Electrical Characteristics of Driver LSI with 35μm Thickness for Flexible Display**

M. Asakawa, T. Nakashima, T. Saeki, R. Hattroi,
A. Yokoo[*], R. Sakurai[*], N. Nihei[*], Y. Masuda[*]
Kyushu Univ., Japan
[*]Bridgestone, Korea

The electrical characteristics of the mechanically flexible driver LSI as thin as 35μm to mount directly on a flexible display were precisely analyzed. The high-voltage transistors on this LSI show the current decrease less than 13% in high voltage region by a self-heating effect. Under the bending conditions, the drain current change by piezoresistive effect was observed.

DES3 - 4 17:30 **A Slim Display Using an Advanced COG Technology**

A. R. Kim, B. R. Kim, S. K. Son, S. H. Moon, N. D. Kim,
S.-W. Kim[*]
Samsung Elect., Korea
[*]Korea Univ., Korea

This paper describes a slim LCD display using A-COG technology which reduces the thickness of a LCD module by assembling column drivers on glass directly instead of attaching COF-type ICs. A-COG is a new architecture which adopts a point-to-point bus topology, a cascade gamma reference scheme, a cascade power distribution.

DES3 - 5 17:50 **Micro-AID Processor for OLED Panel**

Y. Kobayashi
Kyocera Display Inst., Japan

We have developed a programmable wave generator for OLED Panel. OLED performances: power consumption and life time, has deep dependency on its control signals: timing, strength and combination. The Micro-AID Processor, enables easy wave editing and reproduction, and it become possible to drive an OLED panel with its optimum wave form.

Author Interviews
18:00 – 19:00

Thursday, December 6

9:00 - 10:20 **Small Hall**

DES4: Display System Technology

Chair: H. Okumura, Toshiba, Japan
Co-Chair: S. Ono, Matsushita Elec. Ind., Japan

DES4 - 1: 9:00 ***Invited*** **RGW LED Backlighting System for Monochromatic Medical Imaging LCD Monitor**

K. Käläntär, M. Okada
Nippon Leiz, Japan

A backlight employing Red, Green, and Pseudo-white LEDs as light sources has been developed for monochromatic medical-imaging LCD monitor, characterized with clear base and blue base at the color temperatures of 7,500 K and 10,000 K, respectively. The power consumption of the monitor is about 36 W.

DES4 - 2: 9:20 ***Invited*** **Mobile Graphics and Display Architecture Renewal**

N. Suzuki, J. Ropo[*], S. Fujita[*], M. Salmela[*]
Nokia Japan, Japan
[*]Nokia, Finland

A requirement for mobile displays is drastically changed because of mobile phone market innovation. The value-added domain for the display is shifted from its performance metrics to whole handset enrichment. An ABC and a memory integration application are discussed as a mobile display architecture renewal toward the new value-added domain.

DES4 - 3
9:40

A 8ms Delay Image Transmission System and Its Applications

H. Chen, M. Nakao, M. Miyama[*]
Eizo Nanao, Japan
[*]*Kanazawa Univ., Japan*

Based on the real-time prototype proposed on SID2007, We've finished developing a real-time image transmission system. This system achieved low system delay(8msec) and high image quality for both desktop images and motion pictures. In this paper, we explained the whole system in details. And some possible application fields were introduced.

DES4 - 4
10:00

Overlapped RGB Emissions for Reducing Color Breakup and Motion Blur of Field Sequential Color LCDs

S. Shimizukawa, T. Shiga, S. Mikoshiba
Univ. of Electro-Commun., Japan

A method is proposed for field sequential color(FSC) LCDs, in which emission times of R, G, and B backlights partially overlap. This enables shortening of the total light emission time within a TV field, reducing color breakup and motion blur. For a sample image, color breakup of the conventional FSC-LCD was reduced to 63%, and motion blur to 61%.

10:40 - 11:40 **Mid-sized Hall A**

DES5: Late News Papers

Chair: Y. Kudo, Hitachi, Japan
Co-Chair: H. Sekiya, Tohoku Univ., Japan

DES5 - 1L
10:40

A Real-Time Liquid Crystal Signal Compensation Method for High Dynamic Range LCD

L.-Y. Liao, F.-C. Lin, Y.-P. Huang, H.-P. Shieh, S.-C. Yeh[*]
Nat. Chiao Tung Univ., Taiwan
[*]*AU Optronics, Taiwan*

Blur-mask approach was developed to simulate the backlight distribution of locally-controlled dimming LED backlight with lower computational complexity which is less than 1% of conventional convolution method. The blur-mask approach was demonstrated to perform high image quality and high contrast ratio (~20,000∶1) on a 37" LCD-TV. Compared with convolution, blur-mask approach has much lower computational complexity and successfully demonstrated for real-time applications.

DES5 - 2L 11:00 **Spatio-Chromatic Color Gamut Mapping for Wide-Color-Gamut Television**

H. Pan, S. Daly
Sharp Labs. of America, USA

Recent emerging wide-color-gamut TVs cause unnatural skin color rendering due to the stretching of the narrower color gamut of the contents. The stretching can make noise/artifacts hidden in the contents visible, and generate contouring artifacts. In this paper, we propose a color gamut mapping algorithm to address the above issues.

DES5 - 3L 11:20 **A Motion-Oblivious Algorithm for Reducing Motion Blur**

A. I. Russell
Texas Instrs., USA

A technique for reducing motion blur, by increasing the frame-rate of video is presented. It is cheaper to implement than motion-compensated techniques since no motion vectors are needed. The method attempts to temporally localize the sharp components of each input frame as much as possible, thus reducing perceived motion blur.

13:30 - 16:30 **Main Hall C**

Poster DESp: Display Electronic Systems

DESp - 1 **Dynamic Fuzzy Gamma Control (DFGC) with Color Correction**

C. P. Ku, M. T. Hsu, C. J. Shih, I.-C. Shih, M. S. Wu, C. F. Su
Chunghwa Picture Tubes, Taiwan

“Dynamic Fuzzy Gamma Control with Color Correction” method was proposed to enhance the image quality. This method utilizes the dynamic gamma control to increase image contrast. The technology was successfully implemented in a 7.0" TFT-LCD. As the results, the Fuzzy theory could be applied to dynamic gamma control to enhance the contrast ratio and image quality.

DESp - 2 **Modified Overlapped Block Motion Estimation Algorithm Using the Frame Difference**

T. I. Kwak, B. Y. Kim, H. H. Cho, J. H. Yun, S. J. Lee, M. R. Choi
Hanyang Univ., Korea

In this paper, we propose a modified overlapped block motion estimation (MOBME) algorithm for a Frame Rate up Conversion (FRC). Also, the proposed method performs Motion Estimation (ME) based on the Frame Difference (FD) between two sequential frames adaptively. We can classify calculated block as two by FD that detects boundary of motion objects. In experiments, the proposed algorithm shows better performance and lower complexity than conventional algorithms.

DESp - 3 **Skin Color Enhancment Using Saturation Extension**

K.-O. Yang, H.-H. Cho, J.-H. Yun, B.-H. Hwang, M.-R. Choi
Hanyang Univ., Korea

In this paper, we propose the skin color enhancement method that is classified with the skin color detection and the saturation extension method. The proposed method is focused on a preference color processing in order to generate better image quality than the method focused on a uniform one for human vision.

DESp - 4 **Efficient Deinterlacing Algorithm Using Directional Interpolation**

T.-W. Hou[*], H.-K. Ku[,**], K.-H. Sun[*,**], H.-S. Koo[***]*
[*]Nat. Cheng Kung Univ., Taiwan
[**]Fortune Inst. of Tech., Taiwan
[***]Minghsin Univ. of S&T, Taiwan

We propose a deinterlacing algorithm used for the interpolation of interlaced images. Our method efficiently estimate the directional spatial correlations of neighboring pixels. The results for a variety of images and video sequences demonstrate that our proposed algorithm can accomplish better quantitative and visual quality than the previous interpolation algorithms.

DESp - 5 **Experimental Study for the Generation of High Resolution Images Using Image Shifts**

T. Hashimoto, T. Ikuma, H. Okamura, A. Rövid, Y. Shimodaira
Shizuoka Univ., Japan

We propose the generation method of high resolution images using shifted images. Our method uses images that are taken with the high precision small shift. In order to improve the method, the influence of the camera noises was considered into the estimation equation.

DESp - 6 **A Novel X-Y Channel Dirve Method with Balanced Channel Current for LED Backlight System of LCD TV**

K. M. Cho, W. S. Oh, D. Y. Cho, G. W. Moon, B. C. Yang[*], T. S. Jang[*]
KAIST, Korea
[*]Samsung Elect., Korea

A novel X-Y channel driving method for LED backlight system is proposed. The proposed driving method has these merits such as a single input voltage source, good power saving effect and balanced channel current. Simulation and experimental results are demonstrated to verify the feasibility of the proposed driving method.

DESp - 7 **Optimized Dimming Algorithm for X-Y Channel Driving LED Backlight System in LCD TVs**

D. Y. Cho, W.-S. Oh, K.-M. Cho, G. W. Moon, B.-C. Yang[*], T.-S. Jang[*]
KAIST, Korea
[*]Samsung Elect., Korea

This paper proposes a novel RGB-LED backlight system, for 32" LCD TVs, accompanied by an optimized X-Y Channel driving method. This proposed driving method is able to reduce power consumption. Furthermore, the number of LED driver needed in this method, that is 3*(m+n), is much fewer than that of cluster driving method, that is 3*(m*n).

DESp - 8 **A 32-in. Field Sequential Color OCB LCD with Dynamic Backlight Technology**

C. C. Tsai, W. C. Tai, C. N. Mo, C. L. Liu
Chunghwa Picture Tubes, Taiwan

In this paper, a 32 color filter-less LCD TV with field sequential color technology has been designed and analyzed. Dynamic backlight method has also been applied in the FSC TV. This TV can offer luminance of 500 nits and its power consumption is about 12W to 65W.

DESp - 9 **Color-Filter Less RGB CCFL Backlight for Color Field-Sequential LCD**

C. P. Su, F. C. Lu, C.-C. J. Chen, W. C. Lin, C. L. Liu
Chunghwa Picture Tubes, Taiwan

Using higher frame rate RGB backlight module with FSC technique is suitable for large-area LCD-TV application. In this method the color-filter could be replace by red, green and blue color light pattern cooperating with adjacent liquid crystal (LC). Now, we develop a prototype 32-inch RGB CCFL backlight module with FSC.

DESp - 10 **A Single-Chip Driver for 2.4-in. Full-Color QVGA Passive-Matrix OLEDs**

Y.-S. Ahn, J.-P. Hong, N.-R. Hong, J.-H. Choi, H.-L. Kim, H.-K. Jeon, Y.-S. Son, H.-S. Oh, H.-S. Kim[*], D.-K. Han
Silicon Works, Korea
[*]LG Elect., Korea

A single-chip driver for 2.4-inch QVGA PMOLED display is presented. This chip consists of a scan driver, a data driver, a timing generation circuit, 3(R/G/B) reference current generators, and RGB interface circuit. The gray level is controlled by PWM of data currents. This chip is fabricated in a 0.35μm 18V CMOS process.

DESp - 11 **Thermal Estimation Using Adaptive Filtering Methodology for the Prediction of Case Temperature of the Components on System Board of TFT-LCD**

M. L. Tai
Chunghwa Picture Tubes, Taiwan

The conventional thermal estimation for the case temperature of components on system board will usually get the over-prediction results. In this paper, we will propose one optimal thermal estimation scheme. The simulation results show that the proposed estimation scheme can get better prediction, and it will overcome the over-prediction problems.

DESp - 12 **Y-Thin Block Improvement by the TFT-LCD Driving Signal Adjustment**

C. P. Long[*], M. Zhang[,**], Z. L. Peng[*]*
[*]Beijing BOE OptoElect. Tech., China
[**]Graduate Univ. of the Chinese Ac. of Sci., China

The pixel characteristics in the Y-thin block mura area were measured such as the gate line voltage V_{on} and V_{off}. Y-thin block mura is caused by low gate signal V_{gh}. V_{gh} is increased by adjusting the resistors on the PCB to reduce charging difference between mura area and normal area.

DESp - 13L **Simulation Design of High Brightness LED-based Backlight for Liquid Crystal Display in Monitors**

H.-S. Koo, C.-C. Peng, M.-C. Lin, E.-M. Liou, J. L. Sie
Minghsin Univ. of S&T, Taiwan

We demonstrate simulation design and optical characteristics of high brightness LED-based backlight for liquid crystal display in monitors. Optimization of simulation design in architecture and optical properties of high brightness LED-based backlight for liquid crystal display in monitors have been verified and demonstrated. This novel backlight system offers some advantages of high uniformity in light dispersion,, high efficiency in output light, high color gamut in chromatic distribution and low power consumption in operation.

Author Interviews
18:10 – 19:10

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Topical Session on Imaging and Photonic Devices

Wednesday, December 5

13:20 - 16:20 **Main Hall C**

Poster **IPDp: Imaging and Communication Devices**

IPDp - 1 **Electrochromic Devices Based on Nickel Oxyhydroxide Thin Film**

H. Ueta, Y. Abe, F. Peng, K. Kato, M. Kawamura, K. Sasaki, H. Itoh
Kitami Inst. of Tech., Japan

Nickel oxyhydroxide (NiOOH) thin films were prepared by reactive sputtering using an O_2 + H_2O mixed gas. A reflectance-type all-solid-state EC device with a multilayer structure of Al/WO_3/Ta_2O_5/NiOOH/ indium tin oxide (ITO)/glass was fabricated, and optical density change of 0.65 was obtained.

IPDp - 2 **Near-Infrared Electroluminescence of Thin-Film Waveguide ZnS:Cr Structures**

N. A. Vlasenko, P. F. Oleksenko, M. A. Mukhlyo, L. I. Veligura, Z. L. Denisova
Nat. AC. of Sci. of Ukraine, Ukraine

Cr^{2+} emission band narrowing has been first found in ZnS:Cr TFEL structures when the emission exits through the edge of the structure, which represent an optical planar waveguide. Narrowing augments with increasing voltage at the Cr concentration of $5{\cdot}10^{19}$ - $5{\cdot}10^{20}$ cm^{-3}. The results indicate that there is the optical amplification of the emission in the waveguide TFEL structures.

IPDp - 3 **Optimal Design of the Photonic Crystal Fiber by Means of the Genetic Algorithm and Three-Dimensional Finite-Difference Time-Domain Methods**

L.-D. Liao, P. C.-P. Chao[*]*, C.-W. Chiu*[*]
Nat. Cheng Kung Univ., Taiwan
[*]*Nat. Chiao Tung Univ., Taiwan*

No abstract was submitted.

IPDp - 4 **Self-Holding Optical Blocking Characteristics Using Smectic Liquid Crystal**

S. Noka, Y. Fujii, A. Kakuta, S. Kobayashi**
Photonic Sci. Tech., Japan
**Chitose Inst. of S&T, Japan*

Self-holding optical blocking characteristics are discussed using the test cell filled with the smectic liquid crystal(SLC). Extinction ratio over 30dB between “on” and “off” states was obtained in the nematic temperature range less than 2 degrees. Return loss over 40dB was measured with the optical blocker.

Friday, December 7

9:00 - 9:05 **Main Hall A**

Opening

Opening Remarks
9:00

S. Kobayashi, Chitose Inst. of S&T, Japan

9:05 - 10:45 **Main Hall A**

IPD1: Nonlinear Phenomena and Communication Devices

Chair: O. Karthaus, Chitose Inst. of S&T, Japan
Co-Chair: K. Sueoka, Hokkaido Univ., Japan

IPD1 - 1: ***Invited*** **Nonlinear Magneto-Optics and Application for**
9:05 **Magnetic Imaging**

Y. Kawabe
Chitose Inst. of S&T, Japan

Nonlinear magneto-optics is the nonlinear optics related to magnetic characteristics. In magnetic media, time-reversal symmetries and axial characteristics of physical quantities must be considered in the description of nonlinear optical phenomena. In this proceeding, the principle of nonlinear magneto-optics and its application to structural analysis and magnetic imaging are given.

IPD1 - 2 **Study of Supercontinuum Generation with Tapered**
9:25 **Photonic Crystal Fiber**

Y. Matsubara, Y. Fujii, N. Karasawa, S. Kobayashi*
Chitose Inst. of S&T, Japan
**Photonic Sci. Tech., Japan*

Super-continuum light with broadband spectrum was generated by femto second pulse injection into the microstructure fiber such as a photonic crystal fiber. In this study, we generated super-continuum light by injecting Ti-Sa laser pulses with 100fs width and 1kHz repetition rate at 795nm into the tapered PCFs.

IPD1 - 3
9:45

Optical Properties of Polysilane Optical Waveguides on Photobleaching Technology

T. Suda, H. Tsushima[*], S. Kobayashi[**]
Photonic Sci. Tech., Japan
[*]Nippon Paint, Japan
[**]Chitose Inst. of S&T, Japan

Polysilane optical waveguide splitters and Bragg grating filters are discussed. The loss of 1x8 splitter with UV lamp was less than 11.0dB, the loss of 1x4 splitter by the UV laser direct drawing was less than 9.0dB and the Bragg grating reflected signal bandwidth was 0.4nm measured at 1550nm.

IPD1 - 4
10:05

Waveguide Structure Effect for the C- and L-Band of Optical Directional Full Couplers

C.-F. Chen, Y.-S. Ku
Nat. Central Univ., Taiwan

The waveguide structure effect for the C- and L-band of optical directional full couplers weighted by Hamming function are numerically investigated. In the condition of -35 dB crosstalk, it is found that the coupler lengths for C-, L-, and C+L-band are 3.0, 2.6, and 3.6 mm, respectively. Obviously, such couplers have an advantage over conventional couplers for the demand of the suitable coupler length.

IPD1 - 5
10:25

A Novel Smectic Liquid Crystal Optical Attenuator for Optical Telecommunication

A. Kakuta, T. Ikeo, K. Fushimi, K. Hasuda[*], S. Noka[**], S. Kobayashi
Chitose Inst. of S&T, Japan
[*]Renesas Northern Japan Semiconductor, Japan
[**]Photonic Sci. Tech., Japan

A variable optical transmittance modulator using smectic liquid crystals was fabricated for application in a novel variable optical attenuator for telecommunications. New composites with a wide smectic temperature range were developed to fulfill practical thermal criteria. The device exhibited promising properties, such as a latching capability and excellent extinction ratios.

----- Break -----

11:00 - 12:20 **Main Hall A**

IPD2: New Imaging and Other Topics

Chair: S. Kobayashi, Chitose Inst. of S&T, Japan
Co-Chair: Y. Abe, Kitami Inst. of Tech., Japan

IPD2 - 1
11:00

Organic Nano- and Microstructures by a Simple Solvent Evaporation Process

O. Karthaus, Y. Hashimoto, T. Kabuto, K. Kai, K. Kon, S. Nagata, K. Tanaka, Y. Tsuriga, M. Wada
Chitose Inst. of S&T, Japan

A simple solution casting process is introduced allowing for non-lithographic micropatterning of functional low-molar-mass and polymeric materials. During solution evaporation, self-organized structures build up at the solution edge that result in the formation submicrometer-sized dot and stripe patterns. Pattern dimensions can be controlled by concentration, temperature and evaporation speed.

IPD2 - 2
11:20

Long-Wavelength Laser Pulses for Water-Surface Ranging

A. Okubo, Y. Yamabayashi
Chitose Inst. of S&T, Japan

Optical absorption spectrum 1.5 μm wavelength range showed greater loss of 13dB/cm than visible light. Ranging the bottom of water instead of the surface can be avoided by using laser within this wavelength range. An OTDR equipment at 1.55 μm was used to range a 4.6 m distant water-surface, successfully.

IPD2 - 3
11:40

Liquid Crystal Lens in Imaging System

M. Ye, B. Wang[*]*, S. Yanase, S. Sato*
Akita Pref. R&D Ctr., Japan
[*]*Akita Univ., Japan*

Liquid crystal (LC) lens used as an imaging device is reported. The optical properties of the LC lens are discussed. The LC lens together with a glass lens forms an imaging system, and it plays the role of focusing. Very sharp color images are obtained.

IPD2 - 4
12:00

Variations of Spatial-Angular Apodization Caused by the Failure Modes of LED

C. R. Ou, B.-Y. Huang, J.-M. Lee
Hsuiping Inst. of Tech., Taiwan

Failure modes of LED dies will degrade the source performance and leads to the non-uniformity in optical system. This report classified the failure modes into three geometric types, and the apodization effect for each mode is discussed.

IPD2 - 5L **Withdrawn**

Author Interviews
18:10 – 19:10

BANQUET

Wednesday, December 5
19:30–21:30
Palace Ballroom (3F)
Sheraton Sapporo Hotel

See page 10 for details

Fujioka Collection

The world most complete private CRT history collection, including World first Color CRT, World first Trinitron, Early Camera Tube, Early Color and Black & White Televisions, will be demonstrated with live picture at Exhibition.

Main Hall C
Sapporo Convention Center

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	T. Takeda	Nagase ChemteX
	J. S. Yu	LG Chem.
	C. C. Lee	ITRI

Workshop on CRTs

Workshop Chair:	H.-Y. Chen	Chunghwa Picture Tubes
Program Chair:	T. Saito	Tokyo Cathode Lab.
General Secretary:	S. Shirai	Hitachi Displays
Program Committee:	H. Nakanishi	
	Y. Wada	MT Picture Display Co.,Ltd
	T. Sugawara	
	H. Kume	
	J. Henrichs	LP Displays
	K. Son	LP Displays
	C. C. Chao	Chunghwa Picture Tubes
	M. Bae	Samsung SDI

Workshop on Plasma Displays

Workshop Chair:	K. Nunomura	Pioneer
Program Chair:	H. Oaku	Hitachi
General Secretary:	H. Kajiyama	Hiroshima Univ.
Program Committee:	N. Oota	DAP Tech.
	R. Murai	Matsushita Elec. Ind.
	T. Shinoda	Shinoda Plasma/Hiroshima Univ.
	Y. Nakao	Asahi Glass
	S. Mikoshiba	Univ. of Electro-Commun.
	K. Igarashi	Univ. of Electro-Commun.
	M. Uchidoi	Pioneer
	Y. Murakami	NHK
	S. Sakamoto	Noritake Kizai
	Y. Hashimoto	Hitachi

Workshop on EL Displays and Phosphors

Workshop Chair:	Y. Nakanishi	Shizuoka Univ.
Program Chair:	N. Miura	Meiji Univ.
General Secretary:	T. Hisamune	Kasei Optonix
Program Committee:	H. Yamamoto	Tokyo Univ. of Tech.
	H. Kobayashi	Tottori Univ.
	M. Shiiki	Hitachi
	K. Kondo	Stanley
	T. Minami	Kanazawa Inst. of Tech.
	S. Itoh	Futaba

	K. Ohmi	Tottori Univ.
	S. Okamoto	NHK
	M. Sumitomo	Nichia Chem. Ind.
	M. Katayama	Denso
	N. Matsuda	Toshiba
	M. Niboshi	Sharp
	K. Wani	iFire Tech.

Workshop on Field Emission Display

Workshop Chair:	M. Takai	Osaka Univ.
Program Chair:	H. Mimura	Shizuoka Univ.
General Secretary:	N. Egami	NHK
Program Committee:	J. Ishikawa	Kyoto Univ.
	T. Asano	Kyushu Univ.
	M. Nakamoto	Shizuoka Univ.
	Y. Iguchi	FE Tech.
	S. Okuda	Mitsubishi Elec.
	M. Suzuki	Hitachi
	S. Uemura	Noritake
	J.-M. Kim	Samsung AIT

Workshop on Organic LED Displays

Workshop Chair:	Y. Sato	JST
Program Chair:	T. Inoue	TDK
General Secretary:	S. Naka	Univ. of Toyama
Program Committee:	C. Adachi	Kyushu Univ.
	Y. Fukuda	Pioneer
	K. Fukuoka	Idemitsu Kosan
	R. Hattori	Kyushu Univ.
	J. Kido	Yamagata Univ.
	Y. Kijima	Sony
	H. Kobayashi	Seiko Epson
	A. Mikami	Kanazawa Inst. of Tech.
	H. Miyazaki	Nippon Steel chem.
	K. Nakayama	Yamagata Univ.
	S. Tokito	NHK
	T. Tsutsui	Kyushu Univ.
	T. Wakimoto	Merck

Workshop on 3D/Hyper-Realistic Displays and Systems

Workshop Chair:	I. Yuyama	Utsunomiya Univ.
Program Chair:	M. Hashimoto	NTT Data
General Secretary:	S. Yano	NHK
Program Committee:	K. Mashitani	Sanyo Elec.
	Y. Komiya	Olympus
	T. Fujii	Nagoya Univ.
	C.-H. Tsai	ITRI
	T. Mishina	NiCT
	N. Nishida	Univ. of Tokushima
	S. Ohtsuka	Kagoshima Univ.
	J.-Y. Son	Daegu Univ.
	H. Takemura	Osaka Univ.
	T. Yoshida	Toppan Printing

Workshop on Applied Vision and Human Factors

Workshop Chair:	Y. Shimodaira	Shizuoka Univ.
Program Chair:	N. Hiruma	NHK
General Secretary:	J. Someya	Mitsubishi Elec.
Program Committee:	H. Isono	Nippon Inst. of Tech.
	T. Tamura	Tokyo Polytech. Univ
	T. Kurita	NHK

	J. Bergquist	Nokia Japan
	S. Clippingdale	NHK
	M. Idesawa	Univ. of Electro-Comm.
	S. Kubota	Seikei Univ.
	T. Mitsuhashi	Shobi Univ.
	T. Wake	Chukyo Univ.
	R. Yoshitake	IBM Japan
	T. Matsumoto	Sony

Workshop on Projection and Large-Area Displays, and Their Components

Workshop Chair:	Z. Tajima	Mobara Atecs
Program Chair:	T. Hayashi	3M, Asia Pacific
Program Vice-Chair:	H. Kikuchi	NHK
	S. Shikama	Mitsubishi Elec.
General Secretary:	M. Takaso	Techno Syss. Res.
Program Committee:	Y. Hayashi	Sony
	S. Koike	Seiko Epson
	T. Yoshida	Toppan Printing
	H. Nakano	Barco
	T. Ogura	Matsushita Elec. Ind.
	K. Ohara	Texas Instrs. Japan
	S. Ouchi	Hitachi
	T. Suzuki	Victor Company of Japan
	K. Takeda	Seiko Epson
	H. Kanayama	Sanyo Elec.
	Y. Asakura	Nittoh Kogaku
	Y. Masumoto	Matsushita Elec. Ind.
	T. Habu	Ushio

Workshop on Electronic Paper

Workshop Chair:	M. Omodani	Tokai Univ.
Program Chair:	Y. Toko	Stanley Elec.
General Secretary:	H. Arisawa	Fuji Xerox
Program Committee:	A. Suzuki	Ricoh
	S. Maeda	Oji Paper
	Y. Hotta	Ricoh
	T. Fujisawa	Dainippon Ink & Chem.
	H. Kawai	Seiko Epson
	G. F. Zhou	Philips Res. Labs.

Workshop on MEMS for Future Displays and Related Electron Devices

Workshop Chair:	M. Nakamoto	Shizuoka Univ.
Program Chair:	S. Uchikoga	Toshiba
General Secretary:	T. Komoda	Matsushita Elec. Works
Program Committee:	H. Fujita	Univ. of Tokyo
	M. Esashi	Tohoku Univ.
	S. Sugiyama	Ritsumeikan Univ.
	H. Kikuchi	NHK
	Y. Yoshida	Mitsubishi Elec.
	K. Matsumoto	Olympus
	T. Ooasa	Tokyo Electron
	H. L. Tuller	MIT
	G. Barbastathis	MIT
	T. Akinwande	MIT
	W. I. Milne	Cambridge Univ.
	J. Jang	Kyung Hee Univ.
	J. M. Kim	Samsung

Workshop on Display Electronic Systems

Workshop Chair:	H. Okumura	Toshiba
Program Chair:	K. Sekiya	Tohoku Univ.
General Secretary:	Y. Kudo	Hitachi
Vice Program Chair:	K. Käläntär	Nippon Leiz
Program Committee:	A. Nagase	Mitsubishi Elec.
	N. Suzuki	Nokia Japan
	T. Yamamoto	NHK
	K. Takeuchi	Univ. of Electro-Commun.
	O.-K. Kwon	Hanyang Univ.
	H.-S. Koo	Minghsin Univ. of S&T
	M. A. Klompenhouwer	Philips Res. Labs.
	T. Kim	Marvell Semiconductor
	H. Sasaki	Toshiba

Topical Session on Imaging and Photonic Devices

Session Chair:	S. Kobayashi	Chitose Inst. of S&T
Program Chair:	T. Mishima	Hokkaido Univ.
General Secretary:	K. Sueoka	Hokkaido Univ.
Program Committee:	A. Kakuta	Chitose Inst. of S&T

FINANCIAL SUPPORTING ORGANIZATIONS
(as of October 31, 2007)

ADEKA CORPORATION
ASAHI GLASS CO., LTD.
AZ Electronic Materials (Japan) K.K.
CASIO COMPUTER CO., LTD.
Chisso Corporation
Corning Japan K.K.
Dai Nippon Printing Co., Ltd.
EIZO NANAO CORPORATION
FUJIFILM Corporation
Futaba Corporation
Hitachi, Ltd.
Hitachi Displays, Ltd.
JSR Corporation
KASEI OPTONIX, LTD.
Matsushita Electric Industrial Co., Ltd.
Merck Ltd., Japan
MITSUBISHI ELECTRIC CORPORATION LCD DIVISION
MITSUI ENGINEERING & SHIPBUILDING CO., LTD.
NEC LCD Technologies, Ltd.
NICHIA CORPORATION
NORITAKE ITRON CORPORATION
NTT IT CORPORATION
OTSUKA ELECTRONICS CO., LTD.
PIONEER CORPORATION
SED Inc.
Seiko Instruments Inc.
SEMI Japan
SHARP CORPORATION
Sony Corporation
Sumitomo Chemical Co., Ltd. Tsukuba Research Laboratory
TOKYO CATHODE LABORATORY CO., LTD.
TOKYO OHKA KOGYO CO., LTD.
TOPPAN PRINTING CO., LTD.

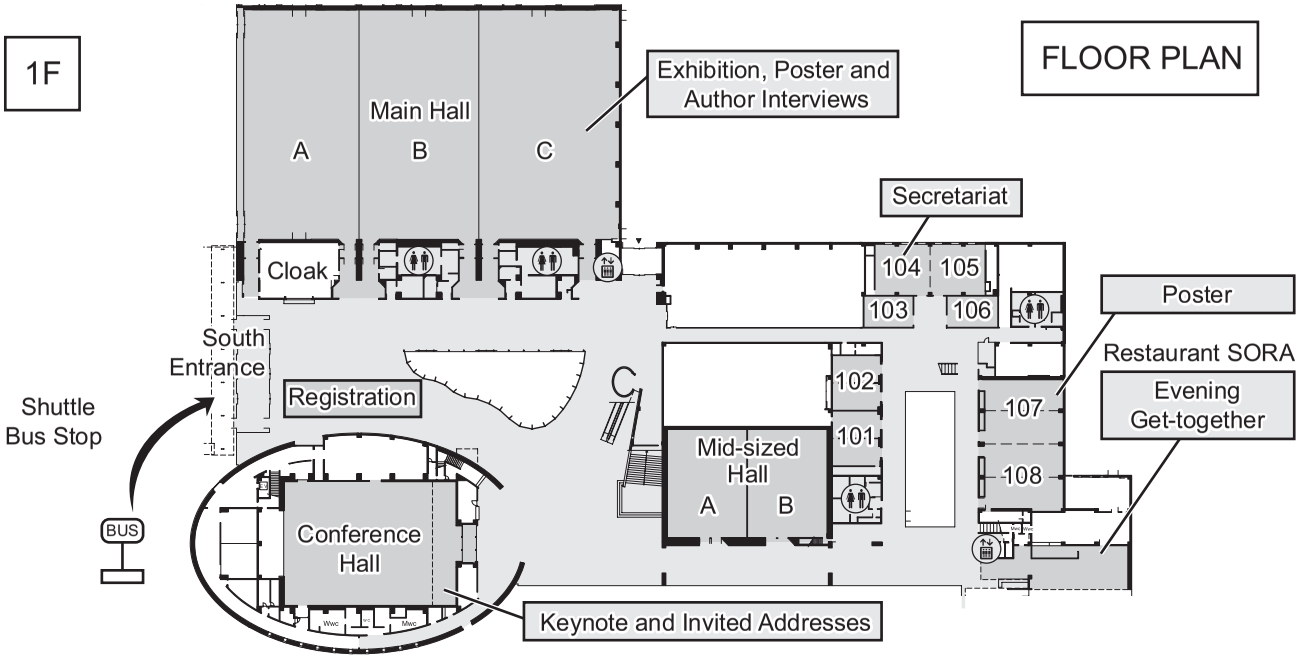
TOSHIBA CORPORATION
Toshiba Matsushita Display Technology Co., Ltd.
TOYO Corporation
Ube Material Industries, Ltd.
ULVAC, Inc.
ZEON CORPORATION

IDW '07 SECRETARIAT

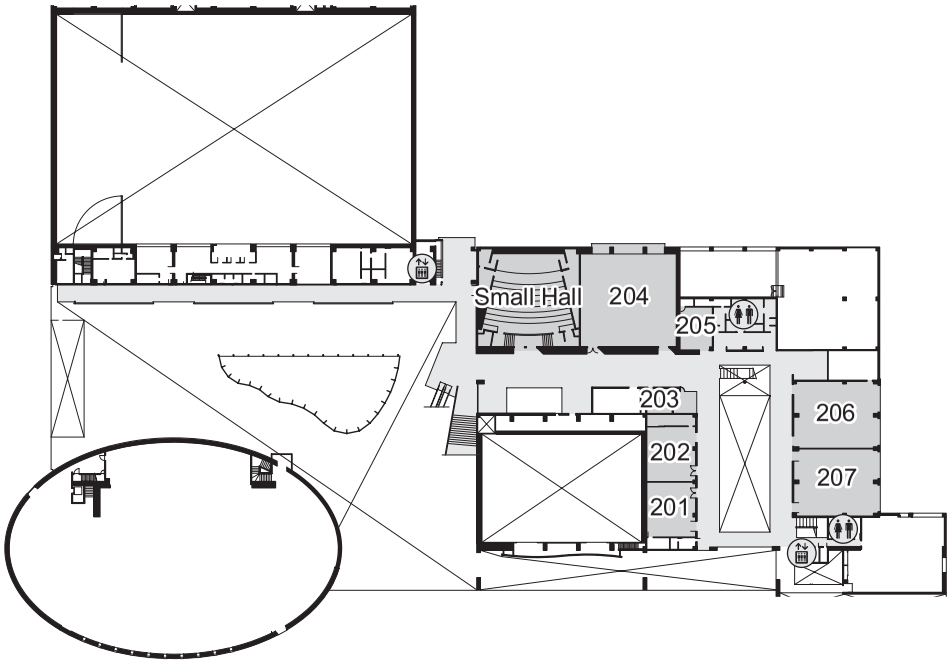
c/o ABEISM CORPORATION
4-30-12 Kamimeguro, Meguro-ku
Tokyo 153-8571, Japan

List of Exhibitors (as of October 31, 2007)

ASTRODESIGN, Inc.
Electronic Devices Lab., University of Toyama
Field Emission Technologies, Inc.
FURUYA METAL CO., LTD.
Grand Seiko Co., Ltd.
HORIBA, Ltd.
Jedat Inc.
Keisoku Giken Co., Ltd.
Kitami Institute of Technology
Kitamura Lab., Chiba University
KONICA MINOLTA SENSING, INC.
MEIRYO TECHNICA CORPORATION
Mutsu Lab./Ryukoku Extension Center, Ryukoku University
MATSUBO Corporation
Nakamoto Lab., Research Institute of Electronics, Shizuoka University
NIPPON FILCON Co., Ltd.
Nissho Electronics Co.
Omodani Lab., Tokai University
OPTO DESIGN, INC.
OPTO SCIENCE, INC.
OTSUKA ELECTRONICS CO., LTD.
Photonics World Consortium
RSoft Design Group Japan K.K.
Ritsumeikan University
Saito Lab., Nagoya University
SANAYI System Co., Ltd.
SHIMADZU CORPORATION
SHINTECH, Inc.
SILVACO Japan Co., Ltd.
TIPs Lab., The University of Tokushima
Toray Research Center, Inc.
TOYO Corporation
University of Hyogo
Xilinx Japan, Co.
Yamaguchi Industrial Promotion Foundation
ZEON CORPORATION


1F
FLOOR PLAN
Main Hall
A
B
C
Exhibition, Poster and Author Interviews
Secretariat
Cloak
104
105
103
106
Poster
Restaurant SORA
Evening Get-together
South Entrance
Shuttle Bus Stop
Registration
C
102
101
107
108
Mid-sized Hall
A
B
BUS
Conference Hall
Keynote and Invited Addresses

2F



BANQUET

Wednesday, December 5
19:30–21:30
Palace Ballroom (3F)
Sheraton Sapporo Hotel

See page 10 for details

IDW Best Paper Award

This new award will go to the most outstanding paper selected from those presented at IDW '07. The 2007 award winners will be announced on the IDW web site:
http://www.idw.ne.jp/award.html

IDW Outstanding Poster Paper Award

The 2007 award winners will be announced on the IDW web site:
http://www.idw.ne.jp/award.html

IDW '07 Timetable

Date	Lobby	Conference Hall	Main Hall A	Main Hall B	Mid-sized Hall A	Mid-sized Hall B	Small Hall	Room 107, 108	Main Hall C	
Tues., Dec. 4	Registration 17:30-20:00	Evening Get-Together at Restaurant "Sora" 18:00-20:00								
Wednesday, December 5	Registration 8:30-18:00	Opening, Keynote 9:00-10:30								
		Break								
		Invited Address 10:40-11:50								
		Lunch								
		LCT1 13:20-14:45	AMD1 13:20-14:35	FMC1 13:20-14:40	OLED1 13:20-14:30	EP1 13:20-14:30	DES1 13:20-14:45		CRTp PDPp1, IPDp 13:20-16:20	Exhibition 13:00-17:00
		Break								
		LCT2 15:00-16:25	AMD2 15:00-16:20	FMC2 15:00-16:20	OLED2 14:50-16:20	EP2 15:00-16:15	DES2 15:00-16:20			
		Break								
		LCT3 16:40-18:00	AMD3 16:30-18:00	FMC3 16:40-18:00	OLED3 16:30-18:00	EP3 16:40-18:00	DES3 16:30-18:10			
									Author Interviews 18:00-19:00	
		Break								
		Banquet in Sheraton Sapporo Hotel 19:30-21:30								
Thursday, December 6	Registration 8:30-18:00	LCT4 9:00-10:10	AMD4/OLED4 9:00-10:30	MEMS1 9:00-10:15	EP4 9:00-10:15	VHF1 9:00-10:40	DES4 9:00-10:20	FMCp 9:00-12:00	PDPp2, PHp 9:00-12:00	Exhibition 9:00-17:00
		Break								
		LCT5 10:40-12:05	AMD5 10:50-12:10	MEMS2 10:35-12:20	DES5 10:40-11:40	VHF2 11:00-12:10	CRT1 10:40-12:00			
		Lunch								
			AMD6 13:30-14:55	MEMS3 13:55-15:20	PDP1 13:30-14:50	PH1 13:30-14:50	CRT2 13:30-14:40		OLEDp, 3Dp, VHFp, LADp, EPp, DESp, 13:30-16:30	
		Break								
		LCT6 15:10-16:35	AMD7 15:10-16:35	MEMS4 15:40-16:45	PDP2 15:10-16:40	PH2 15:10-16:30	CRT3 15:10-16:20			
		Break								
		LCT7 16:45-18:10	AMD8 16:45-18:10	MEMS5 17:05-18:10	PDP3 16:50-18:10	3D1 16:50-18:05	CRT4 16:30-18:00			
									Author Interviews 18:10-19:10	
Friday, December 7	Registration 8:30-15:00	LAD1 9:00-10:20	IPD1 9:00-10:45	FMC4 9:00-10:00		PH3 9:00-10:10	FED1 9:00-10:20	AMDp 9:00-12:00	LCTp 9:00-12:00	Exhibition 9:00-14:00
		Break								
		LAD2 10:40-12:30	IPD2 11:00-12:20	FMC5 10:40-12:15	VHF3 10:40-12:10	PH4 10:40-12:10	FED2 10:40-12:30			
		Lunch								
			AMD9 13:30-14:55	FMC6 13:30-14:50	VHF4 13:30-14:55	3D2 13:30-15:00	FED3 13:30-14:50			
		Break								
		LCT8 15:10-16:35	PDP4 15:10-16:30	FMC7 15:10-16:30	VHF5 15:10-16:30	3D3 15:10-16:20	FED4 15:10-16:30			
		Break								
		LCT9 16:50-17:50	PDP5 16:50-18:10	FMC8 16:50-17:50	VHF6 16:50-17:45	3D4 16:50-18:10	FED5 16:50-17:10			
									Author Interviews 18:10-19:10	

IDW '07 Session Navigator

	Location	Wednesday, Dec. 5					Thursday, Dec. 6						Friday, Dec. 7					
		9:00-11:50	PM			18:00-19:00	AM		PM			18:10-19:10	AM		PM			18:10-19:10
Keynote & Invite	Conference Hall	Opening Keynote & Invite Add.																
LCT	Conference Hall		Fast Response LCDs (1)	Display Measurement	High Performance LCDs		New Materials	Alignment Process (1)		Alignment Process (2)	Novel LCD Modes					Fast Response LCDs (2)	Transflective LCDs	
	Main Hall C					A.I.						A.I.	Posters					A.I.
AMD	Main Hall A		TV Application-LCD vs. OLED-	LCD Application	Novel Application		*Organic TFT & OLED	Organic TFT	poly-Si TFT	Crystallization	SOG & μc-Si TFT				Oxide-Semiconductor TFT			
	Room 107, 108												Posters					
	Main Hall C					A.I.						A.I.						A.I.
FMC	Main Hall B		Manufacturing Tech. (1)	Manufacturing Tech. (2)	Manufacturing Tech. (3)								Color Filters	Materials	Optical Films	Backlight Systems (1)	Backlight Systems (2)	
	Room 107, 108						Posters											
	Main Hall C					A.I.												A.I.
CRT	Small Hall							History & Future of CRT	CRT Deflection Sys.	Super Slim CRT	CRT Tech.							
	Main Hall C		Posters									A.I.						
PDP	Mid-sized Hall A								Protective Layer (1)	Protective Layer (2)	Cell Tech.							
	Main Hall A															Driving Tech.	PDP TV	
	Main Hall C		Posters				Posters					A.I.						A.I.
PH	Mid-sized Hall B								Phos. for FEDs, LEDs & Lighting	Phos. for EL			Synthesis & Theory of Phos.	Phos. for PDPs				
	Main Hall C						Posters					A.I.						A.I.
FED	Small Hall												FEDs & Novel Devices	CNT Emitters for FEDs (1)	CNT Emitters for FEDs (2)	FE Materials & Structures	FE Materials & Devices	
	Main Hall C																	A.I.
OLED	Mid-sized Hall A		Display	Process	Material													
	Main Hall A						*Organic TFT & OLED											
	Main Hall C					A.I.			Posters			A.I.						
3D	Mid-sized Hall B										Hyper Real. Disp. & Acqui. Sys.				3D Display	Holography	Human Factor & 3D Display	
	Main Hall C								Posters			A.I.						A.I.
VHF	Mid-sized Hall A													Display Image Quality	Moving Image Quality	Color	Display Characteristics & Vision	
	Mid-sized Hall B						Motion Blur	Color Breakup										
	Main Hall C								Posters			A.I.						A.I.
LAD	Conference Hall												Projection Comp. & Sys.	Solid State Lightsources				
	Main Hall C								Posters									A.I.
EP	Mid-sized Hall A						Electronic Paper (4)											
	Mid-sized Hall B		Electronic Paper (1)	Electronic Paper (2)	Electronic Paper (3)													
	Main Hall C					A.I.			Posters			A.I.						
MEMS	Main Hall B						Displays & Imaging (1)	Displays & Imaging (2)	Emerging MEMS Tech.	Optical MEMS Devices	Mech. Mater. & Process Tech.							
	Main Hall C											A.I.						
DES	Small Hall		High Dynamic Range Display	High Quality Image Processing	Novel Driver Application		Display System Tech.											
	Mid-sized Hall A							Late News Papers										
	Main Hall C					A.I.			Posters			A.I.						
IPD	Main Hall A												Nonlinear Phenom. & Commun. Dev.	New Imaging & Other Topics				
	Main Hall C		Posters															A.I.

LCT: Workshop on LC Science & Technologies
AMD: Workshop on Active Matrix Displays
FMC: Workshop on FPD Manufacturing, Materials & Components
CRT: Workshop on CRTs
PDP: Workshop on Plasma Displays
PH: Workshop on EL Displays & Phosphors
FED: Workshop on Field Emission Display
OLED: Workshop on Organic LED Displays
3D: Workshop on 3D/Hyper-Realistic Displays & Systems
VHF: Workshop on Applied Vision & Human Factors
LAD: Wokshop on Projection & Large-Area Displays, & Their Components
EP: Workshop on Electronic Paper
MEMS: Workshop on MEMS for Future Displays & Related Electron Divices
DES: Workshop on Display Electronic Systems
IPD: Topical Session on Imaging & Photonic Devices
A.I.: Author Interviews
*: Joint Session

IDW ’07 Secretariat:
c/o ABEISM CORPORATION
4-30-12 Kamimeguro, Meguro-ku
Tokyo 153-8571, Japan

IDW ’07
FINAL PROGRAM