



IDW '08

THE 15TH INTERNATIONAL DISPLAY WORKSHOPS

Workshops on

- LC Science and Technologies
- Active Matrix Displays
- FPD Manufacturing, Materials and Components
- Plasma Displays
- EL Displays and Phosphors
- Field Emission Display and CRT
- 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 Sessions on

- Display Technologies for Professional Use
- Flexible Displays

Final Program

***Toki Messe Niigata Convention Center
Niigata, Japan
December 3(Wed) – 5(Fri), 2008***

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IDW '08 Timetable

IDW '08 Session Navigator

PROGRAM HIGHLIGHTS

Scientific and technological advances in research and development on information displays will be found at the 15th International Display Workshops (IDW '08). A feature of the IDW '08 is an integration of the following thirteen workshops. In addition, two topical sessions will focus on the recent progress of flexible displays and professional use of information displays.

Workshops on

- LC Science and Technologies
- Active Matrix Displays
- FPD Manufacturing, Materials and Components
- Plasma Displays
- EL Displays and Phosphors
- Field Emission Display and CRT
- 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 Sessions on

- Display Technologies for Professional Use
- Flexible Displays

The three-day conference will feature 577 papers, including 2 keynote addresses, 1 invited address, 84 invited papers, 190 oral and 300 poster presentations will be arranged. Following keynote and invited addresses in the Wednesday morning, presentations will begin and continue in seven parallel sessions through Friday. Poster sessions and author interviews will enable participants to discuss presented issues in detail. IDW '08 will present "IDW Best Paper" awards and "IDW Outstanding Poster Paper" awards based on their originalities and technical significance to information displays. Exhibitions from display and related industries will also be featured from Wednesday to Friday in parallel with workshops. The IDW '08 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, fast-response LCDs and high performance LCDs are discussed. Special two sessions on advanced LC materials and LCDs are also included as 15th IDW anniversary.

Workshop on Active Matrix Displays (AMD)

Full of opportunities to stimulate your intellectual curiosity with interesting invited talks and contributed papers, this workshop covers various applications such as LCD and OLED for TV, and novel applications, etc. It also features TFT technologies including organic TFT, poly-Si TFT, crystallization, SOG, $\mu\text{c-Si}$ TFT, and oxide-semiconductor TFT, etc. Come and join us in a discussion of the latest progress in active matrix displays and TFT technologies.

Workshop on FPD Manufacturing, Materials and Components (FMC)

This workshop deals with the recent developments and achievements in FPDs. The cutting-edge technologies of the optical films and color filters, LCD backlighting systems, optical components, manufacturing technologies, and measurement systems are highlighted.

Workshop on Plasma Displays (PDP)

The PDP Workshop introduces over 50 excellent papers. It should be noted that 1/3 of these papers are related to a protecting layer and exoelectron emission from the layer. Although the retail prices of PDP-TVs and LCD-TVs are similar, the number of components used in the PDP modules is an order of magnitude smaller than that used in the LCD modules, suggesting a possibility of a lot cheaper PDP-TVs in future. We have several papers introducing new fabrication technologies. One of the papers randomly selected as a possible topic of this year is a 1m x 3m curved plasma tube array (PTA). During the "Green" G8 Summit of last July held in Japan, the PTA was picked up as an official display device due to its low power consumption. The second random selection is a full-color PDP which is transparent when not in use. Although the technology is still premature, it may bring a bright future of PDPs.

Workshop on EL Displays and Phosphors (PH)

This workshop covers the latest R&D achievements in inorganic ELDs, phosphors for emissive displays and solid-state illumination as well as LEDs. The workshop consists of invited talks, contributed papers and poster papers. These will present phosphors for LEDs, PDPs, ELDs, FEDs, CCFLs and computational approaches for phosphors including interesting topics such as luminescent mechanism and synthesis techniques for phosphors.

Workshop on Field Emission Display and CRT (FED)

This workshop covers the entire field of CRT and field emission display technologies. Recent progress in various field emission displays equipped with carbon nanotube (CNT) field emitter arrays are presented. Field emission characteristics of high-efficiency electron devices (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, display systems and evaluation methods. OLED technologies based on new full-color patterning methods are reported on, technologies facilitating the use of OLED in mobile and TV applications. Device architecture for highly efficient emissions and novel materials supporting these device technologies are also presented.

Workshop on 3D/Hyper-Realistic Displays and Systems (3D)

This workshop focuses on recent progress in 3D, hyper-realistic image system and related visual sciences. It also covers 3D acquisition, measurement, standardization, holography, high-fidelity color reproduction. Invited talks in this workshop include topics from the forefront of 3D imaging technologies, and recent research into advanced display systems.

Workshop on Applied Vision and Human Factors (VHF)

This workshop provides a forum for discussing the latest industrial and academic R&D in the field of applied vision and human factors associated with display technology. These include methods for improved color reproduction, contrast enhancement and the assessment and improve-

ment of the perceived quality of images. The workshop constitutes a unique opportunity to interact with world-renowned experts in the field and discuss the latest advances with them.

Workshop on Projection and Large-Area Displays, and Their Components (LAD)

The hottest technologies for projection displays worldwide will make this workshop exciting. Emerging technologies such as embedded and small projectors with LED and lasers will be highlighted. Ongoing progress in the fields of 3D digital cinema, light sources, light valves, screens and optical systems will be discussed as well.

Workshop on Electronic Paper (EP)

This workshop focuses on current topics in electronic paper including rewritable paper, paper-like displays, and flexible displays. Various novel technologies in electrophoretic, liquid crystal, and toner display systems will be reported on. Systems, devices, materials, human factors, 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 horizons of display technologies into MEMS technologies. Among all the MEMS and display conferences in the world, this is the only opportunity for MEMS researchers to gather and discuss such devices. Research areas such as materials, basic physics and fabrication process are included. Authorities in this field are invited from top research institutions around the world. Invited speakers are from Ecole Polytech., Fraunhofer IPMS, Miradia, Panasonic Elec. Works, Pixtronix, Tohoku Univ., Univ. of Tokyo, and Waseda Univ. Together with excellent contributed papers, this workshop invites participants who wish to open a new field of displays and imaging devices.

Workshop on Display Electronic Systems (DES)

This workshop covers all aspects of display systems in relation to electronics of video data processing, interface technologies, cooperative operations between display components such as cells and backlights, in combinations with other input/output devices, applications to the new arena. In addition, the systems for a wide and high dynamic range of color reproduction, and high-fidelity systems for professional use, and exploration of future standards such as post-HDTV are specially focused.

Topical Session on Display Technologies for Professional Use (DPU)

As the FPDs are rapidly replacing the CRTs, some inconsistency/discontinuity with the existing technologies become apparent as the intrinsic problems on FPDs especially in the professional usages that require high fidelity of color reproduction and image representation. At the same time the FPDs are proliferating to new fields that also require similar characteristics. Though those movements have arisen independently, we must have answers to all. In this session, we will see what are happening in the fields of broadcasts and medical areas and have an opportunity to think what we should do for the future.

Topical Session on Flexible Displays (FLX)

Recently, there is increased attention on the flexible display technologies. The technologies are spread in a wide range of fields from material science to a practical panel. Selected papers from workshops, such as EP, AMD, FMC, LCT and OLED, are gathered in one room to wel-

come dedicated researchers in this field. These hottest sessions will cover all aspects of flexible display technologies including electronic paper, organic TFT, plastic substrate, encapsulation process, analysis of the device performance, flexible LC panel.

IDW Best Paper Award and IDW Outstanding Poster Paper Award

IDW will present “IDW Best Paper” and “IDW Outstanding Poster Paper” awards. The awards committee of IDW will select the most outstanding papers from those presented at IDW '08. The award winners will be announced on the IDW website and given a plaque after the conference.

Exhibition

The IDW '08 Exhibition, which will be held from December 3 through December 5, covers materials, components, manufacturing and measuring equipment, software systems and other related products for display devices. Please join-in and enjoy discussions at exhibitors' booths.

December 3: 12:00 – 18:00

December 4: 10:00 – 18:00

December 5: 10:00 – 14:00

EVENING GET-TOGETHER WITH WINE

Tuesday, December 2, 2008

18:00–20:00

Room “Houou” (30F)

Hotel Nikko Niigata

(Sponsored by Merck Ltd., Japan)

See page 9 for details

IDW '09

The 16th International Display Workshops

December 9-11, 2009

World Convention Center Summit

Phoenix Seagaia Resort

Miyazaki, Japan

<http://www.idw.ne.jp/>

GENERAL INFORMATION

SPONSORSHIP

IDW '08 is sponsored by the Institute of Image Information and Television Engineers (ITE) and the Society for Information Display (SID).

CONFERENCE SITE

Toki Messe Niigata Convention Center
6-1, Bandaijima, Niigata, Niigata 950-0078, Japan

ON-SITE SECRETARIAT

Telephone and fax machines for IDW '08 use will be temporarily set up in the secretariat room (203) at Toki Messe Niigata Convention Center (December 2-5).

Phone: +81-25-246-8530

Fax: +81-25-246-8540

BANQUET

A buffet-style banquet will be held on December 3 from 19:30 to 21:30 in the Continental Room (4F) of Hotel Okura Niigata. As the number of tickets is limited, you are urged to make an advance reservation through the website or by completing the enclosed registration form.

A free chartered-bus from the Conference site to the Banquet site will be offered by the Organizing Committee.

EVENING GET-TOGETHER WITH WINE

A get-together will be held on December 2 from 18:00 to 20:00 in the Houou Room (30F) of Hotel Nikko Niigata. 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, on-site registrants may not be able to obtain a copy of the proceedings, if there is an unexpectedly large number of on-site registrations. Advance registration is strongly recommended.

Registration Fees

The registration fee for IDW '08 includes admission to the conference, a copy of the proceedings (in book format or on a USB flash drive), and CD-ROM. The proceedings on USB flash drive can be selected only by those who have registered and paid by November 7 (Japan Standard Time).

	Paid by Nov. 7	After Nov. 7
Member of ITE/SID/ASO*	¥ 30,000	¥ 40,000
Non-Member**	¥ 40,000	¥ 50,000
Student***	¥ 8,000	¥ 10,000
Life Member of ITE/SID	¥ 8,000	¥ 10,000
Banquet	¥ 8,000	¥ 10,000

*ASO: Academic Supporting Organizations

(See p. 11 as well as "Supporting Organizations and Sponsors" at the end of each workshop section.)

**Non-Member: If you intend to join either ITE or SID, the membership fee will be subsidized by IDW '08 committee.

See <http://www.idw.ne.jp/> for more information.

***Student ID is required.

Please note that the reduced registration fee must be paid by November 7. The full fee will be charged for payments made later than November 7 even if you send the registration form by this date. Also note that *the number of banquet tickets to register on site is limited.*

For additional sets of the proceedings (book or USB flash drive*) 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 flash drive and CD-ROM can be selected only by those applying with payment by November 7.

Payment

Three ways are provided for registration.

(1) e-Registration

Access the following URL.

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

e-Registration will be accepted until November 21, 2008.

(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, 2008.

IDW '08 Secretariat

c/o Bilingual Group Ltd.

3-3-6 Kudan Minami, Chiyoda-ku Tokyo 102-0074, Japan

Phone: +81-3-3263-1345 Fax: +81-3-3263-1264

E-mail: idw@bilingualgroup.co.jp

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

1. Credit Card (VISA, Master, Diners, AMEX, JCB, UC and CF accepted.)
2. Bank Transfer to:

Bank: Bank of Tokyo-Mitsubishi UFJ
(Swift Code: BOTKJPJT)

Branch: Ichigaya Branch (Branch No. 14)

Account No.: 1474095 (Ordinary Account)

Account: IDW 2008

Please attach a copy of the bank receipt with the registration form to avoid any confusion.

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 2 (Tue.) 17:00 – 20:00

December 3 (Wed.) 8:00 – 18:00

December 4 (Thu.) 8:00 – 18:00

December 5 (Fri.) 8:00 – 15:00

The on-site registration fee will be payable by:

1. Cash (JAPANESE YEN only)
2. Credit Card (VISA, Master, Diners, AMEX, JCB, UC and CF accepted.)

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 upon receipt by IDW '08 secretariat of written cancellation, by **November 7**. For cancellations received after November 7 or no-shows, refunds will not be made. However, after IDW '08 closes, a set of the proceedings book/USB flash drive and CD-ROM will be sent to the registrants who have paid the registration fees.

INQUIRIES

IDW '08 Secretariat

c/o Bilingual Group Ltd.

3-3-6 Kudan Minami, Chiyoda-ku Tokyo 102-0074, Japan

Phone: +81-3-3263-1345 Fax: +81-3-3263-1264

E-mail: idw@bilingualgroup.co.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:

- Niigata Prefectural Government
- Niigata Visitors & Convention Bureau (Niigata City)

Please keep an eye on the website (<http://www.idw.ne.jp/>) for latest information.

SID 2009

International Symposium, Seminar and Exhibition

May 31 – June 5, 2009

San Antonio, Texas, USA

HOTEL AND TRAVEL INFORMATION

ACCOMMODATIONS

JTB Corp. will handle arrangements for your hotel reservations.

Hotel reservations can be made at the IDW official website.

<http://www.idw.ne.jp/accommodation.html>

JTB Tokyo Metropolitan Corp.
Corporate Sales Office Yokohama
Yokohama Convention Center

Phone: +81-45-316-4602 Fax: +81-45-316-5701

Office Hours: 9:30-17:30 (Weekdays only)

E-mail: jtb_convention@jtb.jp

There will be an on-site travel information desk during the conference period to handle arrangements for transportations.

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 at least two months before the conference.

JAPAN RAIL PASS AND JR EAST PASS

Japan Rail (JR) provides the following economical passes for some overseas travelers. Because purchase in Japan and usage conditions are restricted, please contact your travel agency prior to your trip.

- (1) The JAPAN RAIL PASS is the most economical way to travel throughout Japan by rail and JR buses.
- (2) The JR EAST PASS is an economical and flexible rail pass to travel around Eastern Japan.

Japan Rail Pass: <http://www.japanrailpass.net/eng/en001.html>

JR East Pass: <http://www.jreast.co.jp/e/eastpass/>

CLIMATE

The average temperature in Niigata during the period is around 5°C, with temperatures of 8°C in the daytime and 2°C at night on average.

BANQUET

Wednesday, December 3, 2008

19:30–21:30

Room "Continental" (4F)

Hotel Okura Niigata

See page 9 for details

NIIGATA CITY

Niigata City is located in the center of the Japanese Islands, 250 km north of Tokyo. The city has a long history as a port, and is distinguished for being the site of one of only five international ports opened in 1868 when Japan resumed contact with other countries after nearly 250 years of self-imposed isolation. Since that time, Niigata has developed into one of the most important modern international ports in Japan. Geographically, the city is distinctive in that it is surrounded by water. The Shinano and Agano, two of the largest rivers in Japan, run through the heart of Niigata before emptying into the sea. Until relatively recently, the city was also crisscrossed by a series of canals used to transport goods. Although the canals have been filled in to make the construction of modern roadways possible, the willows that lined these canals still remain today and now serve to lend a gentle air to the bustling downtown area.

When Niigata is mentioned, many people often think immediately of the area's delicious rice and *sake* or the city's beautiful sunsets, but the residents of Niigata themselves take pride, rather, in the spirit of hospitality and community that so distinguishes the city.

PLACES OF INTEREST

Sado Island

Sado Island lies isolated from the mainland by 35 km, and is accessible by Sado Kisen, a ferry service from Niigata City which takes two and a half hours by car ferry or only one hour by jet foil. Sado Island has a perimeter of 263 km, and a total area of 854.6 km². It is one of the largest islands in Japan. Many tourists come from all over the country every year to visit Sado, an island rich in natural beauty and historic monuments. In the ancient and middle ages, Sado was the island of exile. Many noble or holy people, the ex-Emperor Jun-toku (1197-1242), a Buddhist priest Nichiren Shonin (1222-1282) and a Noh player Zeami (1363 - 1443), for example, were banished there. They left many historic relics as well as a strong influence on the culture of Sado.

Niigata Furusatomura

This facility displays and provides information relating to Niigata's history, culture and sightseeing spots. There are shops selling various traditional crafts and local products, such as *sake*, rice and fish, for which Niigata is famous throughout the country. In addition, there is a food court serving delicious local dishes.

Bandai Bridge

The present Bandai Bridge is the third to have spanned the Shinano River (the first was built in 1887, the second in 1909 and the third in 1929). The bridge is 307 m long, 21.9 m wide and consists of 6 arches. Not only was it strong enough to survive the Niigata Earthquake during the 1960s, it has also become one of the symbols of Niigata City.

Prefectural Government Memorial Hall

Built in 1884, this building was formerly home to the Niigata Prefectural Assembly. This Western-style building fuses elements of Western and traditional Japanese architecture. It is the only prefectural assembly building dating from the early Meiji era still in existence in Japan and is designated as a nationally important cultural property.

NIIGATA INFORMATION DESK

Information concerning hotels and tours will be available during the conference period.

More information is available from these websites:

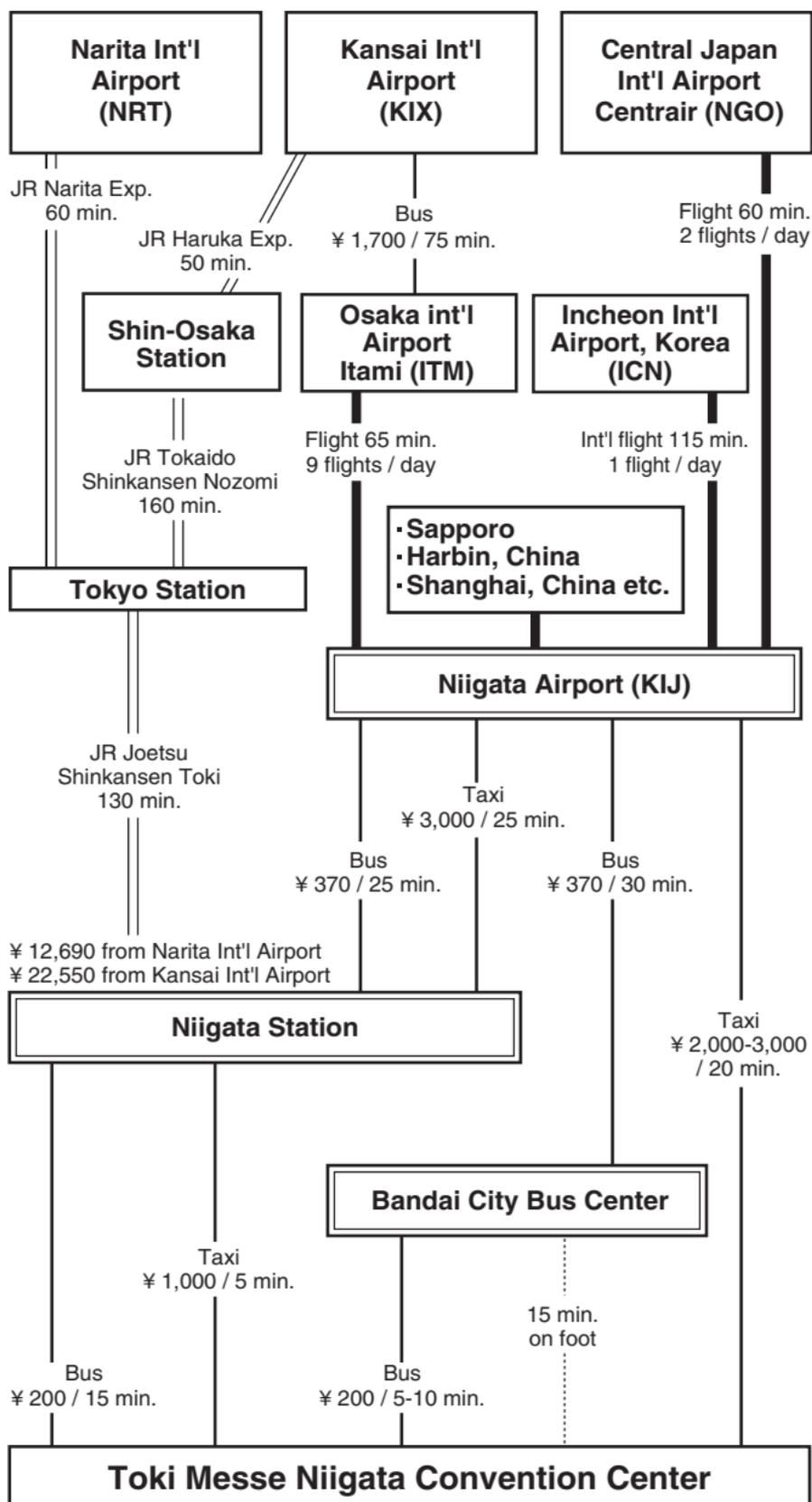
(Niigata City Online)

http://www.city.niigata.jp/e_page/e_index.html

(Niigata Visitors and Convention Bureau)

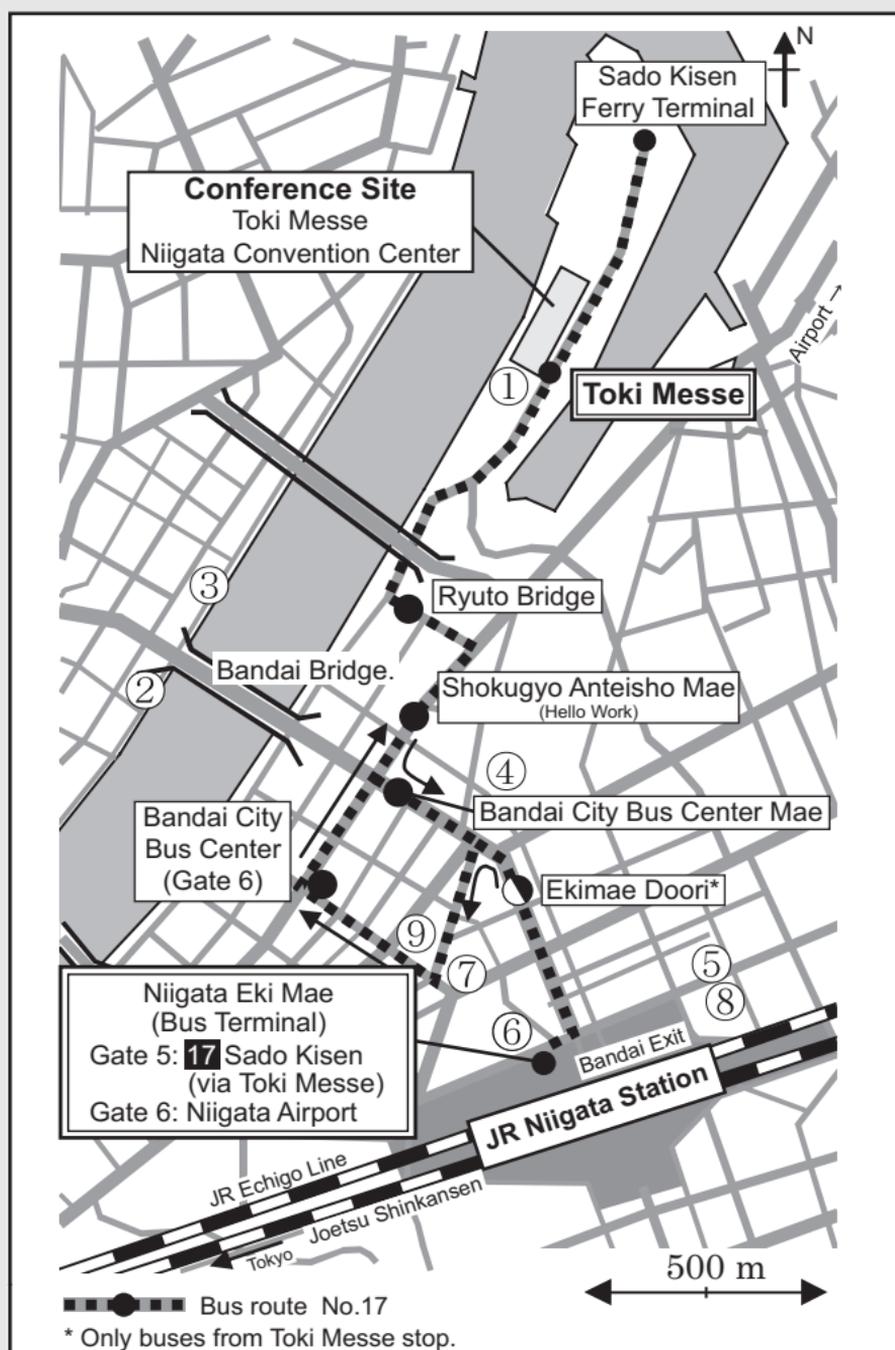
<http://www.nvcv.or.jp/en/>

Access to Conference Site



(as of October, 2008)

Niigata Downtown and Hotel Locations



- | | |
|--|------------------------|
| ① Hotel Nikko Niigata (Conference Site) | Phone: +81-25-240-1888 |
| ② Hotel Okura Niigata (Banquet Site) | Phone: +81-25-224-6111 |
| ③ Niigata Grand Hotel | Phone: +81-25-228-6111 |
| ④ ANA Crowne Plaza Niigata
(formerly the Hotel Niigata) | Phone: +81-25-245-3333 |
| ⑤ Hotel Sunroute Niigata | Phone: +81-25-246-6161 |
| ⑥ Niigata Tokyu Inn | Phone: +81-25-243-0109 |
| ⑦ Niigata Toei Hotel | Phone: +81-25-244-7101 |
| ⑧ Niigata Daiichi Hotel | Phone: +81-25-243-1111 |
| ⑨ Court Hotel Niigata | Phone: +81-25-247-0505 |

IDW '08

Wednesday, December 3

9:30 - 9:40

Snow Hall

Opening

Master of Ceremony: K. Betsui, Executive Chair, Hitachi, Japan

Opening Remarks

9:30

Y. Shimodaira, General Chair, Shizuoka Univ., Japan

*A. Mikami, Program Chair, Kanazawa Inst. of Tech.,
Japan*

9:40 - 11:00

Snow Hall

Keynote Addresses

Co-Chairs: A. Mikami, Program Chair, Kanazawa Inst. of Tech.,
Japan
Y. Shimodaira, General Chair, Shizuoka Univ., Japan

Keynote Address - 1 The Rise of Eco Televisions: Opportunity or Challenge?

9:40

T. J. M. Schoenmakers

Philips, the Netherlands

Better-featured, bigger televisions, massive content offering, plus consumers in emerging economies becoming more affluent will lead to higher environmental impacts. This situation should be assessed from a holistic environmental lifecycle perspective: for televisions, energy and materials are dominant. During the keynote we will review industrial challenges and how these are effectively addressed.

Keynote Address - 2 QoE Based IPTV Services

10:20

J. Kishigami

NTT, Japan

Through the service discovery, enjoying the content, and the aftercare, a variety of quality of services will be measured on IPTV services. Beyond the simple linear TV and Video-on-demand service, more attractive entertainment will be realized by the metadata technology. Total satisfaction of the user (QoE) is the most important issue to make the IPTV service succeed.

----- Break -----

11:10 - 11:50

Snow Hall

Invited Address

Co-Chairs: R. Hattori, Program Vice-Chair, Kyushu Univ., Japan
S. Uchikoga, Program Vice-Chair, Toshiba, Japan

Invited Address
11:10

Learning from Monet: Renown Artists and Display Design

C. M. Falco

Univ. of Arizona, USA

The artist David Hockney and I identified optical evidence demonstrating painters as early as Jan van Eyck (c1425) used projections for producing portions of their images. In making these discoveries, we developed fundamentally new insights into image analysis, which I am now applying to problems in image display and analysis.

EXHIBITION

12:00–18:00 Wednesday, Dec. 3, 2008
10:00–18:00 Thursday, Dec. 4, 2008
10:00–14:00 Friday, Dec. 5, 2008

Exhibition Hall B

Toki Messe Niigata Convention Center

Free admission with your registration name tag.

IDW '09

The 16th International Display Workshops

December 9-11, 2009

World Convention Center Summit
Phoenix Seagaia Resort

Miyazaki, Japan

<http://www.idw.ne.jp/>

Workshop on LC Science and Technologies

Wednesday, December 3

13:20 - 13:30

Marine Hall

Opening

Opening Remarks

13:20

T Nose, Akita Pref. Univ., Japan

13:30 - 14:55

Marine Hall

LCT1: Fascinating LC Materials

Chair: A. Götz, Merck KGaA, Germany

Co-Chair: A. Fujita, Chisso Petrochem., Japan

LCT1 - 1: *Invited* Carbon Nanotube Doped LC for OCB Cells: Physical and Electro-Optical Properties

13:30

S.-Y. Lu, L.-C. Chien

Kent State Univ., USA

We report carbon nanotube (CNT) doped liquid crystals which show significant improvement in response time for optical controlled birefringence (OCB) cells. Addition of CNT in liquid crystal (LC) increases the surface anchoring energy. The anchoring enhancement is due to the π - π electron stacking among the CNTs, LC and alignment layers.

LCT1 - 2: *Invited* Structure and Dynamics of Cubic and "Isotropic" LC Phases

13:55

J. Yamamoto

Kyoto Univ., Japan

Recently, liquid crystal phases with cubic symmetry receive much attention, such as cholesteric blue and cubic phases. We have found isotropic smectic blue phase and thermotropic sponge phase, which has liquid like "isotropic" symmetry. In these systems, structure and dynamics are intrinsically important to clarify the nature of the phases.

LCT1 - 3 **Wide-Banded Cone Lasing Emission in a Dye-Doped Cholesteric LC with a Single Pitch**
14:20

C.-R. Lee, H.-C. Yeh, T.-D. Ji, K.-L. Lin, S.-H. Lin, T.-S. Mo, C.-T. Kuo**, K.-Y. Lo***, S.-H. Chang, A.Y.-G. Fuh, S.-Y. Huang*****

Nat. Cheng Kung Univ., Taiwan

**Kun Shan Univ. of Tech., Taiwan*

***Nat. Sun Yat-Sen Univ., Taiwan*

****Nat. Chia Yi Univ., Taiwan*

*****Chung Shan Medical Univ., Taiwan*

This investigation reports a novel wide-banded cone lasing emission based on a planar dye-doped cholesteric liquid crystal film with a single pitch. The lasing wavelength in this lasing distributes continuously from ~676.7 to ~595.6 nm measured at continuously increasing oblique angle relative to the helical axis from 0° to 50°.

LCT1 - 4L **Precise Measurement Method of LC Material Parameters**
14:40

T. Kishimoto, K. Wako, T. Ishinabe, T. Miyashita*, T. Uchida**

Aomori Support Ctr. for Ind. Promotion, Japan

**Tohoku Univ., Japan*

A highly precise measurement method of LC material parameters was proposed. By application of new driving scheme of LC, and compensation for capacitance of alignment layer and anchoring strength of LC cell, we obtained reliable measurement values using the numerical fitting method on the capacitance-voltage property of LC cell.

----- Break -----

15:00 - 16:20

Marine Hall

LCT2: Characterization of LC Alignment

Chair: M. Kimura, JSR, Japan

Co-Chair: I. Nishiyama, DIC, Japan

LCT2 - 1: Invited Continuous Control of Pretilt Angle of LC
15:00

D. Kang, J.-H. Lee, C. Rosenblatt**

Soongsil Univ., Korea

**Case Western Reserve Univ., USA*

A simple method for continuous control of the pretilt angle is presented. Two different types of polyimide, one used for homeotropic alignment, and the other used for planar alignment, are mixed. By controlling the baking temperature and mixing ratio of the mixture the pretilt angle can be tuned continuously.

LCT2 - 2 **Characterization of High Pretilt Angle Generated by Blend Polyimide**
15:25

T. Shimizu, M. Kimura, T. Akahane
Nagaoka Univ. of Tech., Japan

The alignment characteristics of blend polyimide of planar alignment (PI-H) and vertical alignment (PI-V) were studied. The relationship between the surface energy and the pretilt angle was found by the blend polyimide films treated by the rubbing method or UV irradiation.

LCT2 - 3 **Evaluation of Surface Alignment of LC Using Surface Plasmon Resonance Spectroscopy**
15:45

A. Ikarashi, A. Baba, K. Shinbo, K. Kato, F. Kaneko
Niigata Univ., Japan

We report the evaluation of tilt angles of LC molecules near the surface of SiO₂ alignment layers and in the whole cell under applying constant voltages. Surface-Plasmon-resonance-spectroscopy and waveguide-mode in attenuated total reflection configuration are used to monitor the property of molecules orientation on the surface and the bulk.

LCT2 - 4L **UV Photoalignment Technology Comparable to the Rubbing Alignment Method in Terms of the Azimuthal Anchoring Energy**
16:05

J. W. Woo, D. C. Shin, E. J. Lim, H. J. Park, H. H. Shin
LG Display, Korea

By using the newly developed material and our process technology, we have achieved the azimuthal anchoring energy of the photoaligned layer comparable to that of the rubbed one. We are convinced that the increase of the anchoring energy of photoalignment technology leads to the decrease of an image sticking level.

----- Break -----

EXHIBITION

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Exhibition Hall B
Toki Messe Niigata Convention Center

Free admission with your registration name tag.

16:40 - 18:00

Marine Hall

LCT3: Image Sticking Measurement

Chair: J. C. Kim, Pusan Nat. Univ., Korea
 Co-Chair: S. Komura, Hitachi Displays, Japan

LCT3 - 1 Influence of Ion on Voltage Holding Ratio in LCD
16:40

*M. Mizusaki, Y. Nakanishi, Y. Yoshimura, Y. Yamada,
 K. Okamoto
 Sharp, Japan*

The relation of voltage holding ratio (VHR) with impurity ion in liquid crystal cells was analyzed based on the model of adsorption and desorption to and from the surface of alignment layer. The result indicates the desorption energy of the adsorbed ion affects VHR strongly compared with the adsorption energy.

LCT3 - 2 Development of New Evaluation Method for Image
17:00 Sticking

*N. C. Choi, H. K. Ahn, S. T. Shin
 Samsung Elect., Korea*

We propose the measurement tool that is related with the polarization due to the surface polarization of alignment layer and ion transportation of the dielectric materials of the cell.

LCT3 - 3 A Novel Measurement Method of Ion Density in TFT-
17:20 LCD Panels

*M. Inoue
 Toyo, Japan*

It is well known that contaminations in TFT-LCDs cause panel defects such as Mura, Image sticking and so on. To investigate the existence of contaminations in TFT-LCDs, test panels without TFTs are required. In this paper, I propose a novel measurement method of Ion Density in a real TFT-LCD panel.

LCT3 - 4 Precise Measurement of Very Low Retardation by
17:40 Using Transmission Ellipsometry

Y. S. Shin, J. W. Ryu, Y. K. Kim, S. Y. Kim
 Ajou Univ., Korea
 Samsung Elect., Korea

Ellipsometric technique utilizing compensator is used for the characterization of samples with very low retardation. Optic axes and retardations of low retardation films and weakly rubbed polyimides are determined.

Author Interviews

18:00 – 19:00

Thursday, December 4

9:00 - 12:00

Exhibition Hall B

Poster LCTp1: High Performance LCDs**LCTp1 - 1 Wide-View Crossed Circular Polarizers for LCDs***C.-H. Lin**Nat. Sun Yat-Sen Univ., Taiwan*

An optical compensation principle of the crossed circular polarizers is developed to widen the viewing angle of circular polarizer-type multi-domain vertical-alignment LCDs (CPMVA-LCDs). Based on this compensation principle, the CPMVA-LCD theoretically has a complete 80° viewing cone for contrast ratio (CR)>100:1.

LCTp1 - 2 Optimized Cell Parameters of TN-LCD with WV-EA Film for Excellent Center Contrast Ratio and Down-Side Viewing Angle*X. M. Wang, L. B. Mao, Y. W. Chiu, T. C. Chung, T. S. Jen**Infovision Optoelect., China**JiangSu (IVO) Flat Panel Display Tech. Res. Inst., China*

Narrow down-side viewing angle (DVA) is a headachy issue of TN-LCD with compensation film. The effects of cell and WV-EA film (FUJIFILM) parameters were investigated in this paper. Through the simulated and experimental results, an optimum database for obtaining the excellent center contrast ratio and DVA contrast ratio was built.

LCTp1 - 3 Extensive Study on Optical Anisotropy and Its Non-Uniformity of Wide View Film*J. W. Ryu, Y. S. Shin, Y. K. Kim*, S. Y. Kim**Ajou Univ., Korea***Samsung Elect., Korea*

We analyzed the polarization state change of the light passing through a wide view film as the azimuth angle and the tilt angle were varied. Using the modeling technique of ellipsometry, we searched the best fit orientation distribution of the optic axis of the discotic liquid crystal.

SID 2009

International Symposium, Seminar and Exhibition

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San Antonio, Texas, USA

LCTp1 - 4 A New Transflective LCD Using a Single Cell-Gap OCB-Mode with Fast Response Time

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

A new transflective LCD using a single-cell-gap OCB-mode compensated with discotic liquid crystal films and C-plates was designed to improve response time and viewing-angle performance of transflective displays. We verified that wide viewing angle and high contrast ratio could be achieved in both reflective and transmissive parts of the LCD.

LCTp1 - 5 Single Cell Gap Single Mode MTN Transflective LCD

T. Du, H. Y. Mak, P. Xu, C. Vladimir, H. S. Kwok
Hong Kong Univ. of S&T, Hong Kong

A new design of single cell gap transflective LCD using 75 degree twist nematic mode has been proposed. The electro-optical characteristics in the transmissive part and reflective part are matched. This single TN transflective configuration exhibits high contrast, wide viewing angle, fast response and high transmittance / reflectance.

LCTp1 - 6 Fast Switching Characteristics of a VA LC Cell with Pixel-Isolating Polymer Wall Using Reactive Mesogen

D. H. Song, S. R. Lee, T.-H. Yoon, J. C. Kim, H. S. Woo, S. T. Shin*, J. H. Souk**
Pusan Nat. Univ., Korea
**Samsung Elect., Korea*

We demonstrate a vertical aligned (VA) nematic liquid crystal (LC) cell with pixel-isolating polymer structure using reactive mesogen. Due to the multi-dimensional LC alignment effect of the wall, the proposed cell shows faster response time than conventional VA LC cell, without any loss of transmittance within a pixel area.

LCTp1 - 7 An Optical Configuration of VA LC Cell for Improvement of the Viewing Angle

S.-H. Ji, J.-M. Choi, G.-D. Lee
Dong-A Univ., Korea

We propose an optical configuration of vertical alignment (VA) liquid crystal (LC) cell to eliminate off-axis light leakage in the dark state in visible wavelength range. The advanced VA LC cell has compensation films of a negative C-plate and a half-wave biaxial film.

LCTp1 - 8 Transflective PVA LCD with Single Cell Gap

*S. S. Yang, S. Y. Park, B. G. Cho, T. Won
Inha Univ., Korea*

In this paper, we propose a transflective PVA mode structure with a single cell gap. As an exemplary cell, we selected 8-domain PVA mode with chevron-shaped electrode. Our design significantly improves aperture ratio and optical performance while minimizing the dark region. Optical characteristics were calculated with commercial 3D-FEM solver, TechWiz-LCD.

LCTp1 - 9 A Simulation Study on Excellently Optimized Viewing Angle Performance for OCB LCDs

Y. C. Wang, C. R. Sheu, Z. Y. Yen, J. L. Chen*, T. Y. Ho*,
D. J. Chen**

Nat. Cheng Kung Univ., Taiwan

**Taiwan TFT LCD Assn., Taiwan*

An excellently optimized viewing angle performance for OCB is achieved with the commercial simulation software, DIMOS2.0. For D65 illumination, the optimized compensated cell possesses contrast ratio over 100 almost distributed all viewing angles. At on-axis viewing direction, contrast ratio is over 1000.

LCTp1 - 10 Multi-Domain Transflective LCD Using MTN and ECB Modes by Photoalignment Technology

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

A new design of single cell gap transflective liquid crystal display (LCD) using low twist nematic (LTN) and electricity controlled birefringence (ECB) modes has been proposed. This configuration has a high contrast, good viewing angle, fast response and high transmittance / reflectance. Also the fabrication process is easy.

LCTp1 - 11 A Wide Viewing Angle Advanced MVA LCD with In-Cell Retarder

*P.-C. Yeh, Y.-S. Jeng, C.-J. Hu, W.-M. Huang
AU Optronics, Taiwan*

This paper discloses an in-cell retarder on the CF side of 2.4" AMVA-LCD. The thickness of in-cell retarder with coating RM (reactive mesogens) can be adjustable and get proper compensation. In-cell retarder will be used in place of attached compensation film to improve wide viewing angle of 2.4" AMVA-LCD.

LCTp1 - 12 Driving Characteristic of FLC Controlled by Using Asymmetric Alignment Method

*N. Sawatari, M. Ishikawa, R. Harada, M. Okabe
Dai Nippon Printing, Japan*

We have found that using the asymmetric alignment method control the driving characteristic of Ferroelectric Liquid Crystal (FLC). The FLC of V-sharp mode change to Half-V by using the alignment method. Furthermore, we have fabricated a field sequential color display using the alignment method and Inkjet printing method.

LCTp1 - 13 Improvement of Transient Response Characteristics of Polymer Stabilized Bend Alignment LC Cell

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

It is shown that the decay time of the polymer stabilized bend (PSB) cell can be improved by using a fluorinate nematic mixture, ZLI-4792 and RMM-34 (Merck) as the LC material and the UV curable LC monomer, respectively.

LCTp1 - 14 Electro-Optical Properties of Optically Compensated No-Bias-Bend LCD

*H. Shidara, T. Takahashi, S. Saito
Kogakuin Univ., Japan*

It is shown that the no-bias-bend (NBB) cell is not always superior to the conventional bias-bend (BB) cell comparing the electro-optical characteristics and transient response properties of the NBB cell with that of the BB cell keeping the application to optically compensated (OC) cell in mind.

LCTp1 - 15 Chirality Induced Acceleration of Bend-Growth Rate for OCB Mode

F. Ogasawara^{,**}, K. Kuboki^{***}, K. Wako^{***}, T. Uchida^{****},
A. Yoshizawa^{*}
^{*}Hirosaki Univ., Japan
^{**}Tohoku Chem., Japan
^{***}JST, Japan
^{****}Tohoku Univ., Japan*

We observed bend-growth processes for OCB-mode and detected asymmetric-splay to bend transformation at 0 °C. We investigated kinetic effects of a chiral additive on the bend-growth processes. The chiral additive was found to accelerate the asymmetric-splay to bend transformation in all the directions. We discuss structure-property relationships in chiral compounds.

LCTp1 - 16L Novel Optical Compensation Film for LCD Viewing Angles Reduction*H. L. Ong**Kyoritsu Optronics, Taiwan*

A novel optical compensation film is used to reduce the TN/LCD viewing angle cone, with no change on on-axis contrast ratio and transmission. Test TN panels with this compensation film are fabricated and confirmed the results. This compensation film can also be used for MVA and IPS/LCD viewing angle reductions.

9:00 - 12:00**Exhibition Hall B****Poster LCTp2: Novel LCD Modes****LCTp2 - 1 Reflective Configuration of a Bistable Twisted Nematic LCD with Left- and Right-Handed π -twist States for High Contrast Ratio***J. H. Lee, S. R. Lee, T.-H. Yoon, J. C. Kim**Pusan Nat. Univ., Korea*

The authors propose a reflective configuration of a bistable twisted nematic (BTN) liquid crystal (LC) display which has two stable states of left- and right-handed twist. By employing a circular polarizer and a positive, the BTN LC cell shows a high contrast ratio as well as excellent wavelength dispersion characteristics.

LCTp2 - 2 Transition from U-State to T-State through an Over-Twisted State in Bi-Nem LC Cell*Y. Uchiyama, H. Terashi, T. Takahashi, S. Saito**Kogakuin Univ., Japan*

Transition from the U state to the T state through an over twisted process in the Bi-Nem cell was experimentally observed for the first time. It is theoretically shown that such transition through the over twisted process occurs in the case of relatively large surface dissipation coefficient.

LCTp2 - 3 Novel Bistable LCD Switching between Two Twisted Directions*T. Kobayashi, K. Suzuki, S. Saito, T. Takahashi**Kogakuin Univ., Japan*

A novel bistable LCD having a large pretilt angle and twisted structure was proposed. State-I has a twisted angle of ϕ_I with the splay distortion, and State-II has a twisted angle of $\phi_{II} (= \pi - \phi_I)$ without splay distortion. The computer simulation was carried out and the sample cell was fabricated.

LCTp2 - 4 Numerical Studies of Fringe Field Effect Depending on Pretilt Angel in LCOS Microdisplay

H. Son^{}, M. S. Kim^{*,**}, N. C. Song^{**}, M. H. Oh^{*}, J. Kang^{*}*

^{}Dankook Univ., Korea*

*^{**}Uni-Display, Korea*

The fringe field effects of a Liquid Crystal On Silicon (hereinafter "LCOS") microdisplay were analyzed with the 3-dimensional LC simulator. Because of the small cell pitch (8.1 μm), the undesirable fringe field effect could be diminished the optical characteristics of LCOS panel. The dependence of pretilt angle on the fringe field effect was studied based on the reflected-light distribution form the panel. As the pretilt angle was decreased, the fringe field was moved to the pixel edge and the whole reflected light intensity from the pixel was increased.

LCTp2 - 5 Electric-Optic Characteristics of Nematic LC with Chiral Dopant in Fringe-Field Switching Mode

O.-S. Son, S.-Y. Choi, Y.-I. Park, D.-H. Suh, G. Son

BOE HYDIS Tech., Korea

We have investigated the electro-optic characteristics of LC with chiral dopant at low cell gap in fringe-field switching mode structure. As the rotation direction of chiral dopant and twist direction of LC correspond, the transmittance increases. In the opposite case, the operation voltage decreases.

LCTp2 - 6 Study of LC Alignment Films Anisotropy by Near-Edge X-Ray Absorption Fine Structure Spectroscopy

M. S. Kwak, H. R. Chung, H. M. Kwon, J. H. Kim,

D. K. Han, S. M. Lee, C. G. Lee, S. Y. Cha

LG Display, Korea

The anisotropy of the alignment films (AFs) by the kind of AF was analyzed through NEXAFS. Result of NEXAFS analysis, the anisotropy of surface was appeared in each AFs. It was able to explain being arranged in the direction set to rubbing in plane of AF molecules along with substrate.

LCTp2 - 7 Novel Cholesteric LCs with Dual-Chirality toward High Reflectivity

C.-M. Wu, S.-H. Liu, C.-L. Chin, A.-C. Chen, Y.-C. Liao,

K.-L. Cheng

ITRI, Taiwan

Novel dual-chirality cholesteric LC materials were prepared and evaluated in a dual-cell system. Chiral dopants of the identical chemical structure with (+) and (-) chirality in the presence of nematics yielded better reflectance than the different structures of the chiral dopants with (+) and (-) chirality.

LCTp2 - 8 See-Through LCDs Using Transparent Light-Guide Plates

W.-S. Choi, J.-H. Lee, J. Yeon, J.-B. Yoon
KAIST, Korea

See-through black and white (B/W) liquid crystal displays (LCDs) were implemented by using a transparent light-guide plate (LGP) and a color-filterless film compensated super nematic (FSTN) LC panel. Furthermore, feasibility of further development as full color see-through displays are proven by a initial work conducted with a blue light source.

LCTp2 - 9 Low Power LCD with Low Supply Voltage

A. R. Shashidhara, T. N. Ruckmongathan
Raman Res. Inst., India

Low power dissipation and low voltage operation are achieved by combining the best features of several addressing techniques. A large number of gray shades are displayed with simple drivers and controller to reduce cost.

LCTp2 - 10 Withdrawn**LCTp2 - 11 Electro-Optical Device Using Electrospun Cellulose-Based Nanofibres**

S. Kundu^{}, P. L. Almeida^{*,**}, J. P. Borges^{*,***},
 M. H. Godinho^{*,***}, J. L. Figueirinhas^{****,*****}*
^{}CENIMAT, Portugal*
*^{**}EST/IPS, Portugal*
*^{***}New Univ. of Lisbon, Portugal*
*^{****}CFMC-UL, Portugal*
*^{*****}Instituto Superior Técnico, Portugal*

In this work we present a completely new method of preparing cellulose based electro-optical cells which gives a new idea of developing displays with a lower production cost. These devices can be used as shutters since they can be electrically controlled to be opaque or to be transparent.

LCTp2 - 12L Enhanced of High Image Quality and Fast Response Time with AFFS Plus

*S. Choi, Y. H. Lee, J. H. Park, J. H. Lee, S. H. Kim,
 Y. S. Jo*
Hydis Techs, Korea

We have developed AFFS+ technology with enhanced image quality for notebook and tablet. We improved contrast ratio (>800:1), response time (≤ 20 ms) and wide viewing angle with adopting low cell gap and optimized design between pixel electrode and data line. We propose new AFFS+ design for high image quality.

LCTp2 - 13L Electro-Optic Devices Based on Ferroelectric Liquid Crystal for Flexible Display

S.-J. Jang, T.-H. Lee, H.-M. Kim, C.-S. Moon, T.-K. Park, J.-Y. Chun, S. Kang, H.-H. Hwang*, S.-H. Kim*

LGINNOTEK, Korea

**Image Lab, Korea*

We studied the bistable properties of Ferroelectric Liquid Crystal (FLC) for flexible display. The optimization of device depends on composition of the FLC/chiral dopant mixtures and the rubbing strengths. Finally, we have fabricated the 2.2 inch Flexible FLC display using plastic substrate and post-spacer.

9:00 - 12:00

Exhibition Hall B

Poster LCTp3: Novel Applications**LCTp3 - 1 Effects of Thermal Modulation on Anisotropic Diffraction in Orientation-Controlled LC Composite Volume Gratings**

A. Ogiwara, M. Minato, S. Horiguchi, H. Kakiuchida, K. Yoshimura*, H. Ono**, A. Emoto**, N. Mohamad***

Takamatsu Nat. College of Tech., Japan

**AIST, Japan*

***Nagaoka Univ. of Tech., Japan*

Effects of anisotropic diffraction on thermal modulation in volume gratings using the composite materials of nematic liquid crystals (LC) and LC diacrylate monomers are studied. Experimental results show that the anisotropic diffractions induced by the thermal modulation are controlled by the materials of high refractive indices and the rubbing process.

LCTp3 - 2 Luminance Improvement in LC Electrochemiluminescent Cells by Heating Stir Process

T. Horiuchi, M. Honma, T. Nose

Akita Pref. Univ., Japan

Emission properties in liquid crystal (LC) electrochemiluminescent (ECL) cells doped with an organic fluorescent dye are investigated. A heating stir process is introduced to improve the ECL properties. The mechanism of the significant increase in the luminance and the current density is discussed by the photoluminescent experimental results.

LCTp3 - 3 Effect of Concentration of Embedded LC Director in Electrolyte on Power Conversion Efficiency in DSSC*H. K. Kim, S.-H. Jin*, G.-D. Lee**Dong-A Univ., Korea***Pusan Nat. Univ., Korea*

We optimize concentration rate of the Liquid Crystal in the polymer electrolyte for light efficiency enhancement in a quasi-solid-state dye-sensitized solar cell. As a result, we can know the fact that the PCE and fill factor have a special rate of LC concentration in DSSC.

LCTp3 - 4 Relationship between Electric Properties of LC Devices and Structures of Hybrid Nanoparticles Used as a Dopant*N. Nishida, S. Ohta, Y. Shiraishi, S. Kobayashi, N. Toshima**Tokyo Univ. of Sci., Yamaguchi, Japan*

We prepared Pd nanoparticles protected by 4'-pentylbiphenyl-4-carbonitrile (5CB-Pd) or poly(Nvinyl-2-pyrrolidone) (PVP-Pd). The LCD was fabricated by liquid crystal doped with Pd nanoparticles. Here, we discuss electro-optic and electric properties, especially the relationship between the frequency modulation and conductance, of LCDs doped with nanoparticles.

LCTp3 - 5L Zoom System Realized Using Liquid Crystal Lenses*M. Ye, M. Noguchi*, B. Wang, S. Sato**Akita Pref. R&D Ctr., Japan***Scalar, Japan*

A zoom system built up using LC lenses with electrically tunable focal lengths is reported. Instead of mechanical moving of lenses in conventional zoom systems, the zoom function in this new system is accomplished by adjusting the voltages applied on the LC lenses. Zoom ratio of approximate 1.5:1 is observed.

9:00 - 12:00**Exhibition Hall B****Poster LCTp4: Display Evaluation****LCTp4 - 1 Analysis of Zone Image Sticking in an MVA LCD Cell***R. Kamoto**Micro Analysis Lab., Japan*

Image sticking phenomenon is the most important issues on LCD. There are two kinds of image sticking, it has tried to analyze the zone image sticking in the cell using micro analysis methods such as μ -IR and μ -MS.

LCTp4 - 2 Analysis of Influence Parameters for Touch Mura Improvement

*H. Zhao, P. Zhang, J. You, L. Huangfu, J. Lee
BOE Optoelect. Tech., China*

Influence parameters for Touch Mura have been discussed in this paper. A modeling experiment was carried out to simulate the panel deformation when it was touched. Our research show that small panel bending, small panel align accuracy, increasing LC amount, and reducing PS density can improve the Touch Mura.

LCTp4 - 3 Contrast Ratio Variation Due to Light Scattering from LC Layer by Temperature Effect in TN Panel

*K.-T. Huang, A. Chao, K. Chen, C.-H. Yu
HannStar Display, Taiwan*

Temperature variation affects the LC parameters and light scattering index (Slc) of LC is changed. We found that the CR of panel is inverse proportional to the Slc at different temperature. Slc is proved that it can be utilized in evaluating the light leakage by LC layer of TN panel.

LCTp4 - 4 Measurement Method of Wire-Frame Flickering

*K. Song, S. W. Lee
Kyung Hee Univ., Korea*

This work proposes a measurement method of wire-frame flickering (WFF) of a LCD. We propose a vertical stripe line pattern to measure WFF because the slowly scrolling pattern causes the WFF on the LCD screen. We analyze the luminance fluctuation measured from the WFF using the conventional contrast method and JEITA method.

LCTp4 - 5 Determinations of Twist Angle, Pretilt Angle, and Cell Gap of a TN LC Cell by Phase-Sensitive Heterodyne Interferometry

*H.-C. Tseng, R.-B. Li, W.-C. Chen, K.-H. Yang,
S.-F. Wang*
HannStar Display, Taiwan
Ching Yun Univ., Taiwan

We propose a new measuring method to determine the twist angle, pretilt angle, and cell gap of a TN LC cell by comparing the measured phase retardation versus the rotation angle of the TN cell by phase-sensitive heterodyne interferometry and theoretically calculated values. It provides the most sensitive way.

LCTp4 - 6 Leslie Viscosity Coefficients of Nematic LCs with Negative Dielectric Anisotropy Determined by Transient Current Technique

Y. Iwata, H. Naito, M. Inoue^{}, H. Ichinose^{**}, M. Klasen-Memmer^{***}, K. Tarumi^{***}*

Osaka Pref. Univ., Japan

^{}Toyo, Japan*

*^{**}Merck, Japan*

*^{***}Merck KGaA, Germany*

A method for determining the viscosities of nematic LCs with negative dielectric anisotropy based on analysis of the transient current, induced by step voltage excitation, in homeotropic nematic LC cells is proposed. The Leslie viscosity coefficients can be determined by fitting the calculated transient current to the experimental data.

LCTp4 - 7 Electrical and Surface Characteristics of Polyimide Film on ITO Coated Glass Substrate

*M. Inoue^{***}, M. Akimoto^{*}, S. Kobayashi^{*}, K. Takatoh^{*}, H. Endoh^{***}, H. Fukuro^{***}*

^{}Tokyo Univ. of Sci., Yamaguchi, Japan*

*^{**}Toyo, Japan*

*^{***}Nissan Chem. Ind., Japan*

It is well known that polyimide film plays an important role of aligning liquid crystal molecules. In this paper, we investigate electrical and surface characteristics of a polyimide film on a glass substrate and confirm that the polyimide film of the lower baking temperature has diode characteristics.

LCTp4 - 8 Two Photon Fluorescence Microscopy Technique for Three-Dimensional Imaging of LC Director

H. Yoshida, S. Suzuki, C.-H. Lee, Y. Miura, K. Tokuoka, A. Fujii, M. Ozaki

Osaka Univ., Japan

A microscopic technique to view the three-dimensional liquid crystal director distribution is presented. Polarization fluorescence microscopy employing two-photon absorption allows monitoring of the director in the focal plane of the objective, and therefore three-dimensional information can be gained by scanning the focal plane in the depth direction of the sample.

LCTp4 - 9 Polar Anchoring Energy Measurement of Pre-imidized Polyimide with Low Temperature Process

C. W. Kuo, M. J. Lee, Y. R. Lin, C. K. Ku, C. C. Liao, Y. S. Hung, S. J. Huang**

ITRI, Taiwan

**Nat. United Univ., Taiwan*

In this paper, anchoring energy of pre-imidized polyimide film using low temperature process was discussed. The anchoring energies of polyimide films was calculated by R - V method, and an optical heterodyne interferometer arrangement was applied to measure phase retardations (R) of LC cells versus applied voltages (V).

LCTp4 - 10L New Optical Geometry for Determination of Rotational Viscosity Coefficient of Nematic Liquid Crystals

S. V. Pasechnik^{***}, A. V. Dubtsov'^{**}, D. V. Shmeliova*, V. A. Tsvetkov*, V. G. Chigrinov^{***}*

**Moscow State Univ. of Instr. Eng. & Computer Sci., Russia*

***Dublin Inst. of Tech., Ireland*

****Hong Kong Univ. of Sci. & Tech., Hong Kong*

We present the new results of experimental investigation of a pure twist deformation of nematic liquid crystals induced by homogeneous "in-plane" electric field in the new optical geometry. Analysis of results via simple model enabled us to propose a new method for determination of the rotation viscosity coefficient.

LCTp4 - 11L A Novel Quantification of Image Sticking

H. S. Lin, C. S. Chang, Y. C. Lin, C. J. Chen, C. L. Yang, J. P. Pang

InnoLux Display, Taiwan

Image sticking was successfully forecasted by quantifying mobile ions. The amount of ions proportion to dc bias was verified. In voltage-variant ion curve, there are three distinct areas including off, linear and saturation. This paper finally proposed that dc bias over 2V would result in heavy image sticking.

9:00 - 12:00

Exhibition Hall B

Poster LCTp5: Characterization of LC Alignment**LCTp5 - 1 Adjustable Pretilt Angle Generated by Ion Beam Exposure and Followed by Rubbing Treatment***Z. Y. Yen, C. W. Hsiao, B. H. Wu, F. Y. Lien, J. L. Chen, D. J. Chen**Taiwan TFT LCD Assn., Taiwan*

The pretilt of nematic LC cells can be controlled by ion beam exposure on an alignment layer followed by rubbing treatment. Variable pretilt could be obtained by changing the ion beam parameters. The OCB cells with a pretilt of near 60° were manufactured that show no splay-to-bend transition.

LCTp5 - 2 LC Alignment on SiO_x Film Surfaces by Using Ion Beam Scanning Method*B. K. Jo, P. K. Son, J. C. Kim, T.-H. Yoon, S. J. Rho*, S. T. Shin*, J. S. Kim*, S. Y. Kim*, J. H. Souk***Pusan Nat. Univ., Korea***Samsung Elect., Korea*

We propose a method for the liquid crystal (LC) alignment through the ion beam scanning. We demonstrated vertical alignment of LC on SiO_x film surfaces by ion beam scanning with a stainless steel scanning mask.

LCTp5 - 3 Withdrawn**LCTp5 - 4 Temperature Dependence of Photoalignment of Dye-Doped LCs***C.-Y. Huang, C.-D. Lin, T.-S. Mo*, K.-Y. Lo**, C.-R. Lee**Nat. Cheng Kung Univ., Taiwan***Kun Shan Univ. of Tech., Taiwan****Nat. Chiayi Univ., Taiwan*

A pump-probe method for measuring the reorientation angle of the surface director versus exposure time is utilized to study an influence of temperature on dynamic adsorption-induced photoalignment in dye-doped liquid crystals. Optimal rise time of the photoalignment exists at an inter-temperature due to the competition between opposite temperature-dependent factors.

LCTp5 - 5 Optical Properties of Polyimide(CBDA-BAPP) Thin Films

T. Mizunuma, H. Shitomi^{}, S. Matsumoto
Meiji Univ, Japan
^{*}AIST, Japan*

Changes in the optical properties of polyimide thin films upon exposure to linearly polarized UV radiation were investigated. It was found that the photoalignment behaviors of LC molecule on CBDA-BAPP thin films are strongly related to the photodecomposition of cyclobutane ring of the cyclobutane tetracarboxylic dianhydride structure.

LCTp5 - 6 Orientation Measurement of LC Molecule Deposited on Rubbed Polyimide Film Used by Grazing-Incidence X-Ray Diffraction

T. Koganezawa, I. Hirose, H. Nameki, H. Ishii^{}
Japan Synchrotron Radiation Res. Inst., Japan
^{*}Nissan Chem. Ind., Japan*

We developed a new method for characterizing molecular distribution in very thin liquid crystal layer. The clear anisotropic distribution of a liquid crystal molecular in thin (5 ~ 40nm) layer evaporated onto rubbed polyimide film was successfully observed used by grazing-incidence X-ray diffraction (GIXD).

LCTp5 - 7 Comparison of Friction Characteristics on Alignment Films with Frictional Force Microscopy

*M. S. Kwak, H. R. Chung, H. M. Kwon, J. H. Kim,
D. K. Han, S. M. Lee, C. G. Lee, S. Y. Cha
LG Display, Korea*

Using FFM, the friction surface characteristics between TN and VA mode alignment films (AFs) were compared. The friction asymmetry was appeared according to temperature conditions on TN mode, but not on VA mode. The difference was explained by tilt angle uniformity and density of side chain AF leaning intermolecular repulsion.

LCTp5 - 8 Surface Crystallization of Rubbed Polyimide Film for LC Alignment by Annealing

I. Hirose, T. Koganezawa, T. Sakai^{}, H. Ishii^{*}
Japan Synchrotron Radiation Res. Inst., Japan
^{*}Nissan Chem. Ind., Japan*

We investigated effect of annealing after rubbing on alignment film, since annealing process is performed in actual LCD fabrication. Enhancement of surface polymer crystallization occurred by annealing by GIXD, and the initial orientation of surface polymers induced by rubbing affected on surface crystallization by annealing.

LCTp5 - 9 Rubbing Alignment Using Pre-imidized Polyimide as an Alignment Material

C. K. Ku^{}, M. J. Lee^{*,**}, Y. R. Lin^{*}, C. W. Kuo^{*}, C. C. Liao^{*}*

^{}ITRI, Taiwan*

*^{**}Nat. Chaio Tung Univ., Taiwan*

In this paper, a pre-imidized polyimide was applied for rubbing alignment material in order to lower the curing temperature. The LC cells with alignment layers cured at 150°C have an excellent balance of pretilt angle, VHR, RDC, threshold voltage and response time.

LCTp5 - 10L Photoisomeriation Studies on Disc Shaped Azo Dyes: Characteristic Properties and Applications

G. Hegde^{,**}, M. R. Lutfor^{***}, V. Chigrinov^{*}, H. S. Kwok^{*}*

^{}Hong Kong Univ. of S&T, Hong Kong*

*^{**}Gothenburg Univ., Sweden*

*^{***}School of Sci. & Tech. Universiti Malaysia Sabah, Malaysia*

In this investigation, photoisomerization studies are done for disc-shaped azo dye mixed with liquid crystal. Study suggests that the proposed dye can be implemented for storage devices since it exhibits high thermal back relaxation. This azo-dye is highly reversible and can possibly implement for storage devices and security applications.

LCTp5 - 11L Investigation of Photo Alignment Properties on New Azo Dyes and Applications

G. Hegde^{,**}, T. Du^{*}, V. Chigrinov^{*}, H. S. Kwok^{*}*

^{}Hong Kong Univ. of S&T, Hong Kong*

*^{**}Gothenburg Univ., Sweden*

Excellent photoalignment of different liquid crystals (LC) on the films of commercially available azo dyes is observed. Investigation on characteristic properties of order parameter, azimuthal and polar anchoring energy open up the wide path for utilizing commercially available dyes for different applications. Mechanism behind the phenomena is discussed elsewhere.

SID 2009

International Symposium, Seminar and Exhibition

May 31 – June 5, 2009

San Antonio, Texas, USA

**LCTp5 - 12L Biaxiality Effects in Kinetics of Photoinduced
Orientational Structures in Azo-Dye Films**

A. Kiselev^{}, V. Chigrinov, H. Kwok, A. Murauski,
A. Muravsky*

HKUST, Hong Kong

^{}Nat. Ac. of Scis. of Ukraine, Ukraine*

New photosensitive materials for photo-aligning and photo-patterning of polarizers and phase retarders to produce efficient new liquid crystal display prototypes were investigated. The photoaligning technology enables us to obtain transfective displays, by putting a special configuration of patterned LC alignment or patterned polymerizable phase retarders on each pixel.

**LCTp5 - 13L The Main-Chain Effect on the Surface Anchoring in
Homeotropic Polyimide Having Long Alkyl-Side-
Chain**

J. H. Shin, J.-H. Seo, T.-H. Yoon, J. C. Kim

Pusan Nat. Univ., Korea

In VA cell, the long alkyl-side-chain of the homeotropic polyimide plays more important role in alignment properties of LC molecules than its main-chain. However, our experiment shows the main-chain is also important in the near saturation field. The authors have studied the change of surface anchoring according to rubbing strength.

**LCTp5 - 14L Tunable Liquid Crystal Pretilt Angles Generated by
Nanoparticles**

H. H. Yu, S. C. Jeng^{,**}, C. Y. Yang^{***}, Y. M. Shieh^{***},
Y. H. Hung^{***}, C. W. Kuo^{*}, S. J. Hwang^{***}*

Nat. Formosa Univ., Taiwan

^{}Nat. Kaohsiung Univ. of Appl. Sciences, Taiwan*

*^{**}ITRI, Taiwan*

*^{***}Nat. United Univ., Taiwan*

A potential method possessing a capability of adjusting pretilt angle for liquid crystal alignment was proposed by doping polyhedral oligomeric silsesquioxane (POSS) nanoparticles of in the homogeneously- aligned LC cells. With the different doped POSS concentration, the continuously controllable LC pretilt angles can be achieved from 0° to 90°.

----- Lunch -----

13:20 - 14:25

Snow Hall B

LCT4: LC Alignment Patterning

Chair: M. Kimura, Nagaoka Univ. of Tech., Japan
 Co-Chair: I. Hirose, Japan Synchrotron Radiation Res. Inst., Japan

**LCT4 - 1: *Invited* LC Alignment on Patterned Structure
 13:20 Fabricated by Laser Lithography**

M. Ozaki^{}, Y. Miura^{*}, C. H. Lee^{*}, H. Yoshida^{*},
 K. Tokuoka^{*}, K. Tagashira^{*}, Y. Miyake^{*,**}, A. Fujii^{*},
 Y. Shimizu^{**}*

^{}Osaka Univ., Japan*

*^{**}AIST, Japan*

LC alignment on the micro-structure which is fabricated through a two-photon excitation laser-lithography has been investigated. LC local alignment in a small area with an arbitrary shape is achieved. Columnar LCs introduced in micro-structures is found to exhibit a planar alignment with the columnar axis being perpendicular to the micro-grooves.

**LCT4 - 2 Photo-Aligning and Photo-Patterning by
 13:45 Photosensitive Azo-Dye Layers**

V. G. Chigrinov, H. S. Kwok, H. Hasebe^{}, H. Takatsu^{*}
 Hong Kong Univ. of S&T, Hong Kong*

^{}DIC, Japan*

Kinetics of photoinduced ordering in azo-dye films is studied. The principal extinction coefficients on the irradiation dose are obtained from the absorption-vs-incidence angle curves. The transient photoinduced structures are found to be biaxial. The irradiation time vs the absorption order parameters is interpreted by generalized diffusion model.

**LCT4 - 3 Self-Organized Microwrinkles for LC Alignment
 14:05**

T. Ohzono, H. Monobe, Y. Shimizu

AIST, Japan

The alignments of nematic liquid crystalline (LC) molecules on self-organized microwrinkles are demonstrated. The LC alignment direction corresponds to that of the microwrinkle grooves. The order parameter of the microwrinkle-induced LC alignment within the parallel cell is comparable to that of the cell with mechanically rubbed surfaces.

LCT4 - 4 Withdrawn

----- Break -----

16:40 - 17:40

Snow Hall B

LCT5: Moving Picture Analysis

Chair: M. Ozaki, Osaka Univ., Japan

Co-Chair: M. Inoue, Toyo, Japan

LCT5 - 1 Comparison of Measurement Methods for Motion Blur

16:40

*Y. Enami**Otsuka Elect., Japan*

TV samples were measured using a pursuit camera, a high-speed camera, and a temporal response measurement system, which we have developed. The respective measurement methods are compared and the characteristics of the devices and problems of motion blur computing methods are examined.

LCT5 - 2 Time Resolved Photometric and Colorimetric 2D Measurements of both Dynamic and Static Luminance and Colour Artifacts in FPD

17:00

J. J. Jensen, S. Kobayashi, M. Inoue***, Y. Kaneko****DELTA, Light & Optics, Denmark***Tokyo Univ. of Sci., Yamaguchi, Japan****Toyo, Japan*

Report on time resolved colorimetric measurements of the luminance and colour variation occurring during the frame period of FPD's. Several measurements are performed. For dynamic artefacts, a pursuit eye tracking algorithm is applied. This robust data will be basis of a future metric for quantifying various kinds of colour artifacts.

LCT5 - 3 Analysis of Image Distortion Phenomena Induced by External Force on LCD

17:20

*J.-Y. Ahn, H. K. Hong, H. Jung, H.-I. Baek, M. Lim, H.-H. Shin**LG Display, Korea*

Spontaneous light leakage at low gray levels and image deformation at high gray levels induced by the external force are observed for LCDs. In this study, we report that on what condition and how such the phenomena are observed and explain their mechanism according to the LC alignment.

Author Interviews

18:00 – 19:00

Friday, December 5

9:00 - 10:30

Snow Hall B

LCT6: 15th Anniversary: Progress of LC Materials

Chair: L. C. Chien, Kent State Univ., USA
 Co-Chair: M. Suzuki, Merck, Japan

**LCT6 - 1: *Invited* Innovations in the LC Material Developments
 9:00 and the Prospects towards the Future**

*Y. Gotoh, H. Fujita
 Chisso, Japan*

Liquid crystal (LC) material is an important component that will have the greatest effect on the display properties of all LCD components. Chisso developed the first successful LC material to use fluorine atoms as a substituent during its long years of pursuit in the development of LC materials.

**LCT6 - 2: *Invited* Syntheses and Physical Properties of New
 9:30 LCs with Negative Dielectric Anisotropy**

*H. Takatsu, S. Kawakami, G. Sudo, T. Kusumoto,
 Y. Nagashima, M. Negishi, T. Matsumoto
 DIC, Japan*

Fluorinated liquid crystals of fused ring systems with positive dielectric anisotropy are reviewed. And new liquid crystalline 1,7,8-trifluoronaphthalenes and 7,8-difluorochromans with negative dielectric anisotropy are designed and synthesized. The relationship between dielectric anisotropy and chemical structure is discussed. Some liquid crystal mixtures for VA LCD are prepared.

**LCT6 - 3: *Invited* Advanced LC Materials for Fast Switching
 10:00 Display Modes**

*A. Götz, M. Klasen-Memmer, M. Bremer, A. Taugerbeck,
 K. Tarumi, D. Pauluth
 Merck KGaA, Germany*

Continuous development of new liquid crystal (LC) materials, especially for fast switching times, has been one of the major factors for the success of LC Displays. New, fast switching display modes including appropriate and innovative LC materials for the next display generation will be discussed.

----- Break -----

10:40 - 12:40

Snow Hall B

LCT7: 15th Anniversary: State-of-the-Art LCD Modes

Chair: H. Okada, Univ. of Toyama, Japan

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

LCT7 - 1: *Invited* Progress of the High Performance LCDs

10:40

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

Optical performance of LCDs has been radically improved as evidenced by the increasing application of LCDs in high-quality televisions. This paper describes the concept of optical compensation and the fundamental characteristics of the optical properties for various LCD modes.

LCT7 - 2: *Invited* VA Mode: Promising Candidate for Upcoming New Imaging Era

11:10

*K. Okamoto**Sharp, Japan*

Ten years history from firstly commercialized MVA mode display has been reviewed. Potential of the VA mode will be discussed based on the recent development. VA mode LCDs derived from conventional MVA mode will be introduced and potential of the display performance for upcoming new imaging era will be discussed.

LCT7 - 3: *Invited* The Latest IPS-Pro Technology for LCD-TVs

11:40

*K. Ono, I. Hiyama**Hitachi Displays, Japan*

The IPS LC-mode made its debut with an excellent wide viewing angle performance in the latter half of the 1990's. Its performance has been drastically improved, and in particular, IPS-Pro technology has been used to improve the transmittance and contrast ratio. The technology researchers are aiming at reducing power consumption.

LCT7 - 4: *Invited* Development of Optically Compensated Bend Mode LCDs

12:10

*H. Wakemoto, K. Nakao, K. Nishiyama, A. Takimoto**Toshiba Matsushita Display Tech., Japan*

We have put OCB mode LCDs to practical use by developing the formation technology of bend alignment. We have improved the moving picture quality by combining black insertion with backlight blinking. A MPRT value that surpassed CRT was achieved in OCB-III. OCB-LCDs began to be applied to the advanced products.

----- Lunch -----

13:40 - 14:45

Snow Hall B

LCT8: Novel LCD Modes

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

LCT8 - 1: *Invited* Fundamental Performance of PSS-LCDs

13:40

*A. Mochizuki**Nano Loa USA, USA*

A new type of liquid crystal display drive mode based on smectic liquid crystals is introduced. This new mode enables an extremely fast optical response with wide viewing angle in the time domain by sharing most of intrinsic display platform such as a TFT array, drive electronics and mfg process.

LCT8 - 2 Dual Mode LCDs with Multistable and Dynamic Modes

14:05

*C.-Y. Huang, C.-C. Lai, Y.-H. Tseng, Y.-T. Yang,
 C.-J. Tien, K.-Y. Lo**

*Nat. Changhua Univ. of Education, Taiwan***Nat. Chiayi Univ., Taiwan*

We demonstrate a silica-nanoparticle-doped HAN device with two operation modes. Under AC excitation, the interfacial polarization effect between the LCs and nanoparticles gives the cell a fast response time for the dynamic mode. After DC excitation, the nanoparticles stabilize the homeotropically aligned LCs, giving the cell multistable switching characteristics.

LCT8 - 3 An Anisotropic Polymer-Networked Vertical-Aligned LC Cell with Fast Response

14:25

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

We report electro-optic response of anisotropic polymer-networked VA-LC cell. Optical bouncing in the turn-on process of an overdriven VA-LC cell was eliminated and the turn-off time could be reduced by up to 85 %. We studied the transmittance, the operating voltage, and the response time as functions of polymer concentration.

----- Break -----

15:00 - 16:25

Snow Hall B

LCT9: High Performance LCDs (1)

Chair: A. Mochizuki, Nano Loa USA, USA

Co-Chair: H. Fujikake, NHK, Japan

**LCT9 - 1: *Invited* Developments of FLCs and Applications
15:00 Utilizing Memory Effect***H. Amakawa, S. Kondoh**Citizen Holdings, Japan*

We have succeeded in commercialization of ferroelectric liquid crystal device for watch application using memory effect. In this paper, we will introduce our approach to achieve stable memory states, with SiO alignment, and discuss some related technical points. Finally we will show prototype panels in addition to the watch product.

**LCT9 - 2: *Invited* V-Shaped E-O Properties of Polymer
15:25 Stabilized FLC Free from Conventional Surface
Stabilization: Advanced Color Sequential LCDs***T. Fujisawa, K. Hatsusaka, K. Maruyama, I. Nishiyama,
K. Takeuchi, H. Takatsu, S. Kobayashi***DIC, Japan***Tokyo Univ. of Sci., Yamaguchi, Japan*

By an advanced polymer stabilization technology, we succeeded in fabricating novel Polymer-stabilized FLCs exhibiting V shaped switching (PSV-FLCs) with a fast response and with a free from the conventional surface stabilization. We also achieve the optical throughput from 40% level to 70% and to reduce the operation voltage.

**LCT9 - 3
15:50 Low Driving Voltage, Molecular Arrangement and
Stability of Reverse TN Mode***K. Takato, M. Akimoto, H. Kaneko, K. Kawashima,
S. Kobayashi**Tokyo Univ. of Sci., Yamaguchi, Japan*

Reverse TN (RTN) mode with LC material of opposite chiral direction shows drastically low driving voltage. The mode shows characteristic molecular arrangement of high polar angle, which induces unique properties of driving voltage, viewing angle and response time and so on.

LCT9 - 4L **Improvement of the Long-term Image Sticking in an**
16:10 **IPS-LCD by Development of LCD Cell Materials**

*H. J. Ahn, H. S. Hwang, D. -G. Kim, W. -K. Lee,
 J. W. Woo, W. S. Kim
 LG Display, Korea*

To fast release the residual DC voltage, we controlled the electrical properties of LCD materials. We also propose the simple measurement parameters which can quantitatively evaluate the image sticking phenomenon. When the resistivities of materials become lower than current, the accumulation and the extinction of residual DC voltage is improved.

----- Break -----

16:40 - 17:40

Snow Hall B

LCT10: High Performance LCDs (2)

Chair: K. Ishikawa, Tokyo Inst. of Tech., Japan
 Co-Chair: H. Amakawa, Citizen Holdings, Japan

LCT10 - 1 **Novel Advanced MVA Technology for Mobile**
16:40 **Application**

*Y.-P. Kuo, S.-C. F. Jiang, L.-P. Liu, C.-H. Lin, C.-C. Lin,
 C.-J. Hu, W.-M. Huang
 AU Optronics, Taiwan*

We have developed a novel advanced multi-domains vertical alignment (AMVA-mobile) LCD for mobile application. AMVA-mobile technology is protrusion-less structure and specific pixel structure. We made 2.4 inch VGA (640*480) panel and we got better optical performance than conventional MVA, including transmittance, contrast ratio, response time and touch mura free.

LCT10 - 2 **Optimum Design Parameters of Transflective MVA**
17:00 **LCD**

*K. H. Huang, Y. Y. Huang, C. C. Lin, C. R. Lee, H. T. Yu
 Chunghwa Picture Tubes, Taiwan*

The optimum controlling parameters for designing a transflective multi-domain vertical alignment liquid crystal display (TR-VA LCD) have been investigated. After deliberately considering these parameters, for instance, cell gap, wavelength-dependent indium-tin-oxide (ITO) thickness, the final optical performances are elevated 50% in luminance, 20% in contrast ratio and 33% in reflectivity, respectively.

**LCT10 - 3 Advanced Transflective MVA LCD with Micro Bump
17:20 Technology**

*S. W. Huang, X. H. Su, X. L. Zhou, Z. W. Chen,
S. L. Yang, T. C. Yang, C. J. Hu, W. M. Huang
AU Optronics, Taiwan*

We have successfully improved the ATR-MVA LCD by using micro bump technology which can achieve 1.25% with 7% reflective aperture ratios on AUO's 4.0 inches LCD. Furthermore, we improved the reflectance of micro bump by increasing bump density and well-controlling bump profile. We expect the reflectance can further enhance 34%.

Author Interviews

17:40 – 18:40

Supporting Organization:

The Japanese Liquid Crystal Society (JLCS)

EVENING GET-TOGETHER WITH WINE

Tuesday, December 2, 2008
18:00–20:00

Room "Houou" (30F)
Hotel Nikko Niigata
(Sponsored by Merck Ltd., Japan)

See page 9 for details

Workshop on Active Matrix Displays

Wednesday, December 3

13:20 - 14:40

Snow Hall A

AMD1: Organic TFT

Chair: M. Kitamura, Univ. of Tokyo, Japan

Co-Chair: Y. Fujisaki, NHK, Japan

AMD1 - 1: *Invited* Organic Semiconductors for Stable, High-Performance Thin-Film Transistors

13:20

*K. Takimiya, E. Miyazaki, T. Yamamoto
Hiroshima Univ., Japan*

Novel sulfur-containing fused-aromatics were developed as stable, high-performance p-channel organic semiconductors for OTFT applications. In our contribution, the molecular design strategy, synthesis, and stability of new molecular semiconductors, and the FET characteristics of the devices will be presented.

AMD1 - 2 Self-Aligned Thin Film Transistors with Ink-Jet Printing Process

13:45

*K. T. Lin, C. F. Sung, W. C. Chen, M. H. Yang, Y. Z. Lee
ITRI, Taiwan*

We report results of organic thin film transistor with ink-jet printing process. A silver layer, as the shadow mask to define source-drain, is deposited on the spin-coated photoresist layer. After developing and curing the photoresist, gate, dielectric and semiconductor layers are ink-jet printed and self-aligned to the channel.

AMD1 - 3 Evaluation of Trap Density in Organic Transistors by Applying Drain Pulse Voltage

14:05

*K. Nishita, H. Yajima, S. Naka, H. Okada
Univ. of Toyama, Japan*

Measurement method of trapped charge for an organic FET by applying drain pulse voltage has investigated. Trapped charge could be estimated by calculating difference between ideal and experimental current. Herewith, trapped carrier density was evaluated between 1.1 and $5.8 \times 10^{12} \text{ cm}^{-2} \text{ eV}^{-1}$ in a pentacene OFET with Ta₂O₅/perfluoro-resin insulator.

**AMD1 - 4L Printed OTFTs on Plastic Substrate Toward the
14:25 Realization of Flexible Display**

*K. Matsuoka^{**,*}, O. Kina^{***,*}, M. Koutake^{****,*},
K. Noda^{*****,*}, H. Yonehara^{****}, K. Yase^{*****}
^{*} Jpan Chem. Innovation Inst., Japan
^{**} Konica Minolta Tech. Ctr., Japan
^{***} Toppan Printing, Japan
^{****} DIC, Japan
^{*****} ADEKA, Japan
^{*****} Photonics Res. Inst. AIST, Japan*

We have succeeded in driving a polymer network liquid crystal display (PNLCD) by using an organic thin-film transistor (OTFT) array obtained by the microcontact printing (μ CP) method. By optimizing the fabrication condition, a pattern of line/space of $3\mu\text{m}/3\mu\text{m}$ on a 150mm-squared plastic substrate was achieved.

----- Break -----

15:00 - 16:30

Snow Hall A

AMD2: LCD Applications

Chair: M. Kimura, Ryukoku Univ., Japan
Co-Chair: S. Hirota, Hitachi, Japan

**AMD2 - 1: *Invited* Essential Technologies for Next Generation
15:00 LCD-TVs**

*Y. Yoshida, S. Imai, M. Teragawa
Sharp, Japan*

In this paper, we will describe recent signal processing technologies of LCD-TV, such as “wider color gamut display technology”, “bit-depth extension technology” and “double frame rate technology”. Then we discuss software technology of “Legacy Re-mastering technology” that controls system parameters of every technical component agilely according to content.

**AMD2 - 2 A LCD Novel Design for High Contrast Ratio
15:25**

*W. H. Lu, C. W. Chen, M. F. Tien, P. Su, T. J. Chang,
W. L. Liao, A. Lien
AU Optronics, Taiwan*

We succeeded to develop an approach by using new material, named gray bump in stead of current bump material to achieve high contrast ratio (CR) of liquid crystal display (LCD) at normal direction for MVA mode. It also reduces the oblique light leakage of dark state and improves the viewing angle.

AMD2 - 3: Invited Multi-Bit Memory in Pixel Circuit for Ultra Low Power LTPS TFT-LCD
15:45

K. Yamashita, T.-H. Wu, Y. Matsui, M.-C. Lee, S. Kawata, M. Yoshiga, N. Sumi, M. Shibazaki, Y.-C. Tsai, K. Sano
TPO Displays, Taiwan

An ultra low power 4-bit multi-bit memory in pixel (MIP) circuit was integrated into a 1.4"qQVGA reflective LTPS TFT-LCD. The power consumption of 40uW was measured. This display reproduced 16 gray levels by combined 2 sub pixels and 4 gray voltage levels. Its open aperture was 86%.

AMD2 - 4 Novel Half-Triple-Rate-Driving Method for High Resolution TFT-LCDs with an Integrated a-Si Gate Driver
16:10

C. I. Ryoo, Y. H. Jang, B. Kim, H. Y. Kim, S. C. Choi, H. N. Cho, W. S. Choi, N. W. Cho, T. W. Moon, K.-S. Park, S. Y. Yoon, C.-D. Kim, I. B. Kang
LG Display, Korea

We have developed a novel half-triple-rate driving (HTRD) method for TFT-LCDs with an integrated a-Si TFT gate driver, where 6 sub-pixels are driven with 3 gate lines and 2 data lines. The data is driven by 3-to-2 multiplexing with one and a half times higher scan frequency.

----- Break -----

Author Interviews

18:00 – 19:00

Thursday, December 4

10:40 - 12:05

Snow Hall B

AMD3/OLED4: AM-OLED

Chair: S. Horita, JAIST, Japan
Co-Chair: K. Takatori, NEC LCD Techs., Japan

AMD3/ OLED4 - 1: Invited Amorphous Oxide TFT Backplanes for Large Size AMOLED Displays
10:40

Y. G. Mo, J. K. Jeong, H. D. Kim, H. K. Chung
Samsung Mobile Display, Korea

Amorphous oxide TFT array was fabricated and a bottom-emitting 12.1 inch WXGA AMOLED display was successfully driven by it. The TFT array exhibited the field-effect mobility of 18 cm²/Vs, threshold voltage of 1.8 V, on/off ratio of 10⁹, and subthreshold gate swing of 0.28 V/dec.

AMD3/ OLED4 - 2: Invited Issues of a-Si:H TFTs & LTPS TFTs for an AMOLED Backplane

11:05

M.-K. Han, S.-G. Park, H.-S. Shin

Seoul Nat. Univ., Korea

Various thin film transistors (TFT) such as hydrogenated amorphous silicon TFT (a-Si:H TFT), low temperature poly silicon TFT (LTPS TFT) and solid phase crystallized silicon TFT (SPC-TFT) have gained considerable attentions as a pixel element of AMOLED display. We have discussed many issues on each TFT for AMOLED display.

AMD3/ OLED4 - 3 High Flexibility of AMOLED Displays on Colorless PI Substrate

11:30

Y. S. Huang, H. C. Cheng, C.-J. Liu, C.-W. Lin, K.-Y. Ho, C.-H. Cheng, S. Y. Peng, P. H. Wang, Y.-P. Chen, M.-H. Lee, H.-C. Lin, B.-C. Kung, C.-J. Tsai, Y.-T. Chen, P.-F. Lee, G.-R. Hu, J.-J. Huang, C.-C. Lee*

ITRI, Taiwan

**Nat. Taiwan Normal Univ., Taiwan*

We have demonstrated the 4.1-inch QVGA flexible AMOLED with bottom emission type, and the display was fabricated on 30um-thick colorless PI substrate. The a-Si:H TFT exhibited the field effect mobility of $0.43\text{cm}^2/\text{V}\cdot\text{s}$, the V_{th} of 2.8V, the S.S. of 0.6V/decade, and the I_{on}/I_{off} ratio is larger than 10^6 .

AMD3/ OLED4 - 4L Development of Stable, High-Performing Organic Semiconductors and TFTs

11:50

*G. Lloyd, P. Miskiewicz, M. Carrasco-Orozco, S. Tierney, J. Canisius, M. Heckmeier, D. Mueller, J. Nakanowatari**

Merck Chems., UK

**Merck, Japan*

Stable materials with high carrier mobility values up to $4\text{cm}^2/\text{Vs}$ have been developed and formulated to maximize performance, enhance stability and simplify processing conditions. We demonstrate highly stable organic thin film transistors and highlight the importance of the dielectric in enhancing the performance as well as the stability.

----- Lunch -----

13:20 - 16:20

Exhibition Hall B

Poster AMDp1: Organic TFT**AMDp1 - 1 Improved Stability of Organic Thin Film Transistors for OLED Backplane Application**

J.-Y. Yan, L.-H. Chen, J.-L. Liao, K.-P. Liao, M.-R. Lin, T.-W. Lee, S.-T. Yeh, K.-Y. Cheng, Y.-Y. Wu, C.-H. Yu, Y.-Y. Lee, J.-C. Ho

ITRI, Taiwan

In this article, we study the stability of organic thin film transistors (OTFTs) by different fabrication process and electrical stress conditions. The results indicate that the stability is strongly influenced by the gate and drain voltage. After optimize the fabrication process, the lifetime of OTFTs can be achieved to 10^7 s.

AMDp1 - 2 Post-Annealing Effects of Al₂O₃ Gate Dielectric Fabricated with E-Beam Process in Organic Thin-Film Transistors

G. W. Hyung, K. M. Choi, J. R. Koo*, J. H. Kim, S. J. Kwon*, Y. K. Kim*

Hongik Univ., Korea

**Kyungwon Univ., Korea*

We fabricated a pentacene thin-film transistor with an Al₂O₃ layer using e-beam process with post-annealing and obtained a device with better electrical characteristics at low operating voltages. device was found to have a field-effect mobility of 0.27cm²/Vs, a threshold voltage of -1.2 V, and an I_{on/off} of 2×10^5 .

13:20 - 16:20

Exhibition Hall B

Poster AMDp2: LCD Applications**AMDp2 - 1 Low Power Consumption IPS/FFS TFT-LCD Structure**

G. L. Zhao, C. T. Liao, Y. W. Chiu, T. C. Chung, T. S. Jen
InfoVision OptoElect., China

JiangSu (IVO) Flat Panel Display Tech. Res. Inst., China

A novel IPS/FFS TFT-LCD structure with low power consumption was proposed. This structure was composed of two level Vcom and zigzag-inversion pixel layout arrangement. In this way, we can reduce the swimming of output signal voltage in driver ICs and get 25% power saving in check sub-pixel pattern.

AMDp2 - 2 A Simple Process to Manufacture a-Si TFT LCDs with High Aperture Ratio and Low Power Consumption

*H. L. Lin, C. H. Lin, C. J. Hu, W. M. Huang
AU Optronics, Taiwan*

Traditionally, LCD panels are manufactured by LTPS due to transmittance, power consumption and border width. We have designed a 2.4" WQVGA a-Si panel. It can not only reach high transmittance and slim borders, but also simplify process steps compared to LTPS. Then, the yield and throughput will improve when manufacturing.

AMDp2 - 3 Low Power Consumption for FHD TFT-LCDs with 2Z-Inversion Pixel Structures

*C. C. Yeh, L. S. Lin, E. T. Kuo, S. C. Lin, K. C. Lee,
C. H. Yu
HannStar Display, Taiwan*

LCDs need the low power consumption feature with high image quality. We present 2Z-inversion pixel structures, which implemented 1+2V1H twin-dot inversion on TFT with the column-inversion driving scheme to achieve both requirements. A 28inch WUXGA panel with over 20% power saving could be obtained as traditional dot inversion driving scheme.

AMDp2 - 4 Analysis of Horizontal Crosstalk for HFFS Mode TFT-LCDs

*Y.-C. Chang, S. Yan, T.-H. Hsieh, C. Yang, J.-P. Pang
InnoLux Display, Taiwan*

The structure of HFFS pixel is currently applied in TFT-LCDs, while this structure suffers from serious horizontal crosstalk when operated at higher frame rate. The focus on high frame rate horizontal crosstalk has been investigated and the alleviation strategy for the reduction of crosstalk is shown in this study.

AMDp2 - 5 Novel Method for DC Offset Measurement and Compensation to Improve the Image-Sticking of TFT-LCDs

*Y. B. Qiao, L. B. Mao, S. N. Zhang, S. J. Kong,
T. C. Chung, Y. W. Chiu, C. T. Liao, T. S. Jen
InfoVision OptoElect., China
JiangSu (IVO) Flat Panel Display Tech. Res. Inst., China*

We developed a Fast Fourier Transform (FFT) based DC offset-voltage measurement system to obtain the internal DC offset voltage in gray levels of L0, L128 and L252 of TFT-LCDs. Accordingly, we can compensate the signal voltages to improve the image-sticking performance for TFT-LCDs.

AMDp2 - 6 3-in. WVGA LTPS TFT-LCD with Narrow Border Design

*C. Y. Hsu, C. J. Shih, C. C. Kuo, C. P. Ku, C. K. Yu,
Y. F. Liao, M. S. Wu*

Chunghwa Picture Tubes, Taiwan

A 3" WVGA (800x480) LTPS (Low Temperature Poly Silicon) TFT LCD with narrow border has been presented using integrated gate driver circuit and multiplexer circuit. We proposed a architecture to design LCD panel with high resolution (313 ppi) and narrow border (1.1mm) for high-end application, like cell-phone for mobile TV.

AMDp2 - 7 Application of Laser Direct Writing to Organic-Based Passivation a-Si:H TFT-LCD

*K.-H. Su, Z.-N. Chen, F.-W. Chang, Y.-C. Lai,
M.-C. Wang, S.-W. Liang*

Taiwan TFT LCD Assn., Taiwan

Laser direct writing technology in TFT panel fabrication has been carried out by KrF excimer laser. Organic photoresist material with dielectric constant = 3.83 is served as dielectric passivation layer in our device. From TFT device performance and functional TFT panel demonstration, it's a promising method to replace photolithography.

13:20 - 16:20

Exhibition Hall B

Poster AMDp3: AM-OLED

AMDp3 - 1 Power Decoupled Driving Method for Large Size AMOLED Displays

*S. M. Choi, C. G. Kang, E. J. Lee, H. G. Seo, D. H. Ryu,
K. N. Kim, H. D. Kim*

Samsung Mobile Display, Korea

AMOLED is current driven device. This current induces the voltage drop and a main cause of poor uniformity for large size displays. We propose a new design method to solve that issue. We confirmed that it takes effect to improve uniformity by 11.9% than that of conventional method.

SID 2009

International Symposium, Seminar and Exhibition

May 31 – June 5, 2009

San Antonio, Texas, USA

13:20 - 16:20

Exhibition Hall B

Poster AMDp4: Poly-Si TFT**AMDp4 - 1 Dehydrogenation and Lateral Crystallization of Nanocrystalline Silicon Film Using Solid-State Continuous-Wave Green Laser**

T. Sato, W. Umezu, K. Yamamoto^{}, A. Hara, K. Kitahara^{*}*
Tohoku-Gakuin Univ., Japan
^{}Shimane Univ., Japan*

By optimizing the dehydrogenation of an nc-Si film using a DPSS CW green laser, we succeeded in fabricating a large lateral poly-Si film without employing thermal dehydrogenation. The result leads to the monolithic integration of TG poly-Si TFTs and TG nc-Si TFTs on the same substrate.

AMDp4 - 2 Effect of Y_2O_3 Content in a YSZ Seed Layer on Crystallization of a Low-Temperature-Deposited Si Film

S. Hana, S. Horita
JAIST, Japan

On a glass substrate covered with HF-etched YSZ layer, after ethanol rinsing, a crystallized Si film was obtained at $\leq 430^\circ\text{C}$. The Y_2O_3 content of the YSZ gave a strong effect on the surface chemical composition after the HF-etching, which subsequently determines the Si film's degree of crystallization.

AMDp4 - 3 Influence of Laser Plasma Soft X-Ray Irradiation on Nucleation of Crystal Grain in a-Si Film

Y. Takanashi, K. Masuda, A. Heya, S. Amano,
S. Miyamoto, N. Matsuo, T. Mochizuki
Univ. of Hyogo, Japan

We investigated the influence of Laser Plasma soft X-ray(LPX) irradiation on a-Si film structure for low-temperature crystallization. The optical transmittance of a-Si film was increased by LPX irradiation around 500 nm. This phenomenon relates to movement of Si atom in a-Si film.

AMDp4 - 4 Suppression of Short Channel Effect of Thin-Film Transistor by Very Thin SiN_x Film Formed at Source and Drain Region

T. Kobayashi, K. Ohkura^{}, N. Matsuo, A. Fukushima,
A. Heya, S. Yokoyama^{*}
Univ. of Hyogo, Japan
^{*}Hiroshima Univ., Japan*

The influence of the thin SiN_x film formed at the interface between the poly-Si source/drain and Al electrode on the short channel effect of the scaled down polysilicon thin-film transistor (TFT) is examined. The hump effect disappears and the subthreshold swing decreases for the TFT with the SiN_x film.

AMDp4 - 5 Performance Enhancement of Multi-Gate Poly-Si TFTs with Gate-Overlap Structure

*Y. C. Hsu, C. C. Shih, J. S. Chen, W. M. Huang
AU Optronics, Taiwan*

We proposed a new multi-gate poly-Si TFTs design for LTPS panel, which exhibits better essential characteristics on on-current, mobility, (photo) leakage current and trap-state density. Reliability was also improved in this structure.

AMDp4 - 6 Potential Barrier and Carrier Transport at Grain Boundary in Poly-Si Thin-Film

M. Kimura^{,**}
^{*}Ryukoku Univ., Japan
^{**}Thin Film Materials & Devices Meeting, Japan*

Potential barriers and carrier transport at grain boundaries in poly-Si thin-films are analytically calculated in consideration of energy distributions of trap densities. Dependences on the trap densities and dopant densities are shown. Potential barriers and carrier transport calculated using this analytical method are consistent with those calculated using device simulation.

AMDp4 - 7 Complete Extraction of Trap Density in Poly-Si TFTs

*T. Yoshino, K. Harada, T. Yasuhara, M. Kimura
Ryukoku Univ., Japan*

We have developed an extraction technique of the trap densities at front- and back-interfaces and grain boundaries using C-V and I-V characteristics and 2-D device simulation. The actual trap densities were separated and extracted for a poly-Si TFT fabricated using ELC and oxygen-plasma treatment for the first time.

AMDp4 - 8 A New NBTI Characterization Method on Polycrystalline Silicon Thin-Film Transistors

H.-C. Sun, C.-F. Huang, Y.-T. Chen, C. W. Liu, Y.-C. Hsu, C.-C. Shih*, J.-S. Chen**
Nat. Taiwan Univ., Taiwan
**AU Optronics, Taiwan*

Three negative bias temperature instability characterization methods are investigated and compared on p-channel polycrystalline silicon thin-film transistors. An improved Delay- $I_{D,lin}$ method with new waveform is proposed to extract threshold voltage shift and mobility degradation separately. The fast, accurate method is beneficial for the reliability analyses for the display technologies.

AMDp4 - 9 The Characteristics of the Asymmetric-Offset Structure N-Type Polycrystalline Thin-Film Transistors Fabricated by Alternating Magnetic-Field-Enhanced Rapid Thermal Annealing

*W.-K. Lee***, S.-G. Park*, D.-W. Kang*, B.-S. Jeong**, J. Choi**, C.-W. Kim**, M.-K. Han**
**Seoul Nat. Univ., Korea*
***Samsung Elect., Korea*

We fabricated asymmetric-offset structure poly-Si TFTs which reduced the leakage current considerably and have remarkable reliabilities. The AOS TFTs can be made without additional doping processes. The large drain-side offset and small source-side offset could greatly suppress the leakage current without sacrifice the ON-current with increasing V_{DS} and decreasing V_{GS} .

13:20 - 16:20

Exhibition Hall B

Poster AMDp5: Oxide TFT

AMDp5 - 1 Colloidal ZnO Nanocrystals-Based Transparent Field-Effect Transistors

J. J. Lee, G. W. Hyung, J. S. Lee, Y. K. Kim, H. Yang
Hongik Univ., Korea

Colloidal ZnO nanocrystals were used for fabrication of transparent TFTs. ZnO nanocrystals blended with PVP were spin-cast. Transmittance of the device reached ~80% in the visible region. The device exhibited the drain current with on/off ratio $>10^5$, threshold voltage of -3 V, and field-effect mobility of $0.2 \text{ cm}^2/\text{V}\cdot\text{s}$.

AMDp5 - 2 A Study of Solution Based In-Ga-Zn-Oxide Nano-Particle Thin Film Transistor Devices

*Y. H. Yang, S. S. Yang, C. Y. Kao, K. S. Chou
Nat. Tsing Hua Univ., Taiwan*

We introduce a simple and low cost method to synthesize a transparent In-Ga-Zn-Oxide (IGZO) nano-particle solution. A thin film transistor with the active layer of IGZO is fabricated by the inkjet printing process. The electrical properties of the element are measured and presented.

13:20 - 16:20

Exhibition Hall B

Poster AMDp6: Amorphous Si TFT

AMDp6 - 1 Stability of Low Temperature Hydrogenated Amorphous Silicon Thin Film Transistors on Generation II Size Colorless Polyimide Substrate

*J. J. Huang, B. C. Kung, G. R. Hu, Y. P. Chen, H. C. Lin,
C. J. Tsai, C. J. Liu, K. Y. Ho, P. F. Lee, C. H. Cheng,
Y. S. Huang, C. C. Lee
ITRI, Taiwan*

The a-Si:H TFTs were fabricated on colorless polyimide (PI) at 160°C. Time and temperature dependences of a-Si:H TFT of the ΔV_{th} under electrical stress were investigated in this article. We found that the degradation of device characteristic in parallel channel direction bending is smaller than in perpendicular channel direction bending.

AMDp6 - 2 The Self-Heating Behavior in a-Si:H Thin Film Transistors Liquid Crystal Display under Transient Current Measurement

C. Y. Liang^{,**}, C. Y. Wu^{**}, H. L. Chen^{**}, F. S. Yeh^{*},
T. C. Chang^{***,****}*

^{}Nat. Tsing Hua Univ., Taiwan*

*^{**}AU Optronics, Taiwan*

*^{***}Nat. Sun Yat-Sen Univ., Taiwan*

*^{****}Ctr. for NanoSci. & Nat. Sun Yat-Sen Univ., Taiwan*

A system using micro-second pulses, instead of DC measurement, is necessary for rapid operated devices in circuit. Through transient measurement, the real output characteristics of large size a-Si:H TFTs could be obtained without the additional self-heating effect. Moreover, the more correct circuit power consumption can be achieved by transient measurement.

AMDp6 - 3 Effect of Mechanical and Electrical Stresses on the Performance of an a-Si:H TFT on Flexible Tungsten Foil

*W. G. Lee, J. H. Cheon, T. H. Lim, J. Jang, P. Kumar**
Kyung Hee Univ., Korea
**H. C. Starck, USA*

We studied the effect of mechanical and electrical stresses of hydrogenated amorphous silicon thin-film transistors (a-Si:H TFTs) on flexible tungsten foil. The individual transistors were strained by inward (compression) or outward (tension) cylindrical bending with parallel to the source-drain current path.

AMDp6 - 4 The Influence of Self-Heating Effect on the Electrical Instability of Hydrogenated Amorphous Silicon TFTs

C. C. Chiu, C. C. Shih, J. S. Chen, W. M. Huang
AU Optronics, Taiwan

We had investigated the instability of a-Si:H TFTs which channel width ranges from 30 μm to 6000 μm . It was found that applied high voltage on the drain electrode induced serious V_T shift in large channel width TFTs. This phenomenon is ascribed to self-heating induced V_T shift effect.

AMDp6 - 5 Stability Influence with Various Back-Channel Etch Type of a-Si:H TFT

C.-S. Wei, P. M. Chen, Y.-S. Lee, T.-Y. Peng, M.-S. Chen,
W.-M. Huang
AU Optronics, Taiwan

The various back-channel etch type of RIE, ICP and PE mode influenced on the ON current and stability have been investigated. Channel etch type of PE mode is the best method for highly stability, ON current, field effect mobility, and threshold voltage.

AMDp6 - 6 Energy Spectral Characteristics of Various Backlights in Terms of Photocurrent of a-Si:H Thin Film Transistor

K. M. Choi, S. J. Kwon, E. S. Cho
Kyungwon Univ., Korea

Photo-leakage characteristics of hydrogenated amorphous silicon (a-Si:H) thin film transistor (TFT) were obtained for the illuminations from various backlight sources and the results were analyzed by using the spectral characteristics and their conversions to photon energy spectrums of the different backlights. From the analysis, it was possible to conclude the converted photon energies are proportional to the photo-leakage currents and the absorption of the illuminated light to a-Si:H layer and the generation of electron-hole pairs are mainly carried out at the wavelength less than 500 nm.

AMDp6 - 7 The Effect of Light under Electrical Bias Stresses on Amorphous Silicon Thin Film Transistors as Photo Sensor

*T.-J. Ha, H.-S. Park, S.-H. Kuk, D.-W. Kang, M.-K. Han
Seoul Nat. Univ., Korea*

We analyzed the effect of light under electrical bias stresses on a-Si TFTs as photo sensors. The instability caused by electrical gate bias stresses with light illumination was more enhanced than that without light illumination. The results are due to the increase of carrier density caused by light illumination.

13:20 - 16:20

Exhibition Hall B

Poster AMDp7: Late News

AMDp7 - 1L Characterization of Poly-Si TFT at Temperatures from 1.5 K to 300 K

*T. Serikawa
Osaka Univ., Japan*

Poly-Si TFTs were measured in a wide temperature range to clarify poly-Si film property. Measurements at temperature lower than 10 K showed that conduction mechanism obeys interactions between shallow-level and conduction band. This is caused from that grain boundaries with very low dangling-bond density are formed in the poly-Si film.

AMDp7 - 2L High Field-Effect Mobility Pentacene Thin-Film Transistors with Organic and Inorganic Hybrid Dielectric

*M. H. Chung, J. H. Kwon, S. I. Shin, J. Choi, K. H. Cho,
S. Nahm, B. K. Ju
Korea Univ., Korea*

We fabricated pentacene thin-film transistors (TFTs) with organic and inorganic hybrid gate dielectric consisting of $\text{Bi}_5\text{Nb}_3\text{O}_{15}$ (B_5N_3) and cross-linked poly(4-vinylphenol) (PVP). We obtained excellent electrical characteristics, including field-effect mobility (μ) of $1.37 \text{ cm}^2/\text{V}\cdot\text{s}$, current on/off ratio of $\sim 10^5$, and subthreshold slope (SS) of $2.16 \text{ V}/\text{dec}$.

AMDp7 - 3L Decoder Type a-Si:H Gate Driver

N. H. Jeong, Y. T. Chun, J. W. Kim*, B. S. Bae
Hoseo Univ., Korea
Samsung Advanced Inst. of Tech., Korea

A new decoder type a-Si:H TFT gate driver was developed. The gate driver composed of 11 TFTs and 2 capacitors. The gate driver operated by input digital signal. Output voltage of the gate driver was $-4.9 \sim 25.5 \text{ V}$. Rise and fall times was $15 \mu\text{s}$ and $20 \mu\text{s}$, respectively.

AMDp7 - 4L High Mobility and Stability Microcrystalline Silicon Process for TFT Using Conventional PECVD

T. K. Won, J. Chen, S. Y. Choi, S. K. Beck, D. K. Yim, J. M. White

AKT America, An Appl. Materials, USA

We have investigated the effects of H_2/SiH_4 gas ratio and Ar gas on μ c-Si film growth and developed highly crystalline film having a columnar grain structure and virtually no incubation layer at interface. Bottom gate back-channel-etch TFT was fabricated and mobility $1.15\text{cm}^2/\text{Vsec}$ with good stability under bias condition was demonstrated.

AMDp7 - 5L Effective Deposition of Nanocrystalline Silicon Thin Films at 200 °C by Catalytic CVD

T.-H. Kim, K.-M. Lee, J.-D. Hwang, Y. J. Lee, S. H. Won, J. H. Sok, K. W. Park, W.-S. Hong

Univ. of Seoul, Korea

We attempted the change in the hydrogen dilution ratio with deposition time in a Cat-CVD system to achieve both the minimal incubation layer and the high throughput. We obtained the incubation layer thickness of 3 nm, and were able to grow a 200 nm-thick film in 18 minutes.

AMDp7 - 6L Effect of Etch Process Variation on Brightness Non-Uniformity in AMOLED Pixel Circuit

W. J. Nam, S. K. Lee, S. J. Hwang, J. S. Shim, Y. S. Jeong, S. J. Bae, J. Y. Park, C. W. Han, Y. H. Tak, B. C. Ahn

LG Display, Korea

We briefly report analysis on local brightness non-uniformity, possibly due to a process variation as well as a driving scheme. The capacitances of capacitors in the pixel are varied by etch bias distribution. It could cause variation of data addressing, possibly resulting in local area mura phenomena.

AMDp7 - 7L Fabrication of High Performance Pentacene TFTs Using TX-100 in PVP Gate Dielectric

K.-C. Song, K.-H. Baek, J.-Y. Shim, S.-S. Park, H.-S. Shin, D. J. Kim^{}, K. J. Lee^{*}, L.-M. Do*

ETRI, Korea

^{}Chungnam Nat. Univ., Korea*

We have fabricated high performance pentacene organic thin-film transistor (OTFT) using formulated poly(4-vinylphenol) (PVP) gate dielectric on glass substrate. The formulated gate dielectric layer was composed of PVP, poly(melamine-co-formaldehyde) (PMF) and Triton X-100 (TX-100). The TX100 is a surfactant which is dispersed evenly and it makes good surface roughness.

AMDp7 - 8L The Intergrated a-Si:H Gate Driver Circuit Using Channel Shield Pattern for HDTV/XGA

*S. K. Han, H. Choi, K. S. Oh, K.H. Moon, C. G. Lee, S. Y. Choi**

LG Dispaly, Korea

**Kyungpook Nat. Univ., Korea*

The Intergrated a:Si:H Gate Driver Ciruits are described, especially focusing on the charging and discharging time for HDTV/XGA. The result of UTMOST and SMARTSPICE simulator shows a novel gate driver architecture has been reduced 11.5% (Charing Time) and 12.1% (Discharging Time) for conventional structure.

AMDp7 - 9L Advanced Data Line Reduction Design for Low Cost Landscape TFT-LCDs

C. J. Shih, C. P. Ku, C. Y. Hsu, C. C. Kuo, M. S. Wu, W. Z. Wang

Chunghwa Picture Tubes, Taiwan

A 8.9" WSVGA (1024x600) landscape a-Si TFT has been proposed using advanced data line reduction method. Totally 600 data lines are designed to minimize the cost of driver ICs. Comparing the triple-gate RGB pixel structure [1], the present menthod could further reduce the cost of data driver ICs 30%.

AMDp7 - 10L Novel Row-Inversion IC with Reduced Flicker and Cross-Talk for Low-Cost and Low-Power LCD Applications

H. L. Ong, J. S. Chou

Kyoritsu Optronics, Taiwan

We invented a row-inversion driving scheme to reduce display flicker and cross-talk. Multi-domain alignment (MVA) LCDs were successfully fabricated using the improved row-inversion IC and achieving high image quality, very high contrast ratio, and super wide viewing angle, all while keeping low cost, low voltage, and low power advantages.

AMDp7 - 11L The Power Consumption Research of Stressed Integrated a-Si Gate Driver

K. H. Lee, K. H. Cheng, Y. J. Hsieh

AU Optronics, Taiwan

The power consumption of stressed and unstressed integrated a-Si gate driver is investigated. The power consumption decreases about 40.7% after RA test, which is measured in room temperature(25°C). The reason is the decayed IV curve of TFT after RA test.

AMDp7 - 12L Characteristics of a-Si:H Dual-Gate TFT Using Pixel Electrode of Back Gate with Large Width for Gate Driver

*K. H. Moon, Y. S. Cho, H. Choi, C. T. Kim, C. G. Lee, S. Y. Choi**

LG Display, Korea

**Kyungpook Nat. Univ., Korea*

In this paper was investigated the characteristics of a-Si:H dual-gate thin film transistor using pixel electrode of back gate with large width for gate driver in liquid crystal display. The simulation result of Athena simulator shows the back channel was controlled by the back gate bias.

AMDp7 - 13L Channel Shield TFT (CST) by Pixel Electrode for Suppression of Leakage Current

*K. H. Moon, H. Choi, S. K. Han, S. M. Park, C. G. Lee, S. Y. Choi**

LG Display, Korea

**Kyungpook Nat. Univ., Korea*

The a-Si:H TFT device using channel shield metal was investigated for suppression of leakage current. This is very important design issue owing to crosstalk and flicker. The proposed device has been reduced by 86.6% (Ioff) and 0.877% (Voltage Holding Ratio) for conventional structure.

15:00 - 15:50

Room 201

MEMS4/AMD4: MEMS Displays and Imaging

Chair: M. Scholles, Fraunhofer IPMS, Germany

Co-Chair: M. Bellis, Meradia, USA

MEMS4/ AMD4 - 1: Invited MEMS-Based Direct View Displays Using Digital Micro Shutters

15:00

N. W. Hagood, L. Steyn, J. Fijol, J. Gandhi, T. Brosnihan, S. Lewis, G. Fike, R. Barton, M. Halfman, R. S. Payne Pixtronix, USA

The Pixtronix DMS™ (Digital Micro Shutter) display technology, based on MEMS micro-shutters, is presented. Experimental performance achieved on 2.5" QVGA samples is shown, including 24-bit color, 145% NTSC (CIE 1976) color gamut, 400:1 contrast ratio, and 170° view angles, all at 1/4 the power consumption of comparable TFT-LCD display modules.

**MEMS4/
AMD4 - 2
15:20** **MEMS Membrane Switches Backplane for Matrix
Driven Large Sign Display**

K. Senda, B. S. Bae^{}, M. Esashi^{**}
Sumitomo Precision Prod., Japan
^{*}School of Display Eng., Korea
^{**}Tohoku Univ., Japan*

We successfully developed membrane switches using FPC (flexible printed circuit) material and process. Such a process has the progress of low cost backplane for flexible large signage display. We applied fabricated membranatne switches to electrophoretic display for active matrix driving.

**MEMS4/
AMD4 - 3
15:35** **Active Matrix Flexible Display Array Fabricated by
MEMS Printing Techniques**

C. Lo, O.-H. Huttunen^{}, J. Iitola-Keinanen^{*}, J. Petaja^{*},
J. Hast^{*}, A. Maaninen^{*}, H. Kopola^{*}, H. Fujita,
H. Toshiyoshi
Univ. of Tokyo, Japan
^{*}VTT Tech. Res. Ctr. of Finland, Finland*

A fully printing techniques fabricated active matrix display array was demonstrated on flexible substrate by using Fabry-Perot interference effect. Printing techniques of flexography, lift-off, gravure, and lamination were used for roll-to-roll-ready process on 125 μ m polymer substrate. Red, green, and blue colors were successfully tuned for realization of full color.

**MEMS4/
AMD4 - 4** **Withdrawn**

----- Break -----

Author Interviews

18:00 – 19:00

Friday, December 5

9:00 - 10:20

Snow Hall A

AMD5: Poly-Si TFT

Chair: M.-K. Han, Seoul Nat. Univ., Korea
Co-Chair: S. Utsunomiya, Seiko Epson, Japan

AMD5 - 1: *Invited* Novel Rapid Crystallization Technique for Amorphous Silicon Utilizing the Thermal Plasma Jet
9:00

*H. Shirai, K. Haruta, J. K. Saha**
Saitama Univ., Japan
**JST, Japan*

The current research activities on the crystallization of amorphous silicon (a-Si) utilizing the thermal plasma jet is reviewed. The film crystallization is promoted for a-Si:H on quartz and a-SiN/CrMo hetero structure. The linear atmospheric thermal plasma source has been developed for large-area processing of TFTs.

AMD5 - 2 The Leakage Current and Stability of LTPS TFTs and Lateral Diodes
9:25

N. D. Young, R. Kakkad, K. Hashimoto***
Philips Res. Labs., UK
**TPO Displays, Taiwan*
***TPO Displays Japan, Japan*

Measurements of dark currents and photocurrents in LTPS TFTs and lateral NIP diode structures have been made, and a semi-physical model has been developed. Additionally, the stability of these devices has been assessed, and characteristic parameters have been deduced for the degradation. This enables optimal design of LTPS products.

AMD5 - 3 Plasma Processing in the Fabrication of Silicon-on-Glass (SiOG) Thin-Film Transistors
9:45

C. K. Williams, J. G. Couillard, C. Wang, J. Cites, J. H. Cheon, S. H. Park*, J. W. Choi*, J. Jang**
Corning, USA
**Kyung Hee Univ., Korea*

A Plasma processing is widely used for TFT fabrication processing. We present an empirical study on plasma etching of crystalline silicon on glass as a thinning and surface treatment step that enhances TFT performance in terms of carrier mobility, threshold voltage and subthreshold swing values and their variations.

AMD5 - 4L Highly Uniform Single-Grain Si TFTs Inside (110) Orientated Large Si Grains
10:05

T. Chen, R. Ishihara, A. Baiano, K. Beenakker
Delft Univ. of Tech., The Netherlands

Highly uniform single-grain (SG) TFTs have been realized by integrating MILC and μ -Czochralski process. (110) orientated grains with 6 μ m diameter were obtained on pre-determined positions. Ni concentration was decreased below SIMS detection-limit. Standard deviation of mobility was improved to 6%. This process is promising for integrating 3D-IC on glass substrate.

10:40 - 12:05

Snow Hall A

AMD6: System On Glass

Chair: K. Yamashita, TPO Displays, Taiwan
 Co-Chair: M. Hiramatsu, TMD, Japan

AMD6 - 1: *Invited* In-Cell Touch Panel with Embedded Active Matrix Capacitive Sensors by Using LTPS Technology

E. Kanda, T. Eguchi, Y. Hiyoshi, T. Chino, Y. Tsuchiya, T. Iwashita, T. Ozawa, T. Miyazawa, T. Matsumoto
Seiko Epson, Japan

We have developed a 2" in-cell touch panel with embedded active matrix capacitive sensors which detect a change in liquid crystal capacitance when touched. It has several advantages over conventional external touch panels in terms of thickness, weight, lack of restrictions of touching objects, and Multi-Touch capability.

AMD6 - 2 A New Touch Sensitive Active Matrix Display with Embedded Light Sensors

H.-S. Park, T.-J. Ha, S.-B. Ji, J.-H. Lee, B.-J. Lee*, B.-H. You*, N.-D. Kim*, M.-K. Han*
Seoul Nat. Univ., Korea
**Samsung Elect., Korea*

We present a new touch sensitive hydrogenated amorphous silicon display with embedded optical sensor arrays. The touch-panel operation was successfully demonstrated by fabricating a prototype of the 16-inch active-matrix liquid crystal display. The proposed system eliminates the need for the extraction of information from the captured images in real-time.

AMD6 - 3 Static Sequential Logic Circuit Using CMOS Dynamic Technology for LTPS TFT

Y. Suga, Y. Suzuki, S. Imai, T. Satoh*
Tokai Univ., Japan
**Sharp, Japan*

In this paper, the static sequential logic circuit using the CMOS dynamic circuit technology for LTPS TFT-LCD panel is proposed. The proposed circuit realizes high-speed operation and low-power consumption due to applying the CMOS dynamic circuit technology. And the new circuit can be also realized an operation at the low-frequency.

AMD6 - 4 Novel a-Si:H Gate Driver with Highly Reliable Center-Offset TFTs
11:45

*M. S. Kwon, J. W. Choi, J. I. Kim, S. H. Kim, D. H. Oh,
S. W. Lee, J. Jang
Kyung Hee Univ., Korea*

We developed a stable a-Si:H TFT gate driver comprising 3 pull-down TFTs with center-offset structure. Measurement results show that the V_{th} shift of a center-offset TFT is remarkably improved compared with conventional TFT. Therefore, the lifetime of the proposed gate driver is much longer than that of prior gate driver.

----- Lunch -----

13:20 - 14:40

Snow Hall A

AMD7: Amorphous Oxide TFT

Chair: Y. G. Mo, Samsung SDI, Korea
Co-Chair: H. Hamada, Sanyo Elec., Japan

AMD7 - 1: Invited Application of Transparent Amorphous Oxide TFT to Electronic Paper
13:20

*M. Ito, C. Miyazaki, N. Ikeda, K. Murata, M. Ishizaki,
Y. Kokubo, Y. Ugajin
Toppan Printing, Japan*

Application of transparent amorphous oxide semiconductor (TAOS) to electronic paper is reviewed. We have successfully driven 5.35 inch flexible electronic paper with 150 ppi by TAOS TFT array. Taking advantage of transparent property of TAOS, reversible display and our original display structure, "Front Drive" Structure are demonstrated.

AMD7 - 2 Bias Temperature Stress Study of RF Sputter Amorphous In-Ga-Zn-O TFTs
13:45

T.-C. Fung, K. Abe, H. Kumomi*, J. Kanicki*
Univ. of Michigan, USA
Canon, Japan

Both positive and negative bias-temperature-stress (BTS) are applied and found to cause a positive and negative shift in a-IGZO TFT transfer characteristics, respectively. We used the stretch-exponential equation to model BTS induced ΔV_{th} on a-IGZO TFT. Stress voltage and temperature dependence of ΔV_{th} evolution are described.

AMD7 - 3 **Al-Zn-Sn-O Thin Film Transistors with Top and Bottom Gate Structure for AMOLED**
14:05

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

We have fabricated the transparent bottom and top gate TFTs using new material of Al-Zn-Sn-O as an active layer which was deposited by room temperature sputtering. The bottom gate structure showed good electrical performance, however, the bias stability was relatively poor. It was significantly improved in the top gate structure.

AMD7 - 4 **Withdrawn**

AMD7 - 5L **Novel 4-mask Process for InGaZnO TFTs with Self-aligned Technique Using Direct Patterned Electrodes and Inkjet**
14:25

*R. Takahashi, M. Itagaki, N. Miura, R. Iijima, Y. Shinkai
 Brother Industries, Japan*

IGZO TFTs were developed by a novel 4-mask process, which comprises direct-patterning of NiP for All electrodes, self-aligned etching of a channel layer isolated by inkjet patterning and solution coating of gate insulators. The IGZO TFTs exhibited a mobility of 13.1 cm²/Vs and high stability against gate-bias stress.

----- Break -----

15:00 - 16:15

Snow Hall A

AMD8: Crystalline Oxide TFT

Chair: N. D. Young, Philips Res. Lab., UK
 Co-Chair: Y. Yamamoto, Sharp, Japan

AMD8 - 1 **Investigation of Instability Mechanisms in Zinc Oxide Thin-Film Transistors under Bias Stress**
15:00

*M. Furuta, T. Hiramatsu, T. Matsuda, H. Nitta, T. Hirao
 Kochi Univ. of Tech., Japan*

Stability of ZnO TFTs under BT stress has been investigated. Negative charge trapping is a dominant mechanism of V_t shift. In addition to the charge trapping, defects are created in ZnO film under high V_{GS} stresses. Significant acceleration of V_t shift and state creation were not observed by V_{DS} stresses.

**AMD8 - 2 Theoretical Analysis of IGZO Transparent
15:20 Amorphous Oxide Semiconductor**

*M. Takahashi, H. Kishida, A. Miyanaga, S. Yamazaki
Semiconductor Energy Lab., Japan*

We investigated the electronic structure of In-Ga-Zn-O (IGZO). We found that the conduction path on the plane of Indium is strongly affected by Gallium atoms; furthermore, the formation energy of oxygen vacancy in IGZO is higher than that of typical conductive metal oxide such as In_2O_3 and ZnO.

**AMD8 - 3 New Challenge to Oxide TFT Backplane Technology:
15:40 Using n-Type TiO_2 Active Channel Layers**

J.-W. Park, N. Jeon, J. Jang, S.-W. Han, S. Yoo
KAIST, Korea
Techno-Semichem, Korea

We present new n-type oxide thin-film transistors (TFTs) made of transparent TiO_2 active channels prepared by solution process and MOCVD technique, respectively. Field-effect mobility at saturation region (μ_{sat}) and threshold voltage (V_{th}) of TiO_2 active channel TFTs were extracted to be approximately $0.06\sim 0.12 \text{ cm}^2\text{V}^{-1}\text{sec}^{-1}$ and 6.7-15V for both deposition methods.

**AMD8 - 4L Artificial Retina Using Thin-Film Devices- Grayscale
16:00 Detectability, Moving-Image Capturing and Color
 Sensitivity -**

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

Grayscale detectability, moving image capturing and color sensitivity of the artificial retina using thin-film devices are evaluated. It is found that the output voltage is correctly measured with changing the illuminance, location and color of the incident light.

Author Interviews

17:40 – 18:40

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
Thin Film Materials & Devices Meeting

Workshop on FPD Manufacturing, Materials and Components

Wednesday, December 3

13:20 - 14:40

Room 301

FMC1: Manufacturing I

Chair: I. Bitá, Qualcomm MEMS Techs., USA
Co-Chair: N. Miyatake, Mitsui Eng. & Shipbuilding, Japan

**FMC1 - 1: *Invited* Mirasol Displays: Technology and
13:20 Manufacturing of Interferometric MEMS on Large
Area Glass Substrates**

I. Bitá
Qualcomm MEMS Techs., USA

mirasol™ displays are new low power MEMS-based reflective displays developed and commercialized by Qualcomm. Innovative design and fabrication solutions are described that allow mirasol displays to enable a superior viewing experience and extend the battery life of portable devices.

FMC1 - 2 Withdrawn

**FMC1 - 5L: *Invited* MnO_x Self-Forming Process for TFT Electrode
13:40 Application**

J. Koike, M. Sano, K. Hirota, K. Neishi, Y. Sutou
Tohoku Univ., Japan

Cu-Mn alloys were deposited on glass substrates and on oxidized n+/a-Si substrates. After heat treatment, Mn reacted with the substrate materials to form Mn oxide, and acted as an adhesion promoter as well as a diffusion barrier layer. In addition, the I-V characteristics of source-drain configuration exhibited Ohmic behavior.

**FMC1 - 3 Cu Wiring Process for TFT-LCD
13:55**

*S. Takasawa, S. Ishibashi, T. Masuda**
ULVAC, Japan
**ULVAC Materials, Japan*

The low resistivity Cu wiring process using under oxide layer of Cu or Cu alloy has good adhesion to the glass substrate and Si under-layer, and high barrier performance of prevention between Cu and Si interdiffusion. This Process is effective to enlarging TFT-LCD panel for high-definition TV.

FMC1 - 4 Deposition of Microcrystalline Si_{1-x}Ge_x by Magnetron Sputtering
14:15

*A. Hiroe, T. Goto, A. Teramoto, T. Ohmi
Tohoku Univ., Japan*

Microcrystalline Si_{1-x}Ge_x (x~0.8) films have been successfully deposited by RF magnetron sputtering. Detailed investigation on the deposition behavior has been carried out and it was found out that threshold temperature for crystalline phase formation is about 300°C. Substrate bias effect on the deposition behavior was also investigated.

----- Break -----

15:00 - 16:00

Room 301

FMC2: Manufacturing II

Chair: C. Y. Lee, ITRI, Taiwan
Co-Chair: T. Takeda, Nagase ChemteX, Japan

FMC2 - 1 Withdrawn**FMC2 - 4L In-Cell Retarder on Color filter for Transflective VA-LCDs**
15:00

*G. Fukunaga, T. Taguchi, S. Akao, M. Aimatsu
Toppan Printing, Japan*

High performance in-cell retarders for transflective VA-LCDs are realized on color filter. The retardation is optimized effectually for each color on the reflective area and zero retardation on transmissive area. By using our color filter, thickness of the LCDs can be decreased, and a high contrast ratio can be obtained.

FMC2 - 2 Innovated Linear Atmospheric Plasma for Liquid Crystal Alignment on Polyimide Films
15:15

*C.-Y. Lee, Y.-L. Liu, H.-Y. Huang, C.-H. Su, C.-H. Liu,
W.-T. Hsieh, W.-T. Hsu
ITRI, Taiwan*

A linear atmospheric-pressure-plasma was developed to align the liquid crystal molecules on polyimide films. The LC cells with these PI films exhibit good alignment characteristic and the pretilt angles can be controlled in the range between 0° to 1° which meet the requirement of IPS mode in LC display.

**FMC2 - 3 Development of Ink-Jet Equipment for Energy Saving
15:35 and High Frequency Jetting**

T. Tsuruoka

Shibaura Mechatronics, Japan

Recently, LCD monitors and TV's have grown a lot and mother glasses are getting larger. In this session, the characteristics of a PI coater for large glass substrate making use of industrialized ink-jet method, energy-saving with high productivity are presented. Its liquid droplets dispensing and coating control are also presented.

----- Break -----

16:40 - 17:40

Room 301

FMC3: Manufacturing III

Chair: P. Boher, ELDIM, France

Co-Chair: Y. Ukai, UDDI, Japan

**FMC3 - 1: *Invited* Embedding of Capacitive Touch Sensing in
16:40 the Color Sequential Display**

S.-H. Huang, S.-C. Huang, S.-R. Peng, C.-C. Kuo,

W.-C. Wang, Y.-N. Chu, W.-T. Tseng, H.-T. Yu

Chunghwa Picture Tubes, Taiwan

The new structure which embeds capacitive touch sensor in the display not only improves the optical performance problems caused by external touch panel, but also shows the wider color gamut and transparency. Otherwise, the embedded module employs a standard TFT-LCD process and brings the benefits in cost down and self-development.

**FMC3 - 2 Viewing Angle and Spectral Characterization of LCDs
17:00 and Their Components**

P. Boher, T. Bignon, D. Glinel, T. Leroux

ELDIM, France

A new Fourier optics system capable to measure spectral information at each incidence and azimuth angles is presented. Full viewing angle pattern of radiance at 31 wavelengths regularly distributed in the visible range are obtained. Polarization analysis and grey level analysis is possible at each.

FMC3 - 3 **Analysis of the Array Unknown Mura for TFT-LCD**
17:20 **Manufactory**

M. Zhang^{,***}, Y. Gu^{**}, Y. F. Piao^{***}, J. S. Xue^{***}*

^{}Graduate Univ. of the Chinese Ac. of Sci., China*

*^{**}Technische Fachhochschule, Germany*

*^{***}BOE Tech. Group, China*

In TFT-LCD, mura is a defect which degrades the display quality. The thickness and profile difference between gate lines is the main cause of "array unknown" mura. By changing the etching method, it could be eliminated. A thinner gate layer and gentler profile could decrease array nknown mura level.

Author Interviews

18:00 – 19:00

Thursday, December 4

9:00 - 10:20

Room 301

FMC4: Optical Films

Chair: A. Lien, AU Optronics, Taiwan
 Co-Chair: R. Yamaguchi, Akita Univ., Japan

FMC4 - 1: *Invited* Wideband Motheye Optical Devices Utilizing
9:00 **Blue-ray Disc Mastering Technology**

S. Endoh, K. Hayashibe

Sony, Japan

We developed some of Blu-ray technologies to fabricate fine structures like Motheye. By forming Motheye nano-structures on the display film, we can apparently reduce the reflectance to 0.1-percent or less, which is 1/30 amount of reflectance on current displays' surfaces. And also these Motheye films developed the transmittance above 99-percent.

FMC4 - 2 **In-Cell Viewing Angle Compensation Using Pixelated**
9:20 **Biaxial Retarders for VA-LCDs with No Color Shift**

*I. Amimori, S. Suzuki, H. Kaneiwa, M. Nakajima, K. Ito,
 H. Yoshino, W. Kaneko*

FUJIFILM, Japan

A color shift of VA-LCDs has been extremely improved by pixelated retarders as an in-cell compensation layer using photo-induced biaxial cholesteric materials. DEU'v' of a novel VA-LC cell measured at a black state is smaller than 0.02, and has small light leakage in all viewing angles.

FMC4 - 3 **Advanced Wideband Coatable LCD Retarder with Anomalous Dispersion of Optical Anisotropy**
9:40

A. Geivandov^{}, A. Lazarev^{**}, A. Manko^{*}, S. Palto^{*,***}*

^{}Kontrakt, Russia*

*^{**}Crysoptix, Japan*

*^{***}Inst. of Crystallography RAS, Russia*

Crysoptix has introduced B_A-type plate coatable retarder as an efficient tool for optical compensation of IPS and VA-LCD modes. Today we demonstrate the improved retarder possessing anomalous dispersion of optical anisotropy. A new method of tuning material properties using dye additives allows significantly suppressing colour shift during the LCD switching.

FMC4 - 4 **Hybrid-Dyeing-Process Improved Properties of Polarizers on LCD Panels**
10:00

J.-T. Lien^{,**}, F.-C. Lu^{*}, C.-I. Chiang^{*}, C.-L. Tsou^{*},*

*T.-Y. Lin^{**}, C.-N. Mo^{*}*

^{}Chunghwa Picture Tubes, Taiwan*

*^{**}Nat. Taiwan Ocean Univ., Taiwan*

We have developed a novel manufacturing process of film-based polarizers using the Hybrid-dyeing process. Hybrid-Dyeing technology only modifies the Dye-PVA method of the manufacturing process of the film-based polarizer. It has some advantages, such as high polarization ratio, low cross-transmittance, high durability and wide polarizing bandwidth.

----- Break -----

10:40 - 12:00

Room 301

FMC5: Backlight

Chair: K. Käläntär, Nippon Leiz, Japan

Co-Chair: Y. B. Yang, Sony, Japan

FMC5 - 1: ***Invited* Power Reduction of LCTVs with an Adaptive Dimming Techniques for Standard TV Programs**
10:40

T. Shiga

Univ. of Electro-Commun., Japan

With the adaptive dimming technique, the backlight luminance of LCTVs is adaptively and locally dimmed along with the input video signal. Power saving with the technique was investigated for standard broadcast TV contents. The power saving depends on the backlight design factor. The effect of independent RGB control was small.

FMC5 - 2 Optical Model for Designing Direct Slim Backlight Unit
11:00

*M. Nagayoshi, S. Murata, Y. Tsuru, S. Ohuchi
Hitachi, Japan*

High-accurate and high-speed simulation technique to calculate luminance distribution in Slim backlight unit (BLU) is developed. The accuracy is more than 90%, and the calculation speed is 15 times faster than conventional one. Using this technique, we developed 12.6-mm Slim BLU with high uniformity of ± 10 cd/m²/mm in luminance derivation.

FMC5 - 3 Withdrawn**FMC5 - 5L A Hollow-Centric-Disk Backlight for Safety-Ensured Analog-Digital Automotive/Avionics Display Instruments**
11:20

*K. Kälantär
Nippon Leiz R&D Ctr., Japan*

A hollow-centric-disk backlight has been developed to illuminate a hollow-round transmissive liquid-crystal display that encompasses a mechanical indicator needle passes through for ensuring safety in automotive or avionics. The resulting display is a hybrid type that integrates digital and analog instruments

FMC5 - 4 Multilayer-Incoupling-Structure Design for Ultra-Thin LED-Backlight
11:35

C. H. Ho, H. J. Cornelissen^{}, M. P. C. M. Krijn^{*}, H. A. van Sprang^{*}
Delft Univ. of Tech., the Netherlands
^{*}Philips Res. Labs., the Netherlands*

A new method using a thin-film multilayer filter is proposed to couple light from LEDs into a thin light guide. It can be as thin as 0.79mm for an LED of 1x1mm². With this filter, the backlight system can be much simplified. The coupling efficiency is estimated to be 82%.

----- Lunch -----

Author Interviews

18:00 – 19:00

Friday, December 5

9:00 - 12:00

Exhibition Hall B

Poster FMCp: FPD Manufacturing, Materials & Components

FMCp - 1 Light Plate with Metallic Nanostructures for Color Filterless Display

Y. D. Yao, D. H. Wei^{}, K. W. Cheng^{**}, S. Y. Hsu^{**},
P. K. Wei^{**}, T. P. Lin^{***}, C. N. Mo^{***}*

Tatung Univ., Taiwan

^{}Nat. Taipei Univ. of Tech., Taiwan*

*^{**}Academia Sinica, Taiwan*

*^{***}Chunghwa Picture Tubes, Taiwan*

Periodic Ag nanostructures with different size, shape, and line pitch on ITO coated glass substrates have been fabricated. We have demonstrated that the back light system containing a periodic Ag nanostructure with varied line pitches can be used as a color filter in a display device.

FMCp - 2 Characteristics of Pyramid and Cone Sheets with Self-Aligning Apertures

Y. G. Kim, S. H. Paek, G. Park, J. H. Kwon, J. H. Park^{},
B. G. Kim^{*}, B. C. Ahn^{*}, J. G. Shim^{*}*

Yeungnam Univ., Korea

^{}LG Display, Korea*

Pyramid sheet and cone sheet with apertures on the opposite side are designed and fabricated by the diffuse lithography. The simulation results show that the pyramid or cone sheets with apertures have normal luminance compatible with the dual crossed prism sheets and controllable view angle.

FMCp - 3 ITO Etching Properties of a Compacted In-Line Wet Etch/Cleaning System by Using a Reverse Moving System

*S. H. Im, M. H. Ahn, K. M. Choi, E. S. Cho, S. J. Kwon
Kyungwon Univ., Korea*

For the cost reduction in the fabrication of display panels, a reverse moving system was equipped to an in-line wet etch/cleaning system. For the effect of the alternating movement of substrate on the wet etch process, ITO layer were etched in various moving modes and the results were analyzed.

FMCP - 4 Ampere Particle Current Beams of Boron and Phosphorus for the Ion Implantation of Very Large FPDs Using Multiple Ribbon Beam Permanent Magnet Mass Separation

*D. Aitken
Superion, UK*

The permanent magnet mass analysis described in this paper is aimed at ampere level boron or phosphorus particle beam current, using multiple large (1-3 metres) double ribbon beams, with transmission of multiple ion species containing the required implant particle. The design of the magnet is independent of the substrate size.

FMCP - 5 Arc Discharge Optimization to Obtain High Current of Boron and Phosphorus Ion Beam from a Multi-Cusp Ion Source

*Y. Inouchi, G. Takahashi, S. Dohi, M. Tanii, M. Konishi,
M. Naito
Nissin Ion Equipment, Japan*

A multi-cusp ion source with large extraction area was improved to obtain high currents of boron and phosphorus ions, and above 500 μ A/cm of target currents was confirmed for both ion species. Optimum potential applied to a plasma electrode with respect to a plasma chamber was dependent on ion species.

FMCP - 6 Functions-Integrated Liquid Crystal Polymer Layer with Surface Grating Made by Nanoimprint Lithography Process

*S.-W. Lin, Y.-Y. Lai, H.-L. Kuo, P.-C. Chen, M.-C. Peng,
Y.-P. Hsieh
ITRI, Taiwan*

The liquid crystalline polymer (LCP) layer which integrates polarizing and aligning functions fabricated by nanoimprint lithography is presented. Furthermore, a 1x1 in² LCD cell with liquid crystal sandwiched by a pair of the functions-integrated LCP layers is fabricated, and the contrast ratio of the cell can be up to 39:1.

FMCP - 7 Methodology of Reliability Characterization and Yield Optimization for TFTs in AM-LCDs

*J. J. Chang, C. S. Chuang, C. Y. Chen, J. P. Tseng,
Y. M. Chen, C. C. Hsiao, H. T. Yang, K. S. Wang,
J. C. Chen
AU Optronics, Taiwan*

In this paper, we analyzed the impact of process induced device degradation on TFT-LCDs manufacturing. Three plasma-related topics were categorized and investigated. Moreover, device reliability of different processes and prediction of yield improvement were also important focus in this research.

FMCp - 8 A Stress Measurement and Inspection System for Flexible Display Substrates and LCD Glasses

*C. Wu, Y. Hsieh, W. Lin, F. Yang, K. Chuang
ITRI, Taiwan*

A stress measurement and inspection system was built to analyze the stress distribution of the substrate of flexible display or liquid crystal display. The system was based on the photoelastic method and had the ability to implement a non-contact, non-destroy, and fast measurement. It has a layer of ITO.

FMCp - 9 Novel Material for Coatable Negative C-Plate Retarder

*T. Yamashita, S. Yoshida, M. Eguchi, J. Tsukamoto
Toray Ind., Japan*

We developed a novel coatable negative C-plate retarder having features of (1) no need of aligning treatment including rubbing and photo-alignment, (2) high transmittance, (3) high thermal durability. By applying newly developed negative C-plate retarder to optical compensating VA-LCDs we could realize thin and light-weight LCDs with wide viewing properties.

FMCp - 10 Reactive Mesogen (RM) Technology of Zero Retardation for In-Plane Switching (IPS) Mode

*J. B. Park, S. H. Choi, Y. J. Choi, I. S. Cho, Y. W. Kim
Hyosung, Korea*

In this paper, we propose novel low retardation film compatible to conventional Z-TAC. The concept is to adopt C plate (LC coating) on normal TAC (-C plate). And, to obtain optimized low retardation effect, we optimize coating thickness of C plate on conventional TAC.

FMCp - 11 Retardation Films with In-Plane Oblique Slow-Axis

*M. Hirota, T. Asada, T. Hori, K. Miyagi, K. Arakawa
ZEON, Japan*

We have succeeded in manufacturing a retardation film with the in-plane oblique slow-axis. We could control the direction of its slow axis and its optical parameters. In this work, we designed and evaluated the VA mode using the retardation film with the in-plane oblique slow axis.

FMCP - 12 Novel Patterned LC Polymer Retarders for Prevention of Wavelength Dispersion

*J. Ahn, M. K. Kim, A.-R. Han, Y. C. Kim, S.-H. Paek
Kyunghee Univ., Korea*

We have prepared a novel patterned retarder made from liquid crystalline polymer by sequential area-selective UV irradiation. By controlling the photo-polymerization condition, we obtained the patterned retarder with three sections optimized to retard red, green, and blue. The retarder also had a wide allowable wavelength range and high thermal stability.

FMCP - 13 Single-Layer Retarder for LCD

A. Lazarev, A. Geivandov, I. Kasianova*, E. Kharatiyan*,
P. Lazarev*, S. Palto*,***

Crysoptix, Japan

**Kontrakt, Russia*

***Inst. of Crystallography RAS, Russia*

We have developed a full set of coatable thin birefringent film (TBF™) retarders for LCD. New printable retarders allow efficient optical compensation in VA and IPS LCD modes using a single-layer film. Replacement of conventional stretched polycarbonate retarders with submicron, solution-processed TBF provides substantial cost reduction of LCD optical components.

FMCP - 14 Polyvinyl Alcohol-Iodine Complexes Formation in Aqueous Solution for Improvement of Polarizing Properties of Polarizer

*D. Ogomi, M. Miyazaki, H. Mizushima, M. Miyatake
Nitto Denko, Japan*

We studied the effect of iodine/KI and boric acid on PVA-iodine complex formation in aqueous solution. Moreover, we attempted to improve the polarizing properties of the polarizer on the base of the formation behavior of PVA-iodine complexes in aqueous solution.

FMCP - 15 New Method to Evaluate and Quantify Possibility of Dent Issue on Polarizer

*M. T. Weng, W. F. Sung, P. J. Yeh
AU Optronics, Taiwan*

In order to decrease the dent issues on polarizer in mass production stage, a novel method has been developed to evaluate and quantify the dent issues on polarizer. The result shows that this novel method could grade possibility of the dent issue on polarizer successfully without preparing extra equipment.

FMCp - 16 Brightness-Enhancement Film Using a Single Cholesteric Liquid Crystal Layer

*K. Tamura, K. Harai, Y. Fujino, K. Kawabata, K. Arakawa
ZEON, Japan*

We have developed new brightness enhancement film with a single cholesteric liquid crystal layer made of liquid crystal mixture with high Δn and quarter wave retardation film of the highest n_z in the three refractive indices. The simple structure enables to manufacture the brightness enhancement film at lower cost.

FMCp - 17 Optimized Light-Guide Design for Thin Direct Backlight

*C. S. Chu, Y. T. Li, H. H. Chen
Elect. & Opto-Elect. Res. Labs., Taiwan*

The thickness of a direct backlight module is improved to be thinner because lightguide is applied. The lightguide for adjusting uniformity of light from LED or CCFL could be used. By using the proposed lightguide, the thickness of light mixing cavity of a direct backlight will be realized into 20mm.

FMCp - 18 Film-Bonded Light-Guide Plate Without Using Optical Films

*Y.-Y. Chang, C.-J. Ting, W.-H. Yang
ITRI, Taiwan*

We proposed a film-bonded light-guide plate (LGP) of which the emitting light could be well-controlled without additional prism sheets and light efficiency is high. In addition, a bonding layer with higher refraction index can make the emitting light more concentrating. This design could be applied for a sheetless LGP.

FMCp - 19 Highly light Collimating Backlighting System

Y.-Y. Chang, C.-S. Hsu, C.-J. Ting, C.-P. Chou*
ITRI, Taiwan
Nat. Chiao Tung Univ., Taiwan

We proposed a backlighting system with high-collimating emitting properties of FWHM smaller than 10 degree. A 55mm×60mm prototype is fabricated by ultra-precision diamond tooling and UV embossing. The defects of turning film would lower the collimating emitting properties. FWHM of 7~12 degree is feasible in the current fabrication ability.

FMCp - 20 A Novel Simplified Light Guide Plate Design

C. H. Chien, W. T. Hsu, H. C. Wang
Nat. Sun Yat-Sen Univ., Taiwan

In this investigation, an improved design of light guide plate (LGP) with a new type of edge structure and a simplified micro-prism (V-Cut) bottom structures for generating uniform illuminance distribution was proposed. For the proposed LGP, more design time can be retrenched and be manufactured more easily.

FMCp - 21 Automatic Pattern Design for Light Guide Used in Edge-Lit Backlight

M. Chen, D. Chen, B. Chieh
AU Optronics, Taiwan

Based on energy conservation, a formula describing the relation between output luminance and design dot density in an edge-lit backlight was derived. Using this formula, the dot pattern design can be finished in a few design iterations, so that the developing cost and time can be saved.

FMCp - 22 Enhancement of Value Added on Backlight Module by Diffuser Plate with Pattern

Y. Takahashi, K. Tsukada, K. Kusano, I. Konishi
ZEON, Japan

We developed the diffuser plate made of ZEONOR[®] by the injection molding, and enabled the surface of diffuser plate to be given various fine patterns. As a result, we could provide ultra-thin backlight module, backlight module of using fewer CCFL, and thin backlight module of LED as light source.

FMCp - 23 A Multi Structure Diffuser Plate for Direct LCD TV Backlight

Y. Luo, Y. C. Cheng, L. C. Chang
Innolux, Foxconn Tech. Group, China

LCD TV has being more and more popular. To make it green, thinner, lighter, and cover customers' other requirements, we still have many problem to overcome. This paper is aimed to improve the lamp Mura of direct LCD backlight using a novel multi-structure diffuser plate.

FMCp - 24 A Simulation Study on the Optimization of Optical Films for Edge-Lit Backlight

*J.-H. Park, Y. H. Ju, J. H. Lee, K.-B. Nahm, J.-H. Ko,
J. H. Kim**

Hallym Univ., Korea

**Samsung Elect., Korea*

A simulation model of a simple edge-lit backlight was constructed for evaluating optical performances of collimating sheets. The on-axis luminance gain of micro-lens sheets was sensitive to the geometrical parameters of micro lenses, which suggests that a reliable simulation model can be used to develop new collimation sheets.

FMCp - 25 Anti-Scrape Luminance Enhancement Film

C.-W. Yu, Y.-H. Lin, H.-H. Lin, T.-H. Lin*

ITRI, Taiwan

**Toplux Tech., Taiwan*

A novel anti-scrape brightness enhancement film is demonstrated here. Higher aspherical and lower prism structures are periodically formed on the PET substrate, thus the touched part with the component above the film is the part of aspherical structures. The smooth touched part can protect the film from scrape.

FMCp - 26 White Reflection Molding Compound for Surface Mount LEDs

N. Urasaki, M. Mizutani, H. Kotani

Hitachi Chem., Japan

We have developed a white reflection molding compound that has the high reflectance up to near the ultraviolet region and good reliability. The surface-mounted devices using developed material showed good luminosity and voltage retention stability during the temperature humidity lighting test and the thermal cycle test.

FMCp - 27 Binning Analysis of Phosphor-Based Light Emitting Diode for Direct-Lit Backlight

*Y. H. Chang, Y. K. Lin, Y. K. Lan, R. HW Lin, J.-C. Liang,
S. Chi*

AU Optronics, Taiwan

We represent a systematic procedure to analyze the bin management of direct-lit LED backlight with phosphor based LED. A simple method is also proposed that improve bin utilization by mixing different bins.

FMCP - 28 A Novel Full-Color-LED-Backlight Design in TFT-LCD

*H.-W. Chen, Y.-H. Chen, I. P. Hung, S.-J. Chiou
Chunghwa Picture Tubes, Taiwan*

A Novel LED backlight system to fit the color filter's spectrum. Based on this technology, we successful to improve white light LED Backlight's color gamut NTSC from 64% to 80%, and improve RGB LED Backlight's color gamut NTSC more than 110%.

FMCP - 29 Optical Characteristics of Direct-Lit Flat-Lamp Backlights for LCD Applications

M.-Y. Yu, Y.-Y. Kim, J.-H. Ko, S.-H. Yu, S.-E. Lee*
Hallym Univ., Korea
Korea Polytechnic Univ., Korea

The effects of optical sheets on the performances of flat-lamp backlight have been examined quantitatively. A detailed analysis of the luminance gain and the viewing-angle characteristics have been carried out. Origin of the worse performances of conventional sheets in the flat-lamp backlight as well as possible solutions has been discussed.

FMCP - 30 New Driving Method and Circuit for Low Cost Local Dimming Xe Backlight Unit

J. N. Heo, J. K. Lim, J. Y. Kim, H. S. Tae, J. H. Seo,
K. S. Lee**
Kyungpook Nat. Univ., Korea
*Incheon Univ., Korea
**Samsung Corning Precision Glass, Korea*

The new driving method and circuit are proposed for a low cost local dimming Xe backlight unit. The basic concept of the proposed driving method is that the subsequent discharge can be produced easily under the low voltage condition thanks to the wall charges induced by the previous discharge.

FMCP - 31 Nanostructure Arrays for Backlight Luminance Enhancement

Y. M. Lan, D. H. Wei, Y. D. Yao, J. K. Wu*, C. R. Lin,
T. P. Lin**, C. N. Mo**
Nat. Taipei Univ. of Tech., Taiwan
*Tatung Univ., Taiwan
**Chunghwa Picture Tubes, Taiwan*

By using polystyrene ball array as a template to fabricate networking hexagonal Ag nanowall, and the total lighting output was enhanced by 20%. We believe that the networking nanowall of the Ag nanostructure acted as a waveguide to extract the light emitted to the outer medium effectively.

FMCP - 32 Withdrawn

FMCP - 33 Photosensitive Spin-on Glass Material with Phenyl Silsesquioxane (PSQ) Derivatives

*Y. Tashiro, T. Iwata, T. Sekito, D. Yokoyama, T. Nonaka
AZ Elect. Materials Japan, Japan*

We succeeded in development of SOG materials based on alkali soluble phenyl silsesquioxane (PSQ) backbone. The alkali soluble Silsesquioxane (APSQ) can provide both positive and negative-tone of photosensitive SOG combination with diazo naphthoquinone or photo-base agent, respectively. Here we demonstrate successful usage of photosensitive SOG materials and lithography patterning.

FMCP - 34 Aminosilane Silicon Oxide Gas Barrier Coating on Plastic Substrates

H. G. Kim^{,**}, M. J. Kim^{*}, S. S. Kim^{*,**}*

^{}Kyung Hee Univ., Korea*

*^{**}Regional Innovation Center-Component and Material for Inf. Display, Korea*

Silicon oxide-like layers were coated on PES by sol-gel process and it was oxygen plasma treated. γ -APS solution in ethanol was coated and cured to still enhance the barrier properties. XPS, FE-SEM have been used for characterizing the silicon oxide-like layers. Organofunctional silanes bonds were formed by the interaction of the silanol groups with metal oxide surface, which covered the defect of silicon oxide layer on the substrates. The oxygen transmission rate of barrier coated substrates was found to be 1.05 cc/ m² day, which attained the barrier performances obtained from physical inorganic layer deposition method.

FMCP - 35 Optical and Electric Conductivity Properties of Optimized ZnO-Based Multilayer Thin Films

*J. Dong, S. L. Wu, F. Wang, H. F. Liang, F. G. Zhao,
L. G. Meng, J. T. Zhang*

Xi'an JiaoTong Univ., China

ZnO/Al-AlN/ZnO multilayer films have been proposed to use in flat panel display devices. The merits of this ZnO based sandwich structure include environment-friendly and low price properties. By optimizing the interlayer's thickness and the deposition temperature, a mean transmittance more than 85% and an effective resistivity $1.18 \times 10^{-3}\Omega\cdot\text{cm}$ have been achieved.

FMCp - 36 The Electrical Properties of Al, Ga-Codoped ZnO Thin Films: The Effect of Film Thickness and Oxygen Partial Pressure

K.-H. Seo, C.-W. Kim, M. Park, B.-H. Lim, S.-J. Yu, H. Choi, S.-K. Lim*, S.-H. Yang**

LG Display, Korea

**Heesung Metal, Korea*

Thin films of AGZO have been deposited on glass substrate by dc-magnetron sputtering. The electrical and optical properties of these films were investigated as a function of film thickness and oxygen partial pressure. The minimum resistivity of $3.7 \times 10^{-4} \Omega\text{cm}$ and high average transmittance above 90% in the visible region were exhibited.

FMCp - 37 Preparation of Impurity-Doped ZnO Transparent Electrodes Suitable for LCD Applications by Magnetron Sputtering

J. Nomoto, M. Konagai, J. Oda, H. Fukada, T. Miyata, T. Minami

Kanazawa Inst. of Tech., Japan

Impurity-doped ZnO thin films suitable for transparent electrode applications in LCDs that reduce resistivity and improve the uniformity of resistivity distribution have been prepared by newly developed oxidization-suppressing dc magnetron sputtering deposition methods that superimpose rf power and use more optimized targets.

FMCp - 38 Development of a New Environmentally-Friendly LCD Glass Substrate: OA-10G

T. Yanase, Y. Kato, S. Miwa, H. Yamazaki

Nippon Elec. Glass, Japan

We developed an environmentally-friendly LCD glass substrate, OA-10G. OA-10G exhibits optimum properties for TFT-LCD glass substrates. OA-10G is compatible with our conventional substrate, OA-10. Moreover, OA-10G is suitable for larger and thinner glass substrates.

FMCp - 39 Development of Silica-Dispersed Composite Substrates for Flat Panel Displays

G. H. Kim, S.-M. Yoon*, Y.-H. Song*, H.-A. Chun***

**ETRI, Korea*

***KITECH, Korea*

A new composite substrate for flat panel display, which consists of nano silica-dispersed composite film and a gas barrier layer, was developed. It shows low CTE, high light transparency and chemical resistance.

FMCP - 40 Investigation on Photo-Resist Crack in the Thin-Film-Transistor 4-Mask Fabrication Process

*Z. T. Wang, T. Y. Min, H. J. Qiu, J. G. Zhao, W. B. Gao,
S. K. Lee, S. Y. Cho**

BOE OptoElect. Tech. Group, China

**DongJin Semichem, Korea*

Photo resist crack in 4Mask process are investigated. Nitric acid attack to photo resist is confirmed to be the cause of photo resist crack. The practical solutions to remove photo resist crack is to control nitric acid concentration in S/D wet etchant and soft bake time in gray tone mask.

FMCP - 41L The Properties of ITO Films with Oxide Buffer Layer Grown onto PES Substrates

S. M. Lee, C. S. Kim, S. K. Jung, S. H. Sohn

Kyungpook Nat. Univ., Korea

ITO films with the oxide buffer layers (TiO_2 , SiO_2) were deposited by a low frequency (LF) magnetron sputtering method onto the PES substrates. The change of sheet resistances of ITO films with the oxide buffer layers was investigated as a function of the aging time in the air and the vacuum.

FMCP - 42L Improving Light Extraction Efficiency of Monolithically Fabricated Micropatterned Light Guide Plate

H.-S. Lee, H. Song, Y.-K. Mun, Y.-S. Choi, J.-H. Yeon,
J.-H. Lee*, J.-B. Yoon*, H.-Y. Choi, S. Lee*

Samsung Elect., Korea

**KAIST, Korea*

Light extraction efficiency is improved by introducing new dumbbell-like extraction structures to the monolithically fabricated micropatterned light guide plate (LGP) in Ref.1,2. The fabricated 2.2inch LGP with suggested structures without any additional optical film shows an average luminance 4032nit and 70% uniformity with four side view 0.97cd@15mA LEDs.

FMCP - 43L Photo-Sensitive Passivation Layer for a-Si TFT of LCD with Characteristics of Low Dielectric Constant

K. Sugitani, A. Tanabe, M. Hammura, H. Ohmori

ZEON, Japan

Solution-processed organic passivation layer was developed for a-Si thin film transistor. This layer has high reliability equal to traditional passivation layer (SiNx:H). This material also has the function of planarized layer and the characteristic of low-dielectric constant, which decreases RC delay, especially in the field of large size LCDs.

FMCp - 44L Patterned Retarders and Polarizers Based on Reactive Mesogens Aligned by Plasma Beam

O. Yaroshchuk, R. Kravchuk, O. Parri^{}, V. Chigrinov^{**},
H.S. Kwok^{**}*

NAS of Ukraine, Ukraine

^{}Merck Chems., UK*

*^{**}Hong Kong Univ. of S&T, Hong Kong*

Recently, we reported extension of ion/plasma beam alignment technique for the alignment of reactive mesogens (RM). The present study shows that this technique can be successfully used for the alignment patterning of RM films. A variety of prototypes of patterned retarders and dichroic polarizers is prepared.

FMCp - 45L A General Purpose Configuration Design of Magnetic Board for Better Film Coating Uniformity

C. Wei, J. M. Chen^{}*

Tatung Univ., Taiwan

^{}Chunghwa Picture Tube, Taiwan*

A magnetic board was used in a plasma enhanced coating system. The film quality is affected by the magnetic field which is associated with the configuration of the magnetic board. A new configuration design aims to eliminate the film thickness variation caused by the non-uniform magnet field was proposed.

----- Lunch -----

13:20 - 14:40

Room 301

FMC6: Materials I

Chair: D. Allan, Corning, USA

Co-Chair: K. Miyazawa, Chisso, Japan

FMC6 - 1 Novel Photorefractive Material Development for New Updatable Holographic Three-Dimensional Display

13:20

M. Yamamoto, W. Lin, T. Gu, D. Flores, P. Wang, S. Tay^{},
L. Guoqiang^{*}, P. Blanche^{*}, R. Voorakaranam^{*}, A. Tunc^{*},
P. Hilaire^{*}, J. Thomas^{*}, R. Norwood^{*}, N. Peyghambarian^{*}*

Nitto Denko Tech., USA

^{}Univ. of Arizona, USA*

We have successfully developed novel organic polymer-based photorefractive materials which have both good diffraction efficiency and long grating persistency. Developed materials were succeeded in principle-proving concept of novel, highly image-persistent, and rewritable holographic display systems. By using the materials, we are also aiming for developments of holographic rewritable display devices.

**FMC6 - 2 Thermal Creep and Warp Performance of Jade-like
13:40 High Viscosity Glasses**

*D. Allan, M. Potuzak
Corning, USA*

Beam-bending measurements of creep in a modified beam-bending viscometry apparatus show important differences among glasses with different viscosity. Glasses with higher viscosity have less creep, which is important for avoiding creep and the associated warp (permanent shape deformation) during processing of glass sheets for polysilicon liquid crystal display applications.

**FMC6 - 3 Mechanical Attributes of Jade Glass for Advanced
14:00 Displays**

*S. T. Gulati, J. D. Helfinstine, T. Ono**
Corning, USA
**Corning Tech. Ctr., Japan*

The mechanical properties of Corning's Jade glass are ideally suited for mobile displays. The key focus of this paper is to provide comparative data for scored and finished edges of Jade vs. a-Si glasses which confirm that Jade offers higher edge strength and good cuttability than a-Si glasses.

**FMC6 - 4 Photo Degradation Properties in Oriented Liquid
14:20 Crystal Modes**

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

Photo degradations of LC cells with homogeneous, homeotropic, twisted nematic and hybride orientation have been investigated. The degradation of the TN cell started first by the reduction of the azimuthal anchoring strength. The photo stability does not change if in the cell under the voltage application.

----- Break -----

IDW Best Paper Award

This award will go to the most outstanding paper selected from those presented at IDW '08.

The 2008 award winners will be announced on the IDW website:

<http://www.idw.ne.jp/award.html>

15:00 - 16:20

Room 301

FMC7: Materials II

Chair: P. Drzaic, Unidym, USA
 Co-Chair: T. Nonaka, AZ Elec. Materials, Japan

FMC7 - 1: Invited Chemical Design of Polysilsesquioxane as a Gate Insulator for Organic Thin-Film Transistors

15:00

T. Hamada^{*,**}, *S. Yamazaki*^{*,**}, *T. Nagase*^{*,**},
K. Tomatsu^{**}, *Y. Ueda*^{**}, *M. Watanabe*^{*,****},
S. Watase^{*,****}, *T. Tamai*^{*,****}, *T. Kobayashi*^{*,**},
S. Murakami^{*,****}, *H. Naito*^{*,**}, *K. Matsukawa*^{*,****}
^{*}JST, Japan
^{**}Osaka Pref. Univ., Japan
^{***}Tech. Res. Inst. of Osaka Pref., Japan
^{****}Osaka Municipal Tech. Res. Inst., Japan

Novel functional polysilsesquioxane gate insulator materials have been developed, which have a high-dielectric constant, photolithographic property, and hydrophobic surface by changing the chemical structure. Top-contact organic thin-film transistor (OTFTs) fabricated on polysilsesquioxane insulator using poly(3-hexyl)thiophene as an organic semiconductor exhibits good transistor property.

FMC7 - 2: Invited Integration of Transparent Carbon Nanotube Electrodes into a Color 5.5-in. AMLCD

15:20

Y.-B. Park, *L. Hu*, *G. Irvin*, *P. S. Drzaic*, *J. H. Hur*^{*},
J. M. Kim^{*}, *J. Jang*^{*}
 Unidym, USA
^{*}Si-Display Tech, Korea

We describe the details associated with the fabrication of a full color 5.5" active matrix liquid crystal display with integrated carbon nanotube (CNT) transparent electrodes for both pixel electrode of the TFT backplane and common electrode of the color filter side. Processes and results for coating and patterning the CNT layers are described and proto-type AMLCD is demonstrated.

FMC7 - 3 Engineered Nanoparticles for Display Optics and Electronics

15:40

N. Kambe, *H. Du*, *G. Liu*, *A.-L. Chu*, *I. S. Altman*,
S. Chiruvolu
 NanoGram, USA

Nanoparticles applications for FPD are expected as an enabler for the next-generation products. Laser-driven chemical synthesis and surface engineering of inorganic nanoparticles to be bonded to organic polymers are outlined. Refractive-index engineering for light-path management, Si inks for backplane printing, and LED nanophosphors are discussed as application examples.

FMC7 - 4 **Structure-Correlated Stability of Thin Films of Pentacene Formed by Liquid Process**
16:00

T. Minakata, Y. Natsume
Asahi-KASEI, Japan

We have fabricated wet-processed thin-film transistors of unsubstituted pentacene by two kinds of fabrications both solution and dispersion processes. Stabilities of the carrier mobility of the films against ambient storage have been studied and it turns out that they are correlated with the thin film structures.

----- Break -----

16:40 - 17:55

Room 301

FMC8: Materials III

Chair: K. Fujishiro, Nippon Steel Chem., Japan
 Co-Chair: D. Aoki, Dai Nippon Printing, Japan

FMC8 - 1 **Development of New Green Pigment, Polyhalogenated Zinc Phthalocyanine for Color Filter**
16:40

S. Funakura, Y. Tachikawa, A. Kudo, I. Yao, K. Shimada
DIC, Japan

Polyhalogenated zinc phthalocyanine pigment (Green 58) demonstrates better properties of brightness, contrast ratio and chromaticity than conventional polyhalogenated copper phthalocyanine pigment (Green 36) in color filter. Quantum chemical calculations of these pigments suggest that phthalocyanine ring symmetrical property of Green 58 is more than that of Green 36.

FMC8 - 2 **Optical-Electrical Transport Characteristics, UV-Visible Enhanced Photo Response with Embedding Si-Rich SiO_x Photonic Sensor in LCD Panel**
17:00

A.-T. Cho, C.-T. Peng, M.-H. Lee, C.-C. Shih, S.-S. Chen,
Y.-J. Hsu, C.-C. Chiu, J.-S. Chen, W.-M. Huang
AU Optronics, Taiwan

We report a UV-visible photonic sensor with Si-nanocrystals sensitizer on TFT-LCD panel. As the photonic sensor was operated by bias, enhanced photo-response with largely opto-electronic conversion demonstrated transistor-like operation mechanism. Photonic sensor using Si-nanocrystals as sensitizer sandwiched between two electrodes structure is proposed to integrate with UV-to-Visible, ambient-light-sensing on TFT-LCD.

FMC8 - 3 **The Syntheses of Divinylbenzene-Based Soluble Copolymers with Reactive Terminal Groups and Highly Branched Structures, and the Development of Novel High Refractive Index Optical Materials for Fine-Patterned Optical Sheets**
17:20

*M. Kawabe, H. Kitajima, N. Nishio, I. Akiba**

Nippon Steel Chem., Japan

**Univ. of Kitakyushu, Japan*

Soluble poly(divinylbenzene-co-ethylstyrene-co-styrene)s (PDVs) with reactive terminal functional groups and highly branched structures were synthesized by cationic polymerization. The novel UV-curable optical materials were developed using by the PDVs. These materials exhibited high refractive index ($n_D=1.56-1.60$) and excellent fine-pattern moldability. Consequently, these materials are very attractive as a prism/lens sheets.

FMC8 - 4L **Multi-Primary Color Filter for LED Backlight**
17:40

T. Sumino, S. Nakazawa, T. Yano

Dai Nippon Printing, Japan

Multi primary color filter is applied to get wide color gamut and high efficiency liquid crystal displays. In this paper, we evaluated multi primary color performance using RGB, RGBY and RGBYC primary color filters and some LED backlights.

Author Interviews

17:40 – 18:40

Supporting Organizations:

The Japan Society for Printing Science and Technology

Japan Society of Colour Material

The Technical Association of Photopolymers, Japan

Society of Photographic Science and Technology of Japan

The Society of Radtech, Japan

The Japanese Research Association of Organic Electronics Materials

Japan Electronics Packaging and Circuits Association

Workshop on Plasma Displays

Thursday, December 4

9:00 - 10:20

Room 302

PDP1: Cell Technology

Chair: L. S. Park, Kyungpook Nat. Univ., Korea
 Co-Chair: Y. Murakami, NHK, Japan

PDP1 - 1 **LaB₆: New Cathode Material for AC PDP TVs** 9:00

*M. Ono, S. Hara, T. Shiga, Y. Amano**
Univ. of Electro-Commun., Japan
**TT&T, Japan*

The low-cost LaB₆ electrode has been incorporated into AC type PDP TVs. Since LaB₆ is conductive, unlike MgO, different panel structure and driving methods from those of MgO PDPs have to be adopted. This paper introduces how TV expression was realized with the LaB₆ PDP.

PDP1 - 2 **Effects of Solution Synthesized Thin-Film Phosphor Layer on the Characteristics of Transparent AC PDPs** 9:20

H. N. Choi, S. Y. Lee, Y. S. Kim
Hongik Univ., Korea

In an attempt to develop a transparent full-color ac-PDP, transparent phosphor layer was prepared via several processing process: electrophoretic deposition and liquid reaction process. Effects of coating thickness on optical transmittance and luminance of test panels were investigated. The results indicated that full color transparent ac-PDP is feasible with the approach.

PDP1 - 3 **Development of Low Cost PDP with ITO-Less Fence Electrode Cell Structure** 9:40

A. K. Srivastava, M. Samanta, A. Mitra, J. Chaki
Samtel Color, India

A silver fence electrode structure with straight barrier ribs has been developed. During cell design optimization, various issues of existing fence electrode structure are focused. This fence electrode structure provides 10% improved luminance as compared to ITO based structure. Such cell structure can be optimized for low-cost high-resolution plasma displays.

PDP1 - 4 Variation of Auxiliary Electrode Width in an AC PDP
10:00

S.-M. Lee, C. S. Choi, K. C. Choi
KAIST, Korea

The width of an auxiliary electrode was varied in order to increase the voltage margin and the luminous efficacy in FEEL PDP. The voltage margin and the luminous efficacy in FEEL PDP with a narrow auxiliary electrode were higher than those in FEEL PDP with a wide auxiliary electrode.

----- Break -----

10:40 - 12:00

Room 302

PDP2: Driving & Discharge

Chair: L. F. Weber, Consult., USA
Co-Chair: K. Nunomura, Japan

PDP2 - 1 Observation of Vacuum Ultraviolet Radiation from
10:40 SrO- and SrCaO-PDP Operated at Lower Voltage

G. Uchida, F. Xing, S. Uchida^{}, T. Yano, N. Awaji,*
H. Kajiyama, T. Shinoda

Hiroshima Univ., Japan

^{}Tokyo Metropolitan Univ., Japan*

Here is presented the measurement on SrO- and SrCaO-PDP operated at lower voltage. SrO- and SrCaO-PDP attained high luminous, where the breakdown voltage is 30 % lower than that of MgO-PDP. The VUV observation shows that the excimer production is more efficient for high Xe contents and high sustaining voltage.

PDP2 - 2 Reduction of Address Delay Time Degradation by
11:00 Discharge Transition from Priming Cell to Display
Cell in AC PDPs

S. Nobuki, N. Uemura, S. Ho, M. Shiiki, K. Suzuki
Hitachi, Japan

We clarified temporal degradation of address delay time is caused by a decline in the number of electron sources. We verified discharge transition from a priming discharge to an address discharge to reduce degradation. The priming path height was about 7 μm . The discharge transition time was about 0.2 μs .

PDP2 - 3 **Effects of Wall Charge Leakage and Address
11:20** **Discharge Characteristics under Variously Sputtered
MgO States in AC PDP**

C.-S. Park, S.-K. Jang, H.-S. Tae, E.-Y. Jung, E. G. Heo**
Kyungpook Nat. Univ., Korea
**Samsung SDI, Korea*

The effects of the wall charge leakage and address discharge characteristics are examined under variously sputtered MgO states. With an increase in the amount of MgO sputtered from the MgO surface, the wall charge leakage and the variation in the formative address delay time are minimized under the address on-times.

PDP2 - 4 **New Energy Recovery Circuit with Asymmetric
11:40** **Inductance for 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*

A new energy recovery sustain-circuit (ERC) using asymmetric inductance is proposed to reduce the power consumption of an ac-PDP. The proposed ERC uses different inductors in the energy recovery circuits of the Y- and X-boards, respectively, to compensate for the dissymmetric phenomenon of the sustain waveforms in the Y- and X-boards.

----- Lunch -----

Author Interviews

18:00 – 19:00

Friday, December 5

9:00 - 12:00

Exhibition Hall B

Poster PDPp: Plasma Displays**PDPp - 1 Development of Simulators on Precise Characterization for PDP Materials**

A. Endou^{*}, I. Yamashita^{*}, K. Serizawa^{*}, H. Onuma^{*},
 K. Inaba^{**}, H. Kikuchi^{**}, R. Sato^{**}, A. Suzuki^{*},
 M. Koyama^{*}, H. Tsuboi^{*}, N. Hatakeyama^{*}, H. Takaba^{*},
 C. A. Del Carpio^{*}, M. Kubo^{*}, H. Kajiyama^{**}, A. Miyamoto^{*}
^{*}Tohoku Univ., Japan
^{**}Hiroshima Univ., Japan

We proposed a novel concept, "quantum-theory-based simulation with precise characterization", to sketch "real" models which are indispensable to advance the understandings of materials theoretically. To this end, novel spectroscopic characterization simulators and a novel quantum-theory-based simulator based on our molecular dynamics simulator and quantum chemical molecular dynamics simulator were developed.

PDPp - 2 Luminous Efficacy Improvement by Selective Suppression of Xe Ion Current in AC PDP

S. Sinha
 Samtel Color, India

In AC Plasma Displays (PDP) ~ 70% of total discharge power goes to Ne⁺ and Xe⁺ ions. The contribution of Xe⁺ ions to the ion heating loss is 1.5 to 5.5 times larger than Ne⁺ ion for 5 to 30% Xenon respectively.

PDPp - 3 Withdrawn**PDPp - 4 Influence of Substrate Temperature on Secondary Electron Coefficient (γ) of MgO Protective Layer and Discharge Characteristics in AC PDP**

S. H. Hong^{*}, C. G. Son^{*}, Y. J. Hong^{*}, S. H. Cho^{*},
 Y. G. Han, S. H. Jeong^{*}, S. H. Kim^{*}, J. E. Nam^{*},
 G. S. Cho^{*}, B. H. Hong^{*}, H. S. Uhm^{**}, E. H. Choi^{*}
^{*}Kwangwoon Univ., Korea
^{**}Ajou Univ., Korea

We have investigated the influence of the substrate temperature on the secondary electron coefficient (γ) of MgO protective layer and discharge characteristics in AC-PDP. The γ of MgO protective layer has been measured by using Gamma Focused Ion Beam system by varying the glass substrate temperature from -20°C to 80°C. Also, the firing voltages have been investigated with the above ranges of substrate temperatures for the 4-inch test panel in a thermo-hygrostat chamber.

PDPp - 5 Improvement of Discharge Characteristics in PDP Using Lead-Free and Low Permittivity Rear Dielectric Layer

T.-J. Kweon^{,**}, J.-W. Han^{*}, H.-S. Tae^{*}, J.-W. Nam^{**},
E.-G. Heo^{**}*

^{}Kyungpook Nat. Univ., Korea*

*^{**}Samsung SDI, Korea*

In this paper, the lead-free and low permittivity rear dielectric material (ZnO-B₂O₃ glass system) was adopted to remove the lead-oxide (PbO) ingredient and improve the discharge characteristics, and the resultant change in the discharge characteristics, such as the luminance, and luminous efficiency, address power consumption, were examined in comparison with that of the lead-oxide (PbO) containing glass system rear dielectric material in the 50-in. HD PDP. In the rear panel fabricated by the ZnO-based dielectric material, the luminous efficiency is improved by about 7 %, and address power consumption is reduced by 20% or more.

PDPp - 6 Investigation on Address Discharge Characteristics for R, G, and B Cells and Effects of Phosphor Thickness on Address Discharge Delay in AC PDP

H. D. Park, H.-S. Tae, H.-S. Jung^{}, M. Hur^{*}, M. Yoo^{*}*

Kyungpook Nat. Univ., Korea

^{}Samsung SDI, Korea*

In this paper, the address discharge characteristics are analyzed in the red, green, and blue cells, respectively by using the V_t closed-curve method. To reduce the difference of the address discharge delay among the R, G, and B cells, the effects of the phosphor thickness on the address discharge delay are examined. By controlling properly the phosphor thickness among the R, G, and B cells, the difference of the address discharge delay is observed to be minimized among the R, G, and B cells.

PDPp - 7 Effect of a Pair of Annular Electrodes Buried in Rib on Coplanar Discharge in AC PDP

M. Kawamoto, M. Nishitani^{}, M. Kawasaki^{**},*

*Y. Yamamoto^{**}, K. Tachibana*

Kyoto Univ., Japan

^{}Panasonic, Japan*

*^{**}Toray Ind., Japan*

We estimated the performance of a new structure PDP cell with a pair of annular electrodes buried in the surrounding barrier ribs. The result showed a higher luminous efficiency by about 60% than that of a conventional coplanar structure when auxiliary pulses are applied to the annular electrodes.

PDPp - 8 Discharge Characteristics in Accordance with Various Indium Tin Oxide (ITO) Sustaining Electrodes in AC PDP

*S. H. Cho, S. H. Hong, S. S. Lee, C. G. Son, Y. J. Hong,
Y. G. Han, G. C. Gwon, B. H. Hong, G. S. Cho,
E. H. Choi*

Kwangwoon Univ., Korea

We have measured the electron temperature, brightness and luminous efficiency in accordance with various ITO electrode's structures in alternating current plasma display panels. Also we have investigated the correlation of luminous efficiency with the density of excited Xe atoms in the $1s_5$ metastable state and electron temperatures. It is found in this study that the luminous efficiency is the highest for the fish-boned electrodes among the other ITO electrodes. It is also found that the maximum density of excited Xe atoms in the $1s_5$ metastable state for fish-boned ITO electrode is the highest to be $3.0 \times 10^{13} \text{ cm}^{-3}$ in comparison with those of $2.7 \times 10^{13} \text{ cm}^{-3}$ and $2.1 \times 10^{13} \text{ cm}^{-3}$, respectively, for T and squared structures.

PDPp - 9 Effects of Aluminum Fence-Electrode Design on Characteristics of AC PDP

S. Y. Lee, H. N. Choi, D. H. Lee, Y.-S. Kim*

Hongik Univ., Korea

**Int. Metal Inst., Korea*

Effects of aluminum fence-electrode design on performance of ac-PDP were conducted. The aluminum electrode was prepared by chemically etching an aluminum foil bonded to a glass substrate via anodic bonding process. Firing voltages, luminance and discharge characteristics of test panels with various sustain gap were evaluated at different Xe contents.

PDPp - 10 Effects of Xe Gas Composition Change in 4K Panel

*D. H. Yoon, T. J. Jang, B. J. Chung, J. H. Choi, J. H. Lee,
H. M. Son, Y. K. Seong, W. S. Yoon, Y. K. Kim, H. Y. Ahn,
D. H. Choe*

Samsung SDI, Korea

Although implementation of High Xe is regarded as one of the most plausible solutions in term of the efficiency, not so many research results have been reported regarding the high proportion of Xe in small cell. In this paper, the characteristic of high Xe gas was evaluation in 4K panel.

PDPp - 11 Optimization of He-Ne-Xe Gas Mixtures for High Speed and Low Voltage Performance in AC PDPs

E. Y. Jung, K. J. Suh, J. C. Ahn, E. G. Heo, S. K. Jang, C.-S. Park**

Samsung SDI, Korea

**Kyungpook Nat. Univ., Korea*

We investigated systematically discharge characteristics with various gas conditions in He-Ne-Xe mixtures in order to realize a high speed performance. As the helium gas increases from 0 to 50%, the address delay (T_f) becomes shortened about 50nsec. As the gas pressure decreases from 600torr to 300torr, the T_f and T_s are reduced about 71nsec, 65nsec respectively. From these results, we proposed the optimization conditions for obtaining the high speed and low driving voltage.

PDPp - 12 A Study on Temporal Dark and Bright Image Sticking Characteristics under Various Panel Gas Pressures in AC PDP

J. H. Kim, C.-S. Park, H.-S. Tae

Kyungpook Nat. Univ., Korea

The influences of the temporal dark and bright image sticking were investigated under the various panel working gas pressures in the ac-PDP. To study the temporal dark and bright image sticking phenomena for various panel gas pressures, the differences in the displayed luminance, IR emission profile, and disappearing time were measured. With a decrease in the working gas pressure, the temporal dark and bright image sticking were reduced.

PDPp - 13 Explanation for Wall Charge Leakage in PDP

T. Kurai, Y. Kim

Samsung SDI, Korea

We derived time dependent function of Wall charge voltage by using Poisson-Boltzmann equation. We compared temperature dependence of Wall Charge Leakage estimated by our theory to that of measured value. Then we gave the explanation of the cause of temperature dependence of Wall Charge Leakage.

PDPp - 14 Design of Erase Waveform for Stabilizing Reset Discharge in Sustain Gap of 200 μ m

S. H. Yoon, C. S. Min, J. H. Seo

Univ. of Incheon, Korea

In a 200 μ m gap structure a very unstable discharge is occurred. Based on the V_t close curve, the unstable discharge is analyzed at various conditions. By reducing the voltage level of the last sustain pulse, the discharge during the erase ramp period is stabilized.

PDPp - 15 Driving Characteristics of Negative Waveform in AC PDPs during Reset and Address Periods

C. Eom, H. Lim, J. Lee, H. Park, B. Kong*, S. Moon*, J. Kang*

Dankook Univ., Korea

**LG Elect., Korea*

Comparative experiments were performed with the 42-inch XGA PDP module. The negative waveform improved contrast ratio about 15.4 ~ 22.5 % than the positive waveform. In address period, the formative time delay ($= T_f$) of negative waveform was about 22.7 % faster than that of positive waveform.

PDPp - 16 Effects of Initial Wall Charge Distribution in Reset Period on Wall Voltage Variation in Address Period in AC PDP

B.-T. Choi, H.-S. Tae

Kyungpook Nat. Univ., Korea

It has been known that the wall voltage distribution is varied depending on the applied voltages during an address period, thus causing the deterioration of address delay. To investigate the relation between the wall voltage variation during the address period and the initial wall charges accumulating during the reset period, the wall voltage variation is examined relative to the initial wall charge conditions by using the V_t closed curve. It is found that the applied voltage levels for minimizing the wall voltage variation depends on the initial wall charge condition.

PDPp - 17 Modified Reset Waveform for Stable Address Discharge under Variable Ambient Temperature in AC PDP

S.-K. Jang, H.-S. Tae

Kyungpook Nat. Univ., Korea

It has been known that the address discharge delay time during an address period strongly depends on the wall charge leakage. It was observed that the wall charge leakage phenomenon during an address period was related to both the ambient temperature and the electric field between the address and scan electrodes. The wall charge leakage was increased with an increase in the voltage difference between the address and scan electrodes. Base on the experimental observation, the modified reset waveform with multi-negative falling level (V_{nf}) is proposed to produce the stable address discharge under variable ambient temperature.

PDPp - 18 A Novel Driving Waveform for Improving Address Time Lag in PDP

*B.-H. Chen, C.-Y. Hsiung, J.-K. Ye
Nat. Dong-Hwa Univ., Taiwan*

We proposed a new waveform to improve the address time lag. Each line scan waveform has different applied voltage having progressively increased pulse height instead of conventional all line with constant scan voltage. Our results show address pulse width can reduce from 3 μ s to 1 μ s by improvement of time lag.

PDPp - 19 Improvement of the Luminance with a New Single Sustain Waveform in AC PDP

W. H. Park, H. M. Lim, J. Y. Lee, J. Kang
Dankook Univ., Korea
Myongji Univ., Korea

To improve the luminance in ac PDP, a new single sustain waveform with auxiliary address pulse was proposed. The new single sustain waveform were examined with 2-dimensional fluid code and related experiments with the 42-inch XGA PDP module was performed. The luminance of proposed single sustain waveform was improved more than 2 times of the luminance of general single sustain waveform.

PDPp - 20 Adaptive Address Energy Recover Circuit for Reducing Address Power in Color PDPs

X. N. Zhang, C. L. Liu, Z. H. Liang, X. L. Ding
Xi'an Jiaotong Univ., China
IRICO Group, China

An adaptive address energy recovery circuits (AAERCs) is proposed after analyzing the address power of other address methods. AAERCs can change the work mode in one subfield according to calculating result of address power to get the lowest address power for any pictures comparing with other address methods.

PDPp - 21 Withdrawn**PDPp - 22 Laser Patterning of Rectangular-Shaped ITO Electrode for High Luminous Efficient AC PDP**

*Z. H. Li, S. H. Im, E. S. Cho, S. J. Kwon
Kyungwon Univ., Korea*

In this paper, a Q-switched Nd:YVO₄ laser was used to fabricate the rectangular-shaped ITO electrodes of high efficient AC PDP with different scanning speed and repetition rate. The results showed that the optimized electrode was obtained when the scanning speed was 300 mm/s and the repetition rate was 20 kHz.

PDPp - 23 Addressable Coplanar Electrodes Microplasma Display Devices

L. G. Meng, H. F. Liang, Z. H. Liang, C. L. Liu, H. Wang, Y. J. Zhang

Xi'an Jiaotong Univ., China

Arrays of coplanar electrodes microplasma devices have been fabricated and operated in neon pressures. The fabrication processes is very simple and the uniformity is developed. The experimental results show that the current-voltage characteristics exhibit positive differential resistance and the devices would be the candidates of large microplasma arrays.

PDPp - 24L Effect of Slow-Slope-On Overlap-Scan Method in AC PDP

T. G. Kim, B. H. Lim, D. H. Lee

Kyungpook Nat. Univ., Korea

A AC-PDP driving method was proposed to reduce the address period. The overlap-scan can reduce the address period. However, this method has a narrow address voltage margin compared with conventional scan. In this paper, Slow-Slope-On overlap-scan is presented. The proposed method allows wider address voltage margin than conventional overlap-scan.

PDPp - 25L Numerical Calculation of Escape Factor of 147nm Resonance Radiation Emitted by $Xe^*(^3P_1)$ in a Ne-Xe Mixture

N. Minagawa

Pioneer, Japan

In a PDP discharge simulation, escape factor is usually used to account for the imprisonment of 147nm resonance radiation emitted by $Xe^*(^3P_1)$. At present, escape factors are known for 2 geometries, infinite slab and infinite cylinder. In this work, numerical calculation of escape factor is studied for an arbitrary geometry.

PDPp - 26L A Reconstruction Method of Pseudo Three-Dimensional Distribution of Excited Atom Density in a PDP Cell from Two-Dimensional Projections

*T. Sakai, K. Tachibana**

Display Res. Labs., Japan

**Kyoto Univ., Japan*

A 3D observation of excited atoms density in a unit cell is important for improvements of the efficacy of PDP. We have succeeded on measurement of Xe^* density with special panels. In this paper we proposed a simple method for pseudo 3D representation of the density and obtained reasonable results.

PDPp - 27L Direct Observation of Vacuum Ultraviolet Radiation from AC-PDPs with Narrow Sustaining Electrode

*F. Xing, G. Uchida, N. Awaji, H. Kajiyama, T. Shinoda
Hiroshima Univ., Japan*

We study experimentally AC-PDP with the narrow sustaining electrode (W_{ITO}) in high Xe contents. The specialized-PDP with narrow W_{ITO} achieves high luminous efficacy. The VUV measurement also shows that narrow W_{ITO} leads to strong excimer radiation.

PDPp - 28L Cathode Luminescence Study of MgO

M. Kitagaki^{,**}, C. L. Wang^{*,***}, N. Ding^{*}, X. Y. Zhang^{*,***},
G. Uchida^{*}, S. L. Wu^{***}, T. Shinoda^{*}, H. Kajiyama^{*}*

^{}Hiroshima Univ., Japan*

*^{**}Tateho Chem. Inds., Japan*

*^{***}Key Lab. for Physical Elect. & Devices of the Ministry of Education, China*

A cathode luminescence spectroscopy is applied to discuss the electronic properties of MgO. The measurements at various temperatures below 300 K suggest that the UV luminescence peaked at 240 nm is due to the exciton formation.

PDPp - 29L Cathode Luminescence Study of SrO

H. Kajiyama, G. Uchida, T. Akiyama^{}, M. Kitagawa^{*},
T. Shinoda^{*}*

Hiroshima Univ., Japan

^{}Advanced PDP Dev. Ctr., Japan*

A cathode luminescence spectroscopy is applied to discuss the electronic properties of SrO thin film. The measurements at various temperatures below 300 K suggest that the UV luminescence peaked at 245 nm is due to the exciton formation.

PDPp - 30L Discharge Voltage of PDPs with Reactive Protecting Layer

T. Yano^{,**}, G. Uchida^{**}, K. Uchida^{*}, N. Awaji^{**},
T. Shinoda^{**}, H. Kajiyama^{**}*

^{}ULVAC, Japan*

*^{**}Hiroshima Univ., Japan*

Plasma display panels are manufactured in a vacuum condition. As a protecting layer, MgO, CaO, SrO and SrCaO with various compositions are used. It is demonstrated that the panels processed in vacuum shows a lower discharge voltages and higher luminous efficacy compared with the conventional ones.

13:20 - 14:40

Room 201

PDP3: Protective Layer (1)

Chair: H. Tolner, South East Univ., China
 Co-Chair: H. Kajiyama, Hiroshima Univ., Japan

**PDP3 - 1 A Computational Study on Protecting Layer of PDP:
 13:20 Secondary Electron Emission Property and Surface
 Structure**

K. Serizawa^{}, I. Yamashita^{*}, H. Onuma^{*}, H. Kikuchi^{**},
 M. Kitagaki^{**}, A. Suzuki^{*}, R. Sahnoun^{*}, M. Koyama^{*},
 H. Tsuboi^{*}, N. Hatakeyama^{*}, A. Endou^{*}, H. Takaba^{*},
 C. A. Del Carpio^{*}, M. Kubo^{*}, H. Kajiyama^{**}, A. Miyamoto^{*}
^{*}Tohoku Univ., Japan
^{**}Hiroshima Univ., Japan*

For designing the MgO protecting layer with high γ value, the geometric structure of MgO surfaces, their electronic structures and γ values were relationally studied by computational methods. On the irregular surface, undersaturated Mg atoms seem to work as electron traps which can increase the γ value.

**PDP3 - 2 MgO Sputtering Yields by Noble Gas Ions at
 13:40 Relatively Low Injection Energies**

S. Yoshimura^{}, K. Hine^{*}, M. Matsukuma^{*}, K. Ikuse^{*},
 M. Kiuchi^{**}, T. Nakao^{***}, J. Hashimoto^{***}, M. Terauchi^{***},
 M. Nishitani^{***}, S. Hamaguchi^{*}
^{*}Osaka Univ., Japan
^{**}AIST, Japan
^{***}Panasonic, Japan*

Sputtering yields of MgO by noble gas ions bombardment have been obtained experimentally as functions of injection energy in a range of relatively low energies (<400 eV) with the use of a mass selected mono-energetic ion beam system. The results were also compared with those from numerical simulations.

**PDP3 - 3 Numerical Analysis of Density of Energy States for
 14:00 Electron Emission Sources in MgO**

*S. Ho, S. Nobuki, N. Uemura, S. Mori, T. Miyake,
 K. Suzuki, Y. Mikami, M. Shiiki, S. Kubo^{*}
 Hitachi, Japan
^{*}Hitachi ULSI Syss., Japan*

A thermal excitation and emission model and an analytical protocol are proposed to evaluate the density of energy states for multiple kinds of electron emission sources (EES) in MgO. In Si-doped MgO, the activation energy and number of Si EES are calculated to be 770 meV and 1.8×10^6 per cell.

PDP3 - 4 **Influences of Wall Charges on Electron Emissions**
14:20 **from MgO Protective Layer**

K. Yoshino^{,**}, T. Nagatomi^{*}, Y. Morita^{**}, N. Kosugi^{**},
 T. Oue^{**}, M. Nishitani^{**}, M. Kitagawa^{**}, Y. Takai^{*}*
**Osaka Univ., Japan*
***Panasonic, Japan*

Influences of wall charges on the statistical delay time of the discharge, t_s , were investigated. t_s was smaller with positively increasing the wall charges on the cathode side. This result strongly suggests that the electric field induced in a MgO film on the cathode electrode affects the exoelectron emission.

----- Break -----

15:00 - 16:15

Room 201

PDP4: Protective Layer (2)

Chair: G. Oversluizen, Philips Res. Labs., the Netherlands
 Co-Chair: M. Uchidoi, Panasonic, Japan

PDP4 - 1: *Invited* Factors Affecting Emission of Exo-Electrons
15:00 **from MgO Thin Films of AC PDPs**

Y.-S. Kim, S.-H. Yoon
Hongik Univ., Korea

Factors affecting the exo-electron emission are analyzed experimentally and theoretically. The factors include, sustaining pulses, wall charges, and bias voltage. The experimental measurements have been conducted using our experimental set-up developed and was analyzed using various theoretical models.

PDP4 - 2 **Analysis of Deterioration of Secondary Electron**
15:20 **Emission Coefficient of Protective Layers Formed by**
Alkaline-Earth Oxides for PDPs

M. Sakai, S. Hatta, Y. Fukui, Y. Honda, M. Okafuji,
Y. Yamauchi, M. Nishitani, Y. Takata
Panasonic, Japan

We have analyzed the surface deterioration of a protective layer. The value of γ decreases with the surface carbonation of the alkaline-earth oxides, because the carbonates have the large E_g and have the sharp band below the valence band, which result in the significant increase of breakdown voltage.

PDP4 - 3 **Effects of (Mg_xZn_{1-x})O Electron Emission Layer on Firing Voltages of AC PDPs**
15:40

S. G. Ahn, S. H. Yoon, Y. S. Kim
Hongik Univ., Korea

We explored a possibility of using (Mg_xZn_{1-x})O compound as electron emission layer for ac-PDPs. The firing voltages and luminous efficiency indicated that those properties can be improved significantly. This demonstrates that the control of band gap energy is effective in inducing secondary electron emission from Auger neutralization of Xe⁺.

PDP4 - 4L **High Resolution Microplasma Arrays Fabricated in Aluminum Foil: Improved Device Performance in the Microcavity and Microchannel Structure**
16:00

K. S. Kim^{}, J. K. Yoon^{*}, G. S. Heimberg^{*}, S.-J. Park^{*,**}, J. G. Eden^{*}*
^{*}*Univ. of Illinois, USA*
^{**}*Eden Park Illumination, USA*

Addressable, self-assembled Al/Al₂O₃ electrodes have been fabricated to the shape of microcavity and microchannel arrays. Improved luminance and luminous efficacies have been observed with parabolic cross-sectional Al₂O₃ microcavities. Precise control of the cross-sectional geometry and surface morphology of the cavities within Al/Al₂O₃ microplasma devices was achieved with electrochemical process.

----- Break -----

16:40 - 17:40

Room 201

PDP5: Fabrication

Chair: K. W. Whang, Seoul Nat. Univ., Korea
 Co-Chair: R. Murai, Panasonic, Japan

PDP5 - 1: *Invited* Ultra-Large Area Film Display by Plasma Tube Array Technology
16:40

M. Ishimoto, H. Hiirakawa, K. Awamoto, K. Shinohe, T. Shinoda
Shinoda Plasma, Japan

The plasma tubes array is expected to realize the next generation of wall size film display. We had successfully developed a prototype film display of 3m × 1m screen size which was consisted of 3 sub-modules of 1m × 1m. The results of proto type will be discussed.

**PDP5 - 2 A Comparative Study of Different Getter
17:00 Configurations on PDP Performances**

M. Riva, A. Bonucci, S. Tominetti, C. Carretti, Y. Han,
S. H. Hong*, E.-H. Choi**
SAES Getters, Italy
**Kwangwoon Univ., Korea*

Different getter system configurations have been integrated into 6 inch RGB plasma panels: the main operational parameters have been compared with reference panels (with no getters), at different ageing times. Getter activity during PDP manufacturing is explained, on the basis of contamination studies on each phase of the process flow.

**PDP5 - 3 PDP Manufacturing System under Vacuum Condition
17:20**

K. Uchida, G. Uchida**, T. Yano* **, H. Kajiyama**,
T. Shinoda***
ULVAC, Japan
**Hiroshima Univ., Japan*

A PDP manufacturing method suitable for energy and cost savings is demonstrated. In the method, the panel processing after MgO deposition and panel sealing are all completed under a controlled vacuum circumstance. As a result, the shorter aging time for stable discharge and the lower firing voltage is successfully achieved.

Author Interviews

17:40 – 18:40

Sponsor:

Plasma Display Technical Meeting

PDP International Forum '08

Saturday, December 6, 2008

10:30–16:30

Toki Messe Niigata Convention Center
(IDW '08 Venue)

For further information, visit www.pdptm.org/forum/

Workshop on EL Displays and Phosphors

Thursday, December 4

9:00 - 12:00

Exhibition Hall B

Poster PHP: Phosphors

PHP - 1 Yellow-Emitting Eu^{2+} -Doped Sr-Borate Phosphors for White Light Emitting Diodes

*W. S. Song, D. K. Lee, J. U. Kim, H. Yang
Hongik Univ., Korea*

This work focuses on development of Eu^{2+} -doped Sr-borate as a yellow-emitting phosphor and its application to white LED fabrication. 1300°C -fired $\text{Sr}_{1.93}\text{B}_2\text{O}_5:\text{Eu}_{0.07}$ was used for white LED fabrication. Optical properties were evaluated, resulting in warm white with chromaticity coordinates of (0.340-0.372, 0.287-0.314) and CRI of 75-77 under 5-40 mA forward currents.

PHP - 2 Intensely Red-Emitting in Novel $\text{Na}_2\text{Eu}(\text{WO}_4)_{1-x}(\text{MoO}_4)_x(\text{PO}_4)$ Phosphors for WL-LEDs

C.-H. Chiu, T.-M. Chen, C.-N. Mo
Chunghwa Picture Tubes, Taiwan
Nat. Chiao Tung Univ., Taiwan

The fundamental luminescence and chromaticity properties of a novel class of red-emitting phosphors $\text{Na}_2\text{Eu}(\text{WO}_4)_{1-x}(\text{MoO}_4)_x(\text{PO}_4)$ have been investigated. Under near-UV and blue light excitation the intensely red-emitting of the tungsto-molybdate phosphors may serve as a potential candidate for white-light (WL) LEDs.

PHP - 3 Synthesis and Photoluminescence Properties of Chlorophosphate Phosphor for White Light-Emitting Diodes

*H. S. Yoo, S. Vaidyanathan, S. W. Kim, J. Y. Han,
D. Y. Jeon
KAIST, Korea*

Luminescence properties of $\text{Ba}_5(\text{PO}_4)_3\text{Cl}:\text{Yb}^{2+}$ phosphor were investigated for white light-emitting diodes (LEDs) application. Broad excitation and emission bands were observed due to 4f - 5d transitions of Yb^{2+} ion. The non-radiative transitions between Yb^{2+} ions were responsible for the electric dipole-dipole interaction between Yb^{2+} ions.

PHp - 4 Preparation and Optical Characterization of Blue Emission Phosphate Phosphor $\text{LiSrPO}_4:\text{Eu}^{2+}$ for White LEDs

*T. Ishigaki, T. Hatsumori, K. Uematsu, K. Toda, M. Sato
Niigata Univ., Japan*

$\text{LiSrPO}_4:\text{Eu}^{2+}$ phosphor were prepared. Emission and excitation spectra of the samples were investigated. $\text{LiSrPO}_4:\text{Eu}^{2+}$ and Eu, Mg co-doped LiSrPO_4 samples emitted purple (420nm) and blue (450nm), respectively due to the structural difference of the crystal. The $\text{LiSrPO}_4:\text{Eu}^{2+}$, Mg^{2+} can be potentially useful as a UV radiation-converting phosphor for light-emitting diodes.

PHp - 5 Fabrication of Light Emitting Diode and the Characteristic of Its Display Module

B. S. Park, S. W. Kim, S. G. Lee, S. I. Son*, E.-T. Kim**,
C.-J. Kim*

Univ. of Seoul, Korea

**Pantech, Korea*

***ETRI, Korea*

The main goal of this work is advances in 1.0mm × 0.5mm light emitting diode using AlInGaN cell structure and display module. In the first place, we proposed 200 μm × 200 μm cell structure using AlInGaN. Secondly, we describe new type LED fabrication procedure and results of an examination include application.

PHp - 6 A Novel Broad Band Orange Red Emitting Phosphor for Solid State Lighting

*S. Vaidyanathan, S. W. Kim, H. S. Yoo, D. Y. Jeon
KAIST, Korea*

A novel orange-red emitting phosphors $\text{Ca}_{3-x}\text{Eu}_x\text{Si}_2\text{O}_7$ ($x = 0 - 0.03$, in steps of 0.05) have been synthesized. All the compositions show orange-red emission and the emission intensity is found to be maximum for $\text{Ca}_{2.985}\text{Eu}_{0.015}\text{Si}_2\text{O}_7$ [~ 1.2 Vs $\text{CaS}:\text{Eu}^{2+}$ ($\lambda_{\text{exc}} = 400$ nm)]. $\text{Ca}_{2.985}\text{Eu}_{0.015}\text{Si}_2\text{O}_7$ could find potential application as orange - red phosphors for white LEDs.

PHp - 7 Temperature Dependence of Photoluminescence Spectroscopy and Thermoluminescence Property on Eu-Doped BaMgAl₁₀O₁₇ and SrMgAl₁₀O₁₇

H. Tanno^{,**}, S. Zhang^{*,**}, G. Uchida^{*}, T. Shinoda^{*},
H. Kajiyama^{*}*

^{}Hiroshima Univ., Japan*

*^{**}Dyden, Japan*

The temperature dependence of photoluminescence spectroscopy and thermoluminescence property on BAM:Eu and SAM:Eu are investigated. Peak shift of PL spectroscopy on SAM:Eu is largely observed between 50 and 300 K compared with BAM:Eu. The TL results reveal that the states of europium occupied in BAM and SAM should be different.

PHp - 8 Withdrawn

PHp - 9 Ba₄Gd₆Si₆O₂₄F₂:Tb Green Phosphor for VUV Excitation

A. Kobayashi, T. Kunimoto^{}, K. Ohmi*

Tottori Univ., Japan

^{}Tokushima Bunri Univ., Japan*

A novel fluoroapatite-silicate phosphor Ba₄Gd₆Si₆O₂₄F₂:Tb has been proposed as a green phosphor for VUV excitation. It has been found that the low-temperature synthesis with an excess fluorine is essential to maintain the efficient intensity of the excitation band lying below 200 nm. The currently obtained PLE intensity at 172 nm is about 95% of Zn₂SiO₄:Mn.

PHp - 10 Luminance Uniformity of Organic-Dye-Dispersed Hybrid Inorganic Electroluminescent Device

*Y. Noguchi, M. Kobayashi, S. Kawamura, Y. Masakura,
T. Tamura, T. Uchida, T. Satoh*

Tokyo Polytechnic Univ., Japan

Luminance, which creates problems in conventional dispersed-type electroluminescent (EL) devices, and color purity are improved by dispersing organic dyes. Moreover, the luminance becomes uniform.

PHp - 11 Blue-Emitting Bi-Activated La₂O₃ Thin-Film Electroluminescent Devices

K. Ueda, S. Matsui, H. Fukada, T. Miyata, T. Minami

Kanazawa Inst. of Tech., Japan

Blue-emitting TFEL devices fabricated using a La₂O₃:Bi thin film and a thick BaTiO₃ ceramic sheet have been newly developed. Two types of TFEL devices were fabricated with or without a ZnS thin-film carrier acceleration layer. A luminance of 46.9 cd/m² was obtained in a TFEL device fabricated with a ZnS thin-film layer.

PHp - 12 Bendable Inorganic Thin-Film EL Devices Fabricated on Sapphire Sheets

*K. Sahara, H. Fukada, T. Miyata, T. Minami
Kanazawa Inst. of Tech., Japan*

Inorganic TFEL devices were fabricated using an oxide phosphor emitting layer prepared on a sapphire substrate with either an R- or A-plane lattice structure. Bendable and see-through $\text{Zn}_2\text{Si}_{0.6}\text{Ge}_{0.4}\text{O}_4:\text{Mn}$ TFEL lamps were demonstrated using a double-insulating-layer-type device fabricated on a R-plane sapphire sheet with a thickness of approximately 60 μm .

PHp - 13 Dispersed-Type Inorganic Electroluminescent Device on Printed Conductive Polymer Electrode

*T. Homma, Y. Nakamura, S. Ohmura, T. Uchida, T. Satoh
Tokyo Polytechnic Univ., Japan*

Indium thin oxide (ITO) is used in many applications. However, since indium—one of its main ingredients—is a rare metal, reducing costs and resource-saving methods need to be implemented. Therefore, dispersed-type inorganic electroluminescent devices on printed conductive polymer electrodes incurring low costs in the substitution of ITO were examined.

PHp - 14 Spectral Characteristics of Dispersion-Type Inorganic EL Device Dispersed with Organic and Inorganic Phosphors

N. Taguchi, T. Matsumura-Inoue^{}, Y. Uraoka^{**},
Y. Hasegawa^{**}*

Image Tech, Japan

^{}Minerva Light Lab., Japan*

*^{**}Nara Inst. of S&T, Japan*

We investigated changes of spectrum and luminance in inorganic EL devices dispersed with inorganic phosphors, comparing with that of the organic dye-dispersed inorganic EL. Reported here is that the spectral change and increased luminance occur in the inorganic EL dispersed with a green inorganic phosphor.

PHp - 15 Highly Thermal Stability of Europium(III) Chelate Encapsulated by Sol-Gel Glass

T. Fukuda, S. Yamauchi, E. Kin, H. Ohara, T. Yokoo*,
N. Kijima*, N. Kamata
Saitama Univ., Japan
Mitsubishi Chem. Group, S&T Res. Ctr., Japan

Thermally stable europium(III) chelates has been achieved by coating with silica glasses via a low temperature sol-gel process. It was revealed that the surface coating has a pronounced effect to suppress the decrease in the photoluminescence quantum yield during the thermal treatment approximately 140 °C.

PHp - 16 Characterization of Phosphors Prepared by Planetary Ball Milling

*S. W. Choi, J. H. Shin, S. H. Hong
Seoul Nat. Univ., Korea*

This study is focused on the photoluminescence properties of Eu²⁺-doped CaAl₂O₄ obtained by Pechini and mechanical process. The products prepared by Pechini process were ground using planetary ball-milling at intermediate stages. The morphology, size, and crystallinity of the resulting particles were investigated, particularly focusing on the relations with PL properties.

PHp - 17 Structural Properties of Coated Nanoparticles: the ZnS/ZnO Nanostructure

*P. Verma, A. Pandey
Allahabad Univ., India*

The Production of undoped and doped nanosized semiconductor nanostructures composed of a core of ZnO nanocrystals coated with a ZnS layer has been attempted by using a method of chemical precipitation at room temperature. These doped nanosized semiconductor nanostructures can form a new class of luminescent materials for various applications. The particle size was estimated to be 6nm from Transmission Electron Microscopy (TEM) and calculated as 6 ± 0.4 nm from peak broadening of the X-ray diffraction (XRD) pattern. This treatment is suggested to improve various properties of optoelectronically valuable ZnO/ZnS nanostructures.

PHp - 18 The Variation of the Enhanced Photoluminescence Efficiency of Sol-Gel Derived $Y_2O_3:Eu^{3+}$ Films with Thickness to the Photonic Crystal Layer

*J. R. Oh, H. K. Park, J. H. Park, Y. R. Do
Univ. of Kookmin, Korea*

A sol-gel spin coating method was used to fabricate $Y_2O_3:Eu^{3+}$ thin-film phosphors on nanohole-type 2-D photonic crystal layers with 580 nm pitches and a non-PC substrate in an attempt to improve the efficiency of light extraction. The optical and structural properties of $Y_2O_3:Eu^{3+}$ thick films were characterized by SEM, PL.

PHp - 19 Enhanced Photoluminescence Properties of $SrGa_2S_4:Eu^{2+}$ Thin-Film Phosphors on 2D Photonic Crystal Substrate

*K. N. Lee, K.-Y. Ko, J. H. Moon, Y. R. Do
Univ. of Kookmin, Korea*

In this study of $SrGa_2S_4:Eu^{2+}$ thin-film phosphors, $SrGa_2S_4:Eu^{2+}$ thin-film phosphors were deposited through an RF-magnetron sputtering process. An improved photoluminescence intensity of $SrGa_2S_4:Eu^{2+}$ thin-films were obtained with 2-dimensional photonic crystal layer of various heights. The properties of films are characterized and discussed.

PHp - 20 Dependence of Structural and Luminescent Characteristics of $SrGa_2S_4:Eu$ Thin Film Phosphors on Preparation Conditions

K. Terada, H. Kominami, T. Seino, Y. Arai*, Y. Nakanishi, Y. Hatanaka**, K. Hara
Shizuoka Univ., Japan
*Japan Steel Works, Japan
**Aichi Univ. of Tech., Japan*

Green-light-emitting $SrGa_2S_4:Eu^{2+}$ thin films were successfully prepared on glass substrates by EB evaporation and post-laser-annealing at 500°C. The structural and cathodoluminescence properties varied depending on the annealing conditions, which was discussed in view of the application for FEDs.

PHp - 21 Substrate Bias Voltage Influence on Optical and Structural Characteristics of Zinc Oxide Films Prepared by Radio Frequency Magnetron Sputtering

C. Li, T. Matsuda, T. Hiramatsu, H. Furuta, T. Kawaharamura, M. Furuta, T. Hirao

Kochi Univ. of Tech., Japan

Zinc oxide thin films were prepared on quartz glass using radio frequency magnetron sputtering. It was found that the crystallinities of ZnO films were deteriorated with increasing bias power. The photoluminescence properties of the ZnO films were significantly influenced by substrate bias voltage and thermal annealing.

PHp - 22L Novel Eu^{2+} and Ce^{3+} , Li^+ -Doped $\text{Sr}_3\text{Al}_2\text{O}_5\text{Cl}_2$ Phosphors for White LEDs

X. M. Zhang, N. S. Choi, B. W. Park, K. W. Park, K. I. Seo, J. H. Park, J. S. Kim

Pukyong Nat. Univ., Korea

$\text{Sr}_3\text{Al}_2\text{O}_5\text{Cl}_2$ doped with Eu^{2+} and $\text{Ce}^{3+}, \text{Li}^+$ phosphors were synthesized by solid-state reaction. Three white LEDs combining 420 and 464 nm emitting chip with single $\text{Sr}_3\text{Al}_2\text{O}_5\text{Cl}_2:\text{Eu}^{2+}$ phosphor and mixture of $\text{Sr}_3\text{Al}_2\text{O}_5\text{Cl}_2:\text{Eu}^{2+}$ and $(\text{Ba}, \text{Sr})_2\text{SiO}_4:\text{Eu}^{2+}$ phosphors have been fabricated. The temperature dependence on PL intensity and the optimum doping concentration were studied.

PHp - 23L White-light-emitting T-phased $(\text{Ba}, \text{Ca})_2\text{SiO}_4:\text{Eu}^{2+}$, Mn^{2+} Phosphor

N. S. Choi, B. W. Park, K. I. Seo, J. H. Park, X. M. Zhang, J. S. Kim, S. H. Lee, K. W. Park*, S. D. Jeon**

Pukyong Nat. Univ., Korea

**Lucimea, Korea*

The emission spectra of T-phased $\text{Ba}_{1.2}\text{Ca}_{0.64}\text{SiO}_4:0.1\text{Eu}^{2+}$, 0.06Mn^{2+} phosphor shows the red from Mn^{2+} together with the blue-green from Eu^{2+} . The fabricated white-light emitting diode using a 420-nm-emissive chip with the phosphor shows a warm white color with the color temperature of 4500 K and the high color rendering of 84.

PHp - 24L Energy Transfer in Single-Phase Two Color Emitting $\text{Ca}_3\text{Mg}_3(\text{PO}_4)_4:\text{Eu}$, Mn Phosphors

K. H. Kwon, W. B. Im, H. S. Yoo, D. Y. Jeon*

KAIST, Korea

**Univ. of California, Santa Barbara, USA*

In this study, the single-phase emitting $\text{Ca}_3\text{Mg}_3(\text{PO}_4)_4:\text{Eu}, \text{Mn}$ phosphor for white light-emitting diodes is reported. The luminescent properties and structural information of phosphor samples are investigated. Additionally, the energy transfer from Eu to Mn can be expected in $\text{Ca}_3\text{Mg}_3(\text{PO}_4)_4:\text{Eu}, \text{Mn}$ in terms of PL spectra, energy transfer efficiency and decay time.

PHp - 25L Color Tunability of Blue Spectral Emission of $\text{Sr}_3\text{MgSi}_2\text{O}_8:\text{Eu}^{2+}$ Phosphor via Ba Substitution for the Application to CCFLs

*H. J. Park, W. B. Im, H. S. Jang, H. S. Yoo, D. Y. Jeon
KAIST, Korea*

We have enhanced color rendering property of a blue emitting phosphor $\text{Sr}_3\text{MgSi}_2\text{O}_8:\text{Eu}^{2+}$ (SMS) using incorporation of Ba ion in Sr site of host lattice. Ba^{2+} addition to SMS: Eu^{2+} phosphor caused shifting of PL emission peak. This optical properties of $(\text{Sr}_{1-x}\text{Ba}_x)_3\text{MgSi}_2\text{O}_8:\text{Eu}^{2+}$ is discussed.

PHp - 26L Photoluminescence of $\text{SrGa}_2\text{S}_4:\text{Bi}$ Phosphors

*S. Okamoto, T. Sakai, K. Tanaka
NHK, Japan*

Bi-activated SrGa_2S_4 ($\text{SrGa}_2\text{S}_4:\text{Bi}$) phosphor exhibits green luminescence with a peak wavelength of 533 nm and a full width half maximum (FWHM) of 55 nm. As SrGa_2S_4 is co-activated by Bi^{3+} and Mn^{2+} ions, the excitation band around 400 nm is enhanced relative to that around 300 nm.

PHp - 27L Synthesis of $\text{La}_2\text{O}_2\text{S}:\text{Eu}$ by Citric Acid Gel Method - Dependence of Properties on Pre-firing Condition -

*S. Yamashita, H. Kominami, Y. Nakanishi, K. Hara,
Y. Shimomura*, M. Yoshino*
Shizuoka Univ., Japan
Mitsubishi Chem. Group, S&T Res. Ctr., Japan

White LED is expected as a lighting of the next generation. It is suggested that $\text{La}_2\text{O}_2\text{S}:\text{Eu}$ shows good luminescence in the near-ultraviolet excitation. In this study, synthesis of $\text{La}_2\text{O}_2\text{S}:\text{Eu}$ using the citric-acid-gel method has been studied. As the result, particle size can be controlled by changing pre-firing temperature.

PHp - 28L Direct Deposition of Silicon Quantum Dots Embedded Silicon Nitride Film on Plastic Substrate by Catalytic CVD

*K.-M. Lee, T.-H. Kim, J.-D. Hwang, S. H. Jang,
K. Y. Jeong, M. S. Han, W.-S. Hong
Univ. of Seoul, Korea*

We fabricated silicon quantum dots embedded in silicon nitride film using catalytic chemical vapor deposition process at low temperature. Formation and size of silicon quantum dots in silicon nitride film were analyzed by photoluminescence spectroscopy. Silicon quantum dots of 5 nm in this sample were confirmed by transmission electron microscopy.

PHp - 29L Effect of Pressure on Firing of ZnCdO Powder for Preparation of Multi-Layered ZnO/ZnCdO Particles

*T. Sano, H. Kominami, Y. Nakanishi, K. Hara
Shizuoka Univ., Japan*

Liquid phase synthesis of ZnCdO powder for preparation of multi-layered ZnO/ZnCdO particles has been investigated. Lower temperature process is necessary for the preparation of multi-layered particle. From the result, the powder with high pressured firing showed highly effective not only defect-suppression but also improvement of exciton emission.

PHp - 30L Ultraviolet Light Emission from DC EL Device Sol-Gel Derived ZnO Nanocrystals

*H. Takeuchi, D. Yamaguchi, T. Toyama, H. Okamoto
Osaka Univ., Japan*

We demonstrate a UV DC EL device utilizing sol-gel derived ZnO nanocrystals (NCs) with a crystallite size of about 10 nm. PL spectra from ZnO NCs showed near band edge emission and green emission. The EL emission was observed at over 7 V.

PHp - 31L Optical Properties of the (Y,Gd)BO₃:Eu³⁺ Phosphor Coated with Al₂O₃, SiO₂ and ZnO for a Plasma Display Panel

*J. H. Seo, S. M. Lee, S. H. Sohn
Kyungpook Nat. Univ., Korea*

The surface of (Y,Gd)BO₃:Eu³⁺ phosphor was coated with SiO₂, Al₂O₃ and ZnO nano-particles in a simple surface treatment way, a kind of the modified sol-gel method. It was found that the surface coating of red phosphors with nano-particles leads to an increase in the luminance intensity of the PDP.

PHp - 32L Photoluminescence in YPO₄:Mn²⁺ Codoped with Various Tetravalent Cations Excited by VUV Radiation

*M. Kitaura
Fukui Nat. College of Tech., Japan*

Experiment and calculation have been performed to clarify the effect of tetravalent ions addition on the intensity of the photoluminescence (PL) from Mn²⁺ ions in YPO₄. The PL band at 482 nm was most strongly observed in the addition of Zr⁴⁺ ions under excitation with VUV photons at 147nm.

PHp - 33L Optical Properties of Red-Emitting Thin Film Phosphor Sputtered on Silica Microsphere Photonic Crystal Layer

*J. Y. Han, H. S. Yoo, D. Y. Jeon
KAIST, Korea*

To improve extraction efficiency from sputtered $\text{YVO}_4:\text{Eu}^{3+}$ thin film phosphors silica photonic crystal layer (PCL) was introduced into thin film phosphor layer. Optical properties of sputtered $\text{YVO}_4:\text{Eu}^{3+}$ thin films with silica PCL were investigated via photoluminescence (PL) and optical transmittance and the enhanced PL intensities were obtained.

----- Lunch -----

13:20 - 14:50

Room 302

PH1: Phosphors for LEDs

Chair: K.-S. Sohn, Suchon Nat. Univ., Korea
Co-Chair: R. J. Xie, NIMS, Japan

PH1 - 1: *Invited* Progress in Nitride and Oxynitride Phosphors
13:20

*H. Yamamoto, K. Uheda**

Tokyo Univ. of Tech., Japan

**Mitsubishi Chem. Group, S&T Res. Ctr., Japan*

Nitride and oxynitride phosphors have been actively investigated because they have optical and chemical properties well suited to white LED application. Recent achievement of these phosphors is reviewed mainly for LED backlighting and high-output LEDs. Application of cathode-ray or UV excitation is discussed referring to a successful example of $\text{AlN}:\text{Eu},\text{Si},\text{O}$.

PH1 - 2 Luminescence Properties of Eu^{2+} -Doped Green-Emitting Sr-Sialon Phosphor and Its Application in White LEDs
13:50

Y. Fukuda, I. Mitsuishi, S. Nunoue

Toshiba, Japan

A new green-emitting phosphor $\text{Sr}_3\text{Si}_{13}\text{Al}_3\text{O}_2\text{N}_{21}:\text{Eu}^{2+}$ that can be excited by blue emission has been developed. It shows a highly efficient green luminescence and has small thermal quenching. White LEDs are prepared using this phosphor, assorted with red-emitting phosphor. Luminous efficacy reached 62 lm/W, with Ra value of 87.

PH1 - 3 **Three Band White Light from the White LEDs Using Inorganic Phosphor and Semiconducting Nanocrystal**
14:10

H. S. Jang, H. Yang, B. H. Kwon, S. W. Kim, J. Y. Han, K. H. Kwon, H. J. Park, D. Y. Jeon*

KAIST, Korea

**Hongik Univ., Korea*

Three band white light-emitting diodes (LEDs) were fabricated by combining a blue LED with both a greenish-yellow-emitting phosphor and red-emitting quantum dots (QDs). The CdSe/ZnSe showed stronger PL intensity than CdSe QDs, and this strong emission contributed to the improvement of luminous efficiency of QD-assisted phosphor-converted white LEDs.

PH1 - 4 **Luminescent Characteristics of Alkali-Earth Ortho-Silicate Phosphors Doubly Doped with Terbium and Europium**
14:30

R. Hiramatsu, Y. Fukuda, F. Aiga, K. Ishida, N. Matsuda, H. Asai

Toshiba, Japan

(Sr,Ba)₂SiO₄ phosphors doubly doped with Tb³⁺ and Eu²⁺ were prepared by a solid-state reaction. (Sr,Ba)₂SiO₄:Tb, Eu had characteristic luminescent spectra excited by 390nm. These spectra were in the broadband spectrum assigned to Eu²⁺ and the narrowband spectrum assigned to Tb³⁺. We considered these spectra were attributable to the Eu²⁺-Tb³⁺ energy transfer.

----- Break -----

15:00 - 16:30

Room 302

PH2: Phosphors for PDPs

Chair: T. Hisamune, Kasei Optonix, Japan

Co-Chair: N. Matsuda, Toshiba, Japan

PH2 - 1: **Invited High Performance Phosphors for Advanced PDPs**
15:00

Y.-C. Kim, J. H. Song, J. H. Kim, S. Y. Kwon, H. D. Lee, M. R. Song, I. K. Choi, G. J. Heo, D. H. Park, Y. C. You, D. S. Zang

Samsung SDI, Korea

New phosphors enabled the commercialization of 3D/2D switchable plasma display panel (PDP) televisions and brought a significant increase in luminescent efficiency of PDP. We present basic requirements of high performance phosphors for the 3D PDP and for the high efficient PDP, and describe the optical property of developed phosphors.

PH2 - 2 **Nano-Structured BAM Blue with High Aging**
15:30 **Resistance : Magnetoplumbite Phase on β -Alumina**
(MP on β)

T. H. Kwon, G. J. Kim^{}, K. H. Kim^{*}, W. K. Oh^{*},
 N.-H. Cho^{**}, S.-J. Hwang^{**}, S.-W. Kim^{**}*

Daejoon Elect. Materials, Korea

^{}LG Chem. Res. Park, Korea*

*^{**}Inha Univ., Korea*

The nano-structured type of blue BAM with a configuration of magnetoplumbite phase onto β -alumina-BAM, coined as "MP on β " is proposed to overcome the notoriously poor thermal-stability in its emission characteristics. Its fine structure, investigated by HRTEM, is well correlated with the observed emission behaviors after thermally degrading treatment.

PH2 - 3 **Excitation Energy Transfer by Vacuum Ultra Violet**
15:50 **Excitation in Eu-Doped BaMgAl₁₀O₁₇ and NaAl₁₁O₁₇:**
a Theoretical Study

H. Onuma, H. Tanno^{}, I. Yamashita, K. Serizawa,
 A. Suzuki, R. Sahnoun, M. Koyama, H. Tsuboi,
 N. Hatakeyama, A. Endou, H. Takaba, C. A. Del Carpio,
 M. Kubo, H. Kajiyama^{*}, A. Miyamoto*

Tohoku Univ., Japan

^{}Hiroshima Univ., Japan*

We theoretically investigated the excitation energy transfer in BaMgAl₁₀O₁₇:Eu²⁺ and NaAl₁₁O₁₇:Eu²⁺ materials. Our results suggested that the excitation energy with exchange interaction would be transferred though conduction plane in BaMgAl₁₀O₁₇:Eu²⁺ and spinel block in NaAl₁₁O₁₇:Eu²⁺. The structural defects forming localized levels would decrease the efficiency of energy transfer.

PH2 - 4 **Study of Eu Luminescent Centers Located Near the**
16:10 **Surface of BAM Phosphors by Conversion Electron**
Yield XAFS

T. Honma, T. Kunimoto^{}, T. Hiragi^{*}, H. Tanno^{**},
 H. Kajiyama^{**}, A. Kobayashi^{***}, S. Orita^{***}, K. Ohmi^{***}*

Japan Synchrotron Radiation Res. Inst., Japan

^{}Tokushima Bunri Univ., Japan*

*^{**}Hiroshima Univ., Japan*

*^{***}Tottori Univ., Japan*

Conversion electron yield (CEY)- and X-ray fluorescence yield (XFY)-XAFS measurements have been performed for Eu luminescent centers of BAM thick films. The ratio of the valence state of Eu ion near the surface and the internal bulk of BAM crystal are estimated from Eu-L₃ edge CEY- and XFY-XANES spectra, respectively.

----- Break -----

16:40 - 18:15

Room 302

PH3: Phosphors in EL and General

Chair: D. Y. Jeon, KAIST, Korea
 Co-Chair: T. Miyata, Kanazawa Inst. of Tech., Japan

**PH3 - 1: Invited Search for Phosphors for Use in Displays and
 16:40 Lightings Using Genetic Algorithm Assisted
 Combinatorial Chemistry**

K.-S. Sohn
Suchon Nat. Univ., Korea

A multi-objective genetic algorithm-assisted combinatorial materials search (MOGACMS) strategy was employed to develop new phosphors for use in display applications. We identified several new phosphors, with improved luminance and reliable reproducibility.

**PH3 - 2: Invited Required Characteristics of Phosphors for
 17:10 CCFLs**

T. Kusunoki, T. Igarashi
Sony, Japan

The LED and CCFL are popular light-sources for backlights in LCDs. Recently the LED backlight system is studied actively. However, the CCFL is still the most popular light-source in the market. In this paper the desirable characteristics for phosphors, which are the main component of the CCFL, will be discussed.

**PH3 - 3 Crystallographic and Electroluminescent
 17:40 Characteristics of (Ba,Sr)₂ZnS₃:Mn Thin Film
 Devices**

T. Sasaki, T. Kotani, Y. Miyamoto, K. Ohmi
Tottori Univ., Japan

A novel solid solution compound of (Ba,Sr)₂ZnS₃ having the Ba₂MnS₃-type orthorhombic structure has been developed. (Ba,Sr)₂ZnS₃:Mn thin films with a single crystal phase have been also successfully prepared by electron-beam deposition. A obtained luminance is 320 cd/m² at 1 kHz, and the CIE color coordinates (x, y) are (0.59, 0.41).

**PH3 - 4L High-Luminance from Localized Emission Center
 18:00 Phosphor in Powder-Type EL Devices**

*T. Higuchi, Y. Matsuu, T. Muramatsu, N. Miura**
Kansai Paint, Japan
 *Meiji Univ., Japan

High luminance EL was obtained from the powder phosphor having a localized emission center. The phosphor powders less than 1 μm diameter were dispersed in resin binder. Insulating layers were formed with ITO fine particles encapsulated with insulating material. Luminance level is over 1000 cd/m² at 1 kHz.

Author Interviews

18:00 – 19:00

Friday, December 5

10:40 - 12:20

Room 302

FED2/PH4: Phosphors for FEDs

Chair: M. Takai, Osaka Univ., Japan
 Co-Chair: S. Okamoto, NHK, Japan

FED2/ PH4 - 1: Invited Development of FEDs with New Blue Phosphor

10:40

*Y. Yasuoka, M. Kitada, Y. Obara, T. Mori, Y. Naito, K. Tamura
 Futaba, Japan*

This paper reports AlN:Eu suitable for forming highly fine dots of the FED discussed together with characteristics of the FED panel using it. With the $Y_2SiO_5:Ce$ used in the FED, there are some issues. To solve those issues, the use of the AlN:Eu was discussed for the FED.

FED2/ PH4 - 2: Invited Luminescence and Structure of Europium Doped Aluminum Nitride Phosphor

11:10

T. Takeda, N. Hirosaki, R.-J. Xie, K. Kimoto, M. Saito
 NIMS, Japan
 Tohoku Univ., Japan

Eu doped AlN shows a blue luminescence by UV and electron excitation. However, there is no space for large europium cation occupation in wurtzite AlN structure. TEM measurement showed Eu formed the layer structure in wurtzite AlN structure. The Eu coordination environment corresponded to the luminescence property.

FED2/ PH4 - 3: Preparation of Sulfide Phosphors Using Liquid Phase Process

11:40

*H. Kominami, Y. Nakanishi, K. Hara
 Shizuoka Univ., Japan*

The synthesis process of sulfide phosphors using liquid phase reaction was investigated to aim at fine particle. The powders fired above 700°C were determined at $SrGa_2S_4$ single phase by X-ray diffraction measurement, and the obtained phosphor showed green emission of $SrGa_2S_4:Eu$ excited by 325 nm of He-Cd laser and EB excitation.

FED2/
PH4 - 4
12:00

**Undoped ZnO Phosphor with High Luminescence
Efficiency Grown by Thermal Oxidation**

Z. Y. Xiao, M. Okada, M. Ichimiya, T. Itoh*, G. Han,
Y. Neo, T. Aoki, H. Mimura*

Shizuoka Univ., Japan

**Osaka Univ., Japan*

A novel phosphor with microcavity resonator was proposed. Various ZnO morphologies with hexagonal cross section were fabricated by a thermal oxidation method. Whispering gallery resonance modes produced in ZnO hexagonal micarocavity were assumed to provide a qualitative explanation for the observation of enhancement green emission.

----- Lunch -----

Author Interviews

17:40 – 18:40

Supporting Organizations:

The 125th Research Committee on Mutual Conversion between Light
and Electricity, Japan Society for Promotion of Science
Phosphor Research Society, The Electrochemical Society of Japan

**EVENING GET-TOGETHER
WITH WINE**

Tuesday, December 2, 2008
18:00–20:00

Room “Houou” (30F)
Hotel Nikko Niigata
(Sponsored by Merck Ltd., Japan)

See page 9 for details

Workshop on Field Emission Display and CRT

Friday, December 5

9:00 - 9:10

Room 302

Opening

Opening Remarks

9:00

M. Takai, Osaka Univ., Japan

9:10 - 10:10

Room 302

FED1: FEDs

Chair: F. Wakaya, Osaka Univ., Japan

Co-Chair: M. Nakane, Muroran Inst. of Tech., Japan

FED1 - 1 **Characteristics of CNT-FED for Color Character-Displays**

9:10

*H. Kurachi, S. Uemura, J. Yotani, T. Nagasako, T. Nakao,
M. Ito, A. Sakurai, K. Sato, K. Fukuda*, Y. Saito***

NORITAKE, Japan

**Fuji Elec. Syss., Japan*

***Nagoya Univ., Japan*

High-luminance CNT-FED character-displays using simple line-rib-structure were performed. One display-panel had 48x480-dots and the sub-pixel pitch was 1mm. Another panel had 32x256-color-pixels, and the sub-pixel size was 0.6mmx1.8mm. The power consumption was less than 10W at character-displaying module. It should be useful for public display even under emergent no-power condition.

FED1 - 2 **Ultra-High Luminance FED**

9:30

M. Nagao, T. Yoshida, K. Nakamura, Y. Marushima*,
M. Taniguchi*, S. Itoh*, S. Kanemaru*

AIST, Japan

**Futaba, Japan*

First prototype of ultra-high luminance FED is fabricated in which Spindt-type FEA, memory capacitor, and three TFTs are integrated. The luminance of 1700 cd/m² is demonstrated even under low anode voltage (1.5 kV). The ultra-high luminance FED is expected for applications such as daylight readable display.

FED1 - 3 15-in. Dynamic Field Emission BLU for LCD

9:50

J.-W. Jeong, D.-I. Kim, J.-T. Kang, J.-S. Kim, Y.-H. Song
ETRI, Korea

The 5-inch 12-blocks Local Dimming Field Emission Lamp was demonstrated at the last symposium.[1] Now, we introduce the 15-inch dynamic CNT FEL for LCD BLU. The basic structure of 15-inch FEL was not changed from 5-inch panel. The lithography process was excluded and the screen printing method was mainly used.

FED1 - 4 Withdrawn**FED1 - 5L Withdrawn**

----- Break -----

10:40 - 12:20**Room 302****FED2/PH4: Phosphors for FEDs**

Chair: M. Takai, Osaka Univ., Japan

Co-Chair: S. Okamoto, NHK, Japan

FED2/ PH4 - 1: Invited Development of FEDs with New Blue Phosphor

10:40

Y. Yasuoka, M. Kitada, Y. Obara, T. Mori, Y. Naito,
K. Tamura
Futaba, Japan

This paper reports AlN:Eu suitable for forming highly fine dots of the FED discussed together with characteristics of the FED panel using it. With the $Y_2SiO_5:Ce$ used in the FED, there are some issues. To solve those issues, the use of the AlN:Eu was discussed for the FED.

FED2/ PH4 - 2: Invited Luminescence and Structure of Europium Doped Aluminum Nitride Phosphor

11:10

T. Takeda, N. Hirosaki, R.-J. Xie, K. Kimoto, M. Saito^{*}
NIMS, Japan
^{*}*Tohoku Univ., Japan*

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**FED2/
PH4 - 3**

11:40

**Preparation of Sulfide Phosphors Using Liquid
Phase Process***H. Kominami, Y. Nakanishi, K. Hara**Shizuoka Univ., Japan*

The synthesis process of sulfide phosphors using liquid phase reaction was investigated to aim at fine particle. The powders fired above 700°C were determined at SrGa_2S_4 single phase by X-ray diffraction measurement, and the obtained phosphor showed green emission of $\text{SrGa}_2\text{S}_4:\text{Eu}$ excited by 325 nm of He-Cd laser and EB excitation.

**FED2/
PH4 - 4**

12:00

**Undoped ZnO Phosphor with High Luminescence
Efficiency Grown by Thermal Oxidation***Z. Y. Xiao, M. Okada, M. Ichimiya*, T. Itoh*, G. Han,
Y. Neo, T. Aoki, H. Mimura**Shizuoka Univ., Japan***Osaka Univ., Japan*

A novel phosphor with microcavity resonator was proposed. Various ZnO morphologies with hexagonal cross section were fabricated by a thermal oxidation method. Whispering gallery resonance modes produced in ZnO hexagonal micarocavity were assumed to provide a qualitative explanation for the observation of enhancement green emission.

----- Lunch -----

13:20 - 15:00

Room 302

FED3: CNT Emitters for FEDs

Chair: M. Sasaki, Univ. of Tsukuba, Japan

Co-Chair: Y. Gotoh, Kyoto Univ., Japan

FED3 - 1 Field Emission Lifetime after Aging of CNT Cathodes
13:20*H. Oki, A. Kinoshita, T. Takikawa, W. S. Kim,
K. Murakami, S. Abo, F. Wakaya, M. Takai
Osaka Univ., Japan*

Field emission lifetime after pulse aging of laser-treated and tape-peeled CNT (carbon nanotube) cathodes with an initial current density of 1 mA/cm² as a function of time was investigated. The field emission lifetime of a laser-treated cathode followed by pulse aging was much longer than that of a tape-peeled cathode.

FED3 - 2 Fabrication of Directly Grown Vertically Aligned CNT
13:40 **Pattern Emitter on Glass***H. Furuta, T. Kawaharamura, K. Kawabata, M. Furuta,
A. Hatta, K. Ishii*, K. Okada*, T. Komukai*, T. Morioka*,
T. Matsuda, C. Li, T. Hirao**Kochi Univ. of Tech., Japan***Techno Network Shikoku, Japan*

Short length, high density and vertically aligned CNTs were grown directly on the patterned electrode on the glass substrate below 550 °C by the water-assisted CVD. The emission current of the patterned CNT emitter was stable over 24 hours at the pulse current density of 70 μA/cm² (duty ratio of 7.5%).

FED3 - 3 Evaluations of Field Electron Emission from a
14:00 **Carbon Nanotube***H. Nakahara, Y. Kusano, T. Kono, Y. Saito
Nagoya Univ., Japan*

I-V characteristics and brightness of multi-walled carbon nanotube electron emitters are measured and compared with those of a commercially available single crystalline tungsten emitter. Even a thick MWNT of ~15 nm diameter shows much higher performances (e.g. higher brightness, smaller emission area etc.) than a single crystalline tungsten one.

FED3 - 4 **Field Emission Microscopy of Methane Molecules
14:20** **Adsorbed on Multiwalled Carbon Nanotube Field
Emitters**

T. Yamashita, K. Asaka, H. Nakahara, S. Uemura,
Y. Saito*

Nagoya Univ., Japan

**NORITAKE, Japan*

Adsorption of methane molecules on multiwalled carbon nanotubes (MWNTs) was studied by field emission microscopy. The emission was enhanced when the emitter was exposed to methane during field emission. The current enhancement effect was observed when the initial state of MWNT tip showed a pentagon pattern.

FED3 - 5 **Implementation of Highly Reliable CNT Emitter for
14:40** **Various Field Emission Applications**

D.-J. Kim, K.-B. Kim, J.-W. Jeong, Y.-H. Song**

Kumho Elec., Korea

**ETRI, Korea*

Highly reliable carbon nanotube (CNT) emitter that is applicable the various field emission applications were implemented by maximizing the number of activated CNT emitter which contributes to the field emission without depreciating the properties of raw material.

----- Break -----

15:10 - 16:50

Room 302

FED4: FE Materials and Characteristics

Chair: H. Mimura, Shizuoka Univ., Japan

Co-Chair: M. Namba, NHK, Japan

FED4 - 1 **Emission Properties of the Ti-DLC Films Prepared by
15:10** **Unbalanced Magnetron Sputtering**

H. F. Liang, C. L. Liu, L. G. Meng

Xi'an Jiaotong Univ., China

The field emission properties of the Ti-DLC films were researched. The results showed that the $1.14\text{A}/\text{cm}^2$ emission current density could be detected with $33\text{V}/\mu\text{m}$ and the threshold field could be $24\text{V}/\mu\text{m}$ with $0.411\text{A}/\text{cm}^2$ emission current density with coplanar emission structure. The silicon substrate limited the emission current because of high resistivity. Key words: Ti-DLC films; Field emission; work function.

FED4 - 2 15:30 Field Emission Property of TiO₂ Cathodes after Field Enhanced Surface Treatment

C. Fukuyama, K. Murakami, S. Abo, F. Wakaya, M. Takai, T. Takimoto, Y. Kumashiro*, Y. Takaoka**

Osaka Univ., Japan

**Ishihara Sangyo, Japan*

Cathodes fabricated by a printing method require post treatments such as ion or laser irradiation for protruding the materials out of the surface for better characteristics of field emission. Field enhanced surface treatment was found to be a effective surface treatment for needle-shaped-titanium dioxide cathodes fabricated by a printing method.

FED4 - 3 15:50 Work Function Measurements of Pr-Oxide/W(100) Surface by Using of the Retarding Potential

J. Yoshihara, T. Kawakubo, H. Nakane

Muroran Inst. of Tech., Japan

The work function of W(100) surface modified with praseodymium oxide is 2.7 eV measured by using of retarding potential methods. No peak shift in X-ray Photoelectron Spectroscopy (XPS) spectrum is observed during the heat treatments and no specified Low Energy Electron Diffraction (LEED) pattern are observed.

FED4 - 4 16:10 Nanometer Scale Distributions of Field Emission Current from Carbon Materials Without Nano-Protrusions

S. Nagashima, S. Ogata, M. Sasaki

Univ. of Tsukuba, Japan

Nanometer scale distributions of field emission current and local tunneling barrier height have been measured on arc discharge-prepared carbon thin films as well as highly oriented pyrolytic graphite (HOPG) with defects. The obtained distributions indicate that remarkable improvement of field emission characteristics of Si-FEA upon coating with the carbon thin film is attributed to efficient field emission from the defects on the carbon thin film.

FED4 - 5 16:30 Improvement of in-situ Analyzer of Field Emission Properties

Y. Gotoh, M. Kawasaki, H. Tsuji, J. Ishikawa

Kyoto Univ., Japan

We have been developing an in situ analyzer of field emission properties, which can simultaneously observe the image of field emission microscope and the FN plot and the SK plot. The present report describes the latest information of the analyzer.

----- Break -----

Author Interviews

17:40 – 18:40

Sponsor:

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Supporting Organizations:

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IDW Tutorial in Japanese

Tuesday, December 2, 2008

12:45–17:00

Room 301

Toki Messe Niigata Convention Center

Detailed information will be available:

<http://www.sidchapters.org/japan/index.htm>

Contact Address: idw.tutorial.wz@hitachi.com

Workshop on Organic LED Displays

Wednesday, December 3

13:20 - 14:40

Snow Hall B

OLED1: OLED Materials

Chair: S. Son, LG Chem., Korea
 Co-Chair: A. Mikami, Kanazawa Inst. of Tech., Japan

OLED1 - 1: *Invited* New Singlet Blue and Green Emitter for OLED Applications

13:20

E. Böhm
Merck KGaA, Germany

We developed three new fluorescent dopants for OLED applications. The two blue dopants show color coordinates of CIE (0.13/0.26) and (0.14/0.10) with high current efficiencies of 14.7 cd/A and 5.3 cd/A, respectively. The green dopant shows 24.3 cd/A with excellent lifetime of >350.000 h at 1000 cd/m².

OLED1 - 2 Novel Host Material Based on Benzodifuran with Ambipolar Charge Transport Properties

13:45

*Y. Sato**, *C. Mitsui***, *H. Tsuji***, *E. Nakamura****
**JST, Japan*
***Univ. of Tokyo, Japan*

Novel ambipolar biscarbazole derivative based on benzodifuran showed well-balanced hole and electron mobility. It has demonstrated compatibility of full-color emission as a host material. When it was used for phosphorescent device, it exhibited much improved operation characteristics such as longer lifetime and reduced voltage rise.

OLED1 - 3 Systematic Development of Soluble OLED Materials at Merck

14:00

A. Hayer, N. Schulte, A. Ludemann, S. Heun, S. Leu, H. Buchholz
Merck KGaA, Germany

Systematic development of soluble OLED materials at Merck towards higher efficiency, pure colour and longer lifetime is shown. This is approached via material-intrinsic parameters (new monomers, molecular weight...), as well as stack optimization, where particular focus is the development of hybrid OLEDs with n-doped transport layers for increased power efficiency.

OLED1 - 4L: *Invited* 102 lm/W White Phosphorescent OLED
14:15

*J. J. Brown, B. W. D'Andrade, J. Esler, C. Lin,
V. Adamovich, S. Xia, M. S. Weaver, R. Kwong*
Universal Display, USA

High efficacy white OLEDs with low voltage, high quantum efficiency and outcoupling fixtures achieve total power efficacies of 89 lm/W to 102 lm/W, operating voltages between 2.8 V and 3.5 V at correlated color temperatures of 2,800 - 3,900 K and operational lifetimes exceeding 5,000 hours at 1,000 nits.

----- Break -----

14:50 - 16:00

Snow Hall B

OLED2: OLED Device Technologies (1)

Chair: E. Böhm, Merck KGaA, Germany
Co-Chair: Y. Kijima, Sony, Japan

OLED2 - 1: *Invited* Scalable AMOLED Technologies for TV
14:50 Application

*T. Tsujimura, S. Mizukoshi, N. Mori, K. Miwa,
Y. Maekawa, M. Kohno, K. Onomura, K. Mameno,
S. Vanslyke**
Kodak Japan, Japan
**Eastman Kodak, USA*

Scalability of OLED technologies in terms of display size and mother substrate size is very important for success. GMC has many benefits due to large aperture ratio and simple circuit. To secure the yield and quick ramp up, the White OLED technology with RGBW pixel and driving algorithm have superiority.

OLED2 - 2 Development of High Performance Organic
15:15 Evaporation Source and Manufacturing System for Large-Sized AMOLED Devices

H.-W. Kim, Y.-T. Won, S.-Y. Han, J. Patrin,
R. Bresnahan*, C. Conroy**
Doosan Mecatec, Korea
**Veeco Instrs., USA*

We developed a system for manufacturing large-sized AMOLED devices which can scan sources or a substrate to produce WOLED or full-colored OLED alternatively. We also have developed a valved organic evaporation source for 4th generation substrate (730*920mm²) which enables shutoff during idling time and open process time only. As a result, we could obtain 38% of material utilization and 2.5% of non-uniformity.

OLED2 - 3 Degradation Analysis of the Blue Phosphorescent Organic Light Emitting Diode by Impedance Spectroscopy and Transient Electroluminescence Spectroscopy

15:30

*T. Ogiwara, J. Takahashi, H. Kuma, Y. Kawamura,
T. Iwakuma, C. Hosokawa
IDEMITSU Kosan, Japan*

We carried out both impedance spectroscopy and transient electroluminescence spectroscopy of a blue phosphorescent organic light emitting diode to analyze the degradation mechanisms. It was proved that the resistance of emission layer increased and the emission intensity decreased by degradation of the emission site.

OLED2 - 4 The Quality of Electrically Doped Structures Studied by Capacitance Spectroscopy

15:45

*A. Werner, C. Rothe, L. Limmert, O. Fadhel, S. Murano,
A. Lux
Novaled AG, Germany*

Capacitance spectroscopy allows studying the electrical properties of electronics devices in detail. We apply this method to investigate the properties of junctions formed by electrically doped layers. We show that molecular dopants support well defined interfaces of undoped and doped layers. The stability of the junctions under stress is investigated.

----- Break -----

16:35 - 17:45

Snow Hall B

OLED3: OLED Device Technologies (2)

Chair: T. Tsujimura, Kodak Japan, Japan
Co-Chair: A. Werner, Novaled, Germany

OLED3 - 1: *Invited* New Materials and New Device Structures for High Performance OLEDs

16:35

*J. K. Noh, M. S. Kang, J. S. Kim, J. H. Lee, Y. H. Ham,
J. B. Kim, M. K. Joo, S. Son
LG Chem., Korea*

We report a new device structure of an OLED having a cathode layer formed on top of a substrate followed by deposition of organic and anode layers subsequently. The inverted structure provides higher quantum efficiency, lower driving voltage, better color coordination and longer device lifetime than those of conventional structures.

OLED3 - 2 Multi-Unit White OLED with High CRI and High Efficiency for Lighting Application
17:00

H. Tsuji, N. Ito, N. Ide, T. Komoda
Panasonic Elec. Works, Japan

Multi-unit OLED with only two emissive units having both high color rendering index (CRI) and high efficiency is developed by the combination of a fluorescent blue emissive unit and a phosphorescent green and red emissive unit. The power efficiency at 1,000 cd/m² is 28 lm/W with CRI of 88.

OLED3 - 3 OLED Microdisplay with Embedded Eye-Tracking Camera
17:15

U. Vogel, R. Herold, D. Kreye, B. Richter, G. Bunk,
S. Reckziegel, M. Scholles, C. Grillberger, M. Törker,
J. Amelung
Fraunhofer Inst. for Photonic MicroSys., Germany

This paper describes the integration of highly-efficient, low-voltage organic light emitting diodes (OLEDs) in a display matrix with embedded CMOS photodiodes on a single substrate. This combines display and camera functionality (OLEDCam) in a bi-directional OLED-microdisplay, mainly targeted to provide eye-tracking capability.

OLED3 - 4 Simulation Study for Seamless Imaging of OLED Tiled Display
17:30

H. S. Shim, I. S. Kee, Y. G. Lee, Y. W. Jin, S. Y. Lee
Samsung Elect., Korea

A new OLED tiling technology for seamless imaging is described. The visible seam line of display is eliminated by modification of pixel structure and optical treatment. This seamless viewing is realized for not only normal direction view but oblique view. All of those effects are confirmed by several computer simulations.

Author Interviews

18:00 – 19:00

Eurodisplay 2009 (IDRC 2009)

September 14–17, 2009

Rome, Italy

Thursday, December 4

10:40 - 12:05

Snow Hall B

AMD3/OLED4: AM-OLED

Chair: S. Horita, JAIST, Japan
 Co-Chair: K. Takatori, NEC LCD Techs., Japan

AMD3/ OLED4 - 1: Invited Amorphous Oxide TFT Backplanes for Large Size AMOLED Displays

10:40 Y. G. Mo, J. K. Jeong, H. D. Kim
 Samsung Mobile Display, Korea

Amorphous oxide TFT array was fabricated and a bottom-emitting 12.1 inch WXGA AMOLED display was successfully driven by it. The TFT array exhibited the field-effect mobility of $18 \text{ cm}^2/\text{Vs}$, threshold voltage of 1.8 V, on/off ratio of 10^9 , and subthreshold gate swing of 0.28 V/dec.

AMD3/ OLED4 - 2: Invited Issues of a-Si:H TFTs & LTPS TFTs for an AMOLED Backplane

11:05 M.-K. Han, S.-G. Park, H.-S. Shin
 Seoul Nat. Univ., Korea

Various thin film transistors (TFT) such as hydrogenated amorphous silicon TFT (a-Si:H TFT), low temperature poly silicon TFT (LTPS TFT) and solid phase crystallized silicon TFT (SPC-TFT) have gained considerable attentions as a pixel element of AMOLED display. We have discussed many issues on each TFT for AMOLED display.

AMD3/ OLED4 - 3: High Flexibility of AMOLED Displays on Colorless PI Substrate

11:30 Y. S. Huang, C.-J. Liu, C.-W. Lin, K.-Y. Ho, C.-H. Cheng, S. Y. Peng, P. H. Wang, Y.-P. Chen, M.-H. Lee*, H.-C. Lin, B.-C. Kung, C.-J. Tsai, Y.-T. Chen, P.-F. Lee, G.-R. Hu, J.-J. Huang, C.-C. Lee
 ITRI, Taiwan
 *Nat. Taiwan Normal Univ., Taiwan

We have demonstrated the 4.1-inch QVGA flexible AMOLED with bottom emission type, and the display was fabricated on 30um-thick colorless PI substrate. The a-Si:H TFT exhibited the field effect mobility of $0.43 \text{ cm}^2/\text{V-s}$, the V_{th} of 2.8V, the S.S. of 0.6V/decade, and the I_{on}/I_{off} ratio is larger than 10^6 .

**AMD3/
OLED4 - 4L
11:50** **Development of Stable, High-Performing Organic
Semiconductors and TFTs**

*G. Lloyd, P. Miskiewicz, M. Carrasco-Orozco, S. Tierney,
J. Canisius, M. Heckmeier, D. Mueller, J. Nakanowatari**
Merck Chems., UK
*Merck, Japan

Stable materials with high carrier mobility values up to $4\text{cm}^2/\text{Vs}$ have been developed and formulated to maximize performance, enhance stability and simplify processing conditions. We demonstrate highly stable organic thin film transistors and highlight the importance of the dielectric in enhancing the performance as well as the stability.

----- Lunch -----

13:20 - 16:20

Exhibition Hall B

Poster OLEDp: OLED Poster

**OLEDp - 1 Dopant Ratio Effect on Power Efficiency of Blue
Phosphorescent Organic Light-Emitting Devices
Using Carbazole-Based Hosts**

T.-S. Shieh, J.-S. Lin, P.-C. Liu, M.-T. Chu, M.-R. Tseng
ITRI, Taiwan

The blue phosphorescent OLEDs with carbazole-based hosts and Firpic as a dopant would be compared here. The OLEDs with 4CzPBP as host and Firpic's dopant ratio as lower than 10% could be considered that the triple emitter reverse energy transfer from Firpic guest back to the 4CzPBP host.

**OLEDp - 2 Enhanced Carrier Recombination in White
Phosphorescent OLEDs Using a Blue Composite
Emitter**

M. T. Lee, J. S. Lin, M. T. Chu, M. R. Tseng
ITRI, Taiwan

Based on yellow and composite blue emitters, the white PHOLEDs with a power efficiency of 32 lm/W at brightness of 1000 cd/m^2 can be achieved. The device efficiency can be enhanced by a factor of 1.4 comparing to that of using typical blue emitter composed of host and dopant only.

**OLEDp - 3 High Energy Gap Host Materials for Blue
Phosphorescent Emitters**

C. J. Lin, H. L. Huang, C. H. Cheng, M. R. Tseng**
Nat. Tsing Hua Univ., Taiwan
*ITRI, Taiwan

The blue phosphorescent OLED with high efficiency, high thermal stability and high brightness will be illustrated in this paper. Applying new high energy gap host materials can easily trap the recombination energy of holes and electrons within emitting layer and effectively transfer to blue phosphorescent emitters to emit blue light.

OLEDp - 4 Fabrication of Thin Film by Plasma Polymerization and Application to Organic Light Emitting Device

*R. Koyama, K. Fukuyori, S. Tanaka, S. Yoshikado
Doshisha Univ., Japan*

Thin films applicable to OLED were deposited using plasma-polymerization by discharge at low frequency. The extrapolated operating-voltage of toluene film for the zero film thickness was smaller than benzene-thin-film. Adhesion of the film to substrate was improved by pre-discharge in air.

OLEDp - 5 High Efficient Red Phosphorescent OLEDs Using the Intermixed Double Host System of TCTA/TCTA_{0.5}TPBI_{0.5}/TPBI

*J. G. Jang, H. K. Shin, W. K. Kim
Dankook Univ., Korea*

Based on the intermixed double host system of (TCTA/TCTA_{0.5}TPBI_{0.5}/TPBI) doped with SFC-R411, red phosphorescent organic light emitting diodes with doping density of 5% and 10% were fabricated. The device of (TCTA/TCTA_{0.5}TPBI_{0.5}/TPBI):5% SFC-R411 showed the maximum current efficiency of 15.8cd/A under a luminance of 30cd/m² with peak wavelength of 625nm.

OLEDp - 6 SAXS Study of Polyfluorene in the Solution for PLED

B. W. Shin, J. H. Kim^{}, S. Y. Lee, H. R. Lee
Kyungpook Nat. Univ., Korea
^{*}Pohang Accelerator Lab., Korea*

This study presents the structure of poly[9,9-di-(2-ethylhexyl)-fluorenyl-2,7-diyl] (PF) in toluene by using small angle x-ray scattering (SAXS). That was the shape of disk in a dilute solution with only correlation between polymer and solvent. The correlation between PFs was under the influence of the concentration and temperature of solution.

OLEDp - 7 Impedance Spectroscopy of Multilayer Organic Light-Emitting Diode

Y. Terao, K. Kawaguchi, M. Nishiura, H. Kimura^{}, T. Saito,
M. Ichikawa^{**}, T. Okachi^{**}, H. Naito^{***}
Fuji Elec. Advanced Tech., Japan
^{*}Fuji Electric Holdings, Japan
^{**}Shinshu Univ., Japan
^{***}Osaka Pref. Univ., Japan*

Impedance spectroscopy measurements were carried out on the multilayer OLEDs. Low-efficient OLEDs show large magnitude of negative capacitance (NC). NC may well be connected to loss mechanisms of luminous efficiency and the performance degradation. This is the first time that NC phenomenon is related to multilayer OLEDs performance.

OLEDp - 8 Development of Inverted Organic Light-Emitting Diode Device Applied Multilayer Transparent Anode

*J. Y. Lee, H. W. Choi, H. S. Yang, J. H. Park,
N. H. Myoung, J. H. Lee, H. D. Bae, Y. H. Tak
LG Display, Korea*

Multilayer IZO-Ag-IZO stacks were evaluated as transparent anode for inverted organic light-emitting diode. The multilayer anode exhibited a remarkably reduced sheet resistance of $3.3\Omega/\text{sq}$ and a high transmittance of 89%. The IOLED with the multilayer anode shows good electrical characteristic compared to IOLED with single IZO anode layer.

OLEDp - 9 Effect of Hole Transport Layer Doping on the Organic Light Emitting Diode Performance

G. Chauhan, R. Srivastava, P. C. Srivastava,
M. N. Kamalasanan
Nat. Physical Lab., India
Banaras Hindu Univ., India

Effects of doping on the hole conductivity of (α -NPD) has been analyzed by fabricating the hole-only device and organic light-emitting devices using pure and doped (α -NPD). Doping increases the current densities by 2 orders of magnitude. OLED with 0.4 wt % F₄-TCNQ doped (α -NPD) shows the maximum luminescence and efficiency.

OLEDp - 10 A Novel Active-Matrix Driving Scheme with Buffer Circuitry for WOLED Lighting Application

*H. Yang, S.-C. Chen
Nat. Taipei Univ. of Tech., Taiwan*

A novel active-matrix driving scheme with buffer circuitry applied to white organic light-emitting device (WOLED) for lighting application is proposed and investigated by SPICE simulation. Our simulation result revealed that near 14% extra driving current can be provided to WOLED without increasing current stress of driving transistor as degradation occurred.

OLEDp - 11 Large Area White Organic Light-Emitting Devices with Two Emission Bands

J.-A. Cheng, C. H. Chen, H.-P. D. Shieh, T. Negishi,
Y. X. Yang*, T. Miyata*, W.-S. Huang*, H. Hiraiwa*
Nat. Chiao Tung Univ., Taiwan
ULVAC, Japan

A large area white OLED device with a dimension of 100x100 mm² substrate was fabricated. In the optimized device glass/ITO/NPB/NPB:R-rubrene/MADN:TBDP/Alq₃/LiF/Al, the turn-on voltage and current efficiency were 2.9 V and 9.3 cd/A @ 5.9 mA/cm², respectively. The corresponding 1931CIEx,y coordinate was (0.29, 0.41) and almost independent of varying voltages.

OLEDp - 12 **Withdrawn**

OLEDp - 13 **White OLEDs with Blue and Yellow Emitting Layers:
Effects of Doping and Interface Engineering**

*H. Y. Park, Y. G. Lee, S. I. Lee, K. H. Koh
Ajou Univ., Korea*

We fabricated WOLEDs based on a complementary color scheme using yellow and blue EMLs. The host and guest for a blue EML were MADN and SA-biph. For a yellow EML, both NPB and Alq₃ were tested as a host while TBRB was used as a yellow-emitting guest.

OLEDp - 14 **Low Driving Voltage and High Efficiency for Green
Phosphorescent Organic Light Emitting Devices**

*H. L. Huang, M. R. Tseng
ITRI, Taiwan*

The green phosphorescent OLED with low turn on voltage, high efficiency, high thermal stability and high brightness will be illustrated in this paper. Applying hole injection material and compatible hole blocking material can confine the hole and electron within emitting layer effectively to emit green light.

OLEDp - 15 **Power Efficient OLED with a Novel P-Doped Layer**

*K. H. Lin, M. H. Ho, M. T. Hsieh, C. S. Cheng, S. Y. Su,
C. Y. Wu, C. H. Chen
Nat. Chiao Tung Univ., Taiwan*

An efficient p-doped transport layer composed of 2-methyl-9, 10-di(2-naphthyl)anthracene (MADN) and tungsten oxide (WO₃) has been developed. The incorporation of 10% WO₃ into MADN is found to improve the hole injection and conductivity. This work can simplify the fabrication of future *p-i-n* OLED with a single common ambipolar MADN material.

OLEDp - 16 **High Performance Color Conversion Polymers and
Their Application to OLED Devices**

*M. Nagai, L. Chong, N. Kanai, T. Asakawa, H. Hashida,
K. Kawaguchi, Y. Kawamura, H. Kimura
Fuji Elec. Advanced Tech., Japan*

Highly efficient color conversion polymers were discovered. The films showed excellent PL quantum efficiency (70-80%). The maximum PL and absorbance peaks were around 510 and 480 nm for the green polymer and around 640 and 460 nm for the red one, respectively. They are suited for color-conversion type OLEDs.

OLEDp - 17 Efficiency Improvement and Long Lifetime of Transparent Organic Light-Emitting Diodes Using 8-Hydroxy-Quinolinato Lithium as Passivation Layer by Thermal Annealing

*K. P. Na^{***}, C. P. Lee^{**}, B. K. Ju^{*}, J. I. Han^{**}*

^{}Korea Univ., Korea*

*^{**}KETI, Korea*

We have developed a transparent passivation layer using 8-hydroxy-quinolinato lithium (LiQ) in transparent organic light-emitting devices (TOLEDs). The LiQ passivation layer improves the stability of Ca/Ag double layer which have used as a semitransparent cathode, resulting in substantial increase of the efficiency and lifetime by the enhanced luminance.

OLEDp - 18 Simultaneous Determination of Localized-State Distributions and Charge-Carrier Mobility in Organic Light-Emitting Diodes by Impedance Spectroscopy

T. Okachi, T. Nagase, T. Kobayashi, H. Naito

Osaka Pref. Univ., Japan

A method for determining localized-state distributions in organic light-emitting diodes (OLEDs) by impedance spectroscopy is proposed and the applicability of the method is examined by computer simulation and experiment. The method is particularly useful for OLEDs because localized-state distributions and drift mobility can be determined simultaneously.

OLEDp - 19 Enhancement of Out-Coupling Efficiency in Organic Light Emitting Devices Stacked with High Refractive Index of Porous Light Scattering Layers

T. Koyanagi, A. Mikami

Kanazawa Inst. of Tech., Japan

The total emission flux of an organic light emitting device has been successfully enhanced by employing high refractive index glass substrate coated with a light extraction layer. In addition, we tried to develop a porous titanium oxide layers prepared by wet-process as a light scattering layer.

OLEDp - 20 A Simple Structure P-I-N Phosphorescent OLED

*S. Y. Kim, T. J. Park, W. S. Jeon, R. Pode, J. Jang,
J. H. Kwon*

Kyung Hee Univ., Korea

We present simple P-I-N phosphorescent green OLEDs having an ideal energy level structure. A low driving voltage value of 3.3V and maximum current- and power-efficiency values of 50.1 cd/A and 60.5 lm/W are obtained in this simple P-I-N device.

OLEDp - 21 Optical Analysis on the Influence of Anode Structure upon Luminance in Thin Film Stacked Organic Light Emitting Devices

*M. Yamana, M. Nakamura, N. Ito, Y. Mitsutake,
T. Yamaki, A. Mikami**

Panasonic Elec. Works, Japan

**Kanazawa Inst. of Tech., Japan*

We have investigated luminance in red emitting OLEDs with different anode structure, and compared it with theoretical calculation based on Fresnel's analysis and transfer matrix. There are good agreements between the experimental and theoretical results, and we clarify the affect of anode structure to luminance characteristics by using the analysis.

OLEDp - 22 Horizontal Dipping Method for Simple Fabricating OLEDs

B. Park, M.-Y. Han, M. Kim, C. H. Park, Y. I. Lee

Kwangwoon Univ., Korea

Horizontal dipping (H-dipping) was studied for fabricating OLEDs. Uniform films were fabricated by concave meniscus of used solutions. H-dipped OLEDs were fabricated with high performance; maximum efficiency of 14 cd/A with 14500 cd/m². Patterned OLEDs on 2" substrates were successfully fabricated, implying that H-dipping holds great potential for large-area OLEDs.

OLEDp - 23 Laser Beam Delivering and Shaping Device for Transfer of Organic Film

G. I. Yi, J. H. Kwon, J. H. Yi

Yeungnam Univ., Korea

A single mode fiber laser beam was delivered inside a glove box via a fiber. The laser beam from the fiber end was collimated and sent to a lens set, which condensed Gaussian beam to a square-hat beam on the organic film coated film.

OLEDp - 24 Ink-Jet Printed Small Molecular Electrophosphorescent OLEDs

B. Park, M. Kim, M.-Y. Han, C. H. Park, Y. I. Lee

Kwangwoon Univ., Korea

We studied the efficient light emission from small molecular electrophosphorescent OLEDs. The organic layer was made by ink-jet printing with a composite solution, prepared by dissolving small molecular compounds into mixed solvents. Efficient green emissions were generated; the peak luminance was 50000 cd/m² and the peak efficiency was 45 cd/A.

OLEDp - 25 Image Reversal Photoresist for OLEDs

*S. Yi, Y. S. Shin, D. Ihm, K.-H. Choi**

Hoseo Univ., Korea

**Dongjin Semichem, Korea*

We have developed an image reversal photoresist with high thermal stability and electric insulating properties for OLED applications. The thermal stability and electric insulating properties were investigated. This image reversal photoresist enables the single isolation structure applicable to OLEDs so as to reduce the fabrication process.

OLEDp - 26 Plasma-Polymerized Insulator for Flexible Passive-Matrix Organic Light-Emitting Diode Displays

K. Akedo, A. Miura, K. Noda, H. Fujikawa

TOYOTA Central R&D Labs., Japan

We have investigated plasma-polymerized insulators for flexible passive-matrix OLED displays. They could suppress expansion of dark area compared to conventional photoresist insulators because they had little adsorption of moisture. They also showed long lifetimes in a driving test because they were easily patterned with little damage to ITO anodes.

OLEDp - 27 Out-Coupling Efficiency Enhanced Organic Light-Emitting Diodes on the Flexible Substrate

W. Lee, Y.-W. Lim, S.-D. Lee

Seoul Nat. Univ., Korea

Imprinted polymeric nano-structures between a flexible substrate and a transparent anode in an organic light-emitting diode have improved the out-coupling efficiency. The proposed device shows enhanced luminance by 50% compared to a normal device. Moreover, the polymer-based imprinting technique allows for roll-to-roll processes required for flexible and large area displays.

OLEDp - 28 Gas Property of Inorganic Mg-Zn-F Heterointerface

B. H. Kang, S. H. Kim, D. E. Kim, S. M. Hong, S. Y. Lee,

B. W. Shin, D. H. Kwon, H. R. Lee, S. W. Kang*

Kyungpook Nat. Univ., Korea

**Kyungil Univ., Korea*

We have manufactured Mg-Zn-F thin film of amorphous structure contains MgF_2 , which has better optical transmittance than conventional oxide thin films and Zn, which has high electronegativity. Thin film of semi-triatomic material have higher packing density than conventional MgF_2 film was manufactured and characteristics of this passivation film were evaluated.

OLEDp - 29L Polarized White Emission from Polymer LEDs of Aligned Binary Blend

Y. Hijikata^{,**}, M. Misaki^{*}, S. Nagamatsu^{***},
M. Chikamatsu^{*}, Y. Yoshida^{*}, R. Azumi^{*}, N. Tanigaki^{*},
M. Yamashita^{**}, K. Yase^{*}*

^{}AIST, Japan*

*^{**}Tokyo Univ. of Sci., Japan*

*^{***}Kyushu Inst. of Tech., Japan*

We demonstrate polymer light-emitting diodes with polarized white emission for liquid crystal display backlights application. Polarized white emission was realized by spin-coating a mixed solution of blue and orange emissive polymers onto an alignment layer. The polarization ratio was estimated to be 2.4 with the CIE coordinates of (0.33, 0.34).

OLEDp - 30L A Peel-Off Method For Flexible Organic Light Emitting Diodes By Controlling Works Of Adhesion

*S. Y. Kim, K. Kim, H. K. Yu, K. Hong, J.-L. Lee
Pohang Univ. of Sci. & Tech., Korea*

Flexible Organic light emitting diodes (OLEDs) were fabricated on a glass/MgOx/Ag layered substrate and separated between Ag and MgOx interface by controlling works of adhesion. Adhesive force decreased from 18 gf/cm to 1.4 gf/cm after insertion of the MgOx layer between the Ag and glass.

OLEDp - 31L A Highly Efficient Red Organic Electrophosphorescent Device with Solution-Processed Emissive Layer

*J.-H. Jou, C.-H. Chiu, W.-B. Wang, M.-F. Hsu, Y.-M. Lai,
C.-S. Tuan^{*}*

Nat. Tsing Hua Univ., Taiwan

^{}ITRI, Taiwan*

We successfully fabricated a highly efficient red organic electrophosphorescent device by using solution-processable 4,4'-Bis(carbazol-9-yl)bicyclo-octancebiphenyl as host. A high power-efficiency of 18.6 lm/W at 100 cd/m² with Commission Internationale de l'Eclairage coordinates of (0.55, 0.45) was obtained by doping in the device with 3 wt% red emitter, tris(2-phenylquinoline)iridium(III).

OLEDp - 32L A Novel Polymer Host for High-Efficiency Blue Organic Light-Emitting Diode

*J.-H. Jou, Y.-M. Lai, W.-B. Wang, C.-H. Chiu,
S. Grigalevicius*, C.-C. Chen, B.-S. Wu, T.-R. Huang
Nat. Tsing Hua Univ., Taiwan
Kaunas Univ. of Tech., Lithuania

A highly efficient blue polymer light-emitting diode (PLED) was fabricated by using a novel polymer host, poly[3-(carbazol-9-ylmethyl)-3-methyloxetane]. The resultant device showed a record-high efficiency of 20.3 lm/W at 100 cd/m² by doping 24 wt% blue dye bis(3,5-difluoro-2-(2-pyridyl)-phenyl-(2-carboxypyridyl)iridium (III).

OLEDp - 33L Superhydrophobic Nano-Patterning on a Flexible Gas Barrier Film by Using a Poly(Dimethylsiloxane) Mold

*J. H. Choi, Y. M. Kim, Y. W. Park, T. H. Park, K. Y. Dong,
B. K. Ju
Korea Univ., Korea*

Super-hydrophobic and transparent gas barrier films were fabricated via nano-patterned poly-dimethylsiloxane elastomer imprinting on an ultraviolet curable resin. Ca degradation method and surface energies measurements were used to determine the level of modification of the surface characteristics. As a result, the decreased surface energy led to a lower WVTR.

OLEDp - 34L New Concept of Flexible OLED with Every Light Emitting Pixel which is Crossed by Electrode Strip

*S. W. Kim, S. H. Hwang, H. S. Yoo, S. Vaidyanathan,
D. Y. Jeon
KAIST, Korea*

We propose new concept of flexible OLED with every light emitting pixel which is crossed by electrode strip. Even though our results are very earlier stage to achieve fully flexible display based on textile structure, this basic concept demonstrates the possibility of the textile flexible display coming in the future.

IDMC/3DSA/Asia Display 2009

April 27–30, 2009
Taipei, Taiwan

OLEDp - 35L Fabrication of Micro-Pixel Array via Thermal Imprinting with a Polymer Stamp for Organic Light-Emitting Diodes

T. H. Park, Y. M. Kim, Y. W. Park, J. H. Choi, K. Y. Dong, S. I. Shin, K. C. Choi, B. K. Ju*

Korea Univ., Korea

**KAIST, Korea*

We have developed a noble process to fabricate micro-pixel array of organic light-emitting diodes (OLED) via thermal imprinting technique. We used poly-dimethylsiloxane as a stamp that is profitable to fabricate uniform large-sized area OLED than a hard stamp. As a result, 6 μm pixel sized high-resolution OLED was demonstrated.

OLEDp - 36L A Novel Host Material for High-Efficiency Blue Organic Electrophosphorescent Device

J.-H. Jou, W.-B. Wang, C.-T. Chen, S.-Z. Chen, M.-F. Hsu, C.-J. Wang, M.-F. Wu*, S.-W. Liu*, S.-M. Shen, C.-C. Chen, C.-P. Liu*

Nat. Tsing Hua Univ., Taiwan

**Academia Sinica, Taiwan*

A novel molecular host material, 3,5-di(9H-carbazol-9-yl)tetraphenylsilane (SimCP2), will be presented. By using this host, a blue electrophosphorescent device with a record-high power efficiency of 24.2 lm/W and EQE of 17.7 % at 100 cd/m² with Commission Internationale de l'Eclairage coordinates of (0.18, 0.33) is obtained.

OLEDp - 37L New Passive-Matrix OLED Driver with Multi-Line Addressing Scheme

U. Vogel, P. König, G. Bunk, J. Amelung, C. Xu, S. Barth**, J. Wahl***

Fraunhofer Inst. for Photonic MicroSys. (IPMS), Ctr. for Organic Materials & Elect. Devices Dresden (COMEDD), Germany

**Saarland Univ., Germany*

***Optrex Europe GmbH, Germany*

This paper describes a new 160x80 passive-matrix OLED driver ASIC capable in applying multi-line addressing (MLA). Application is directed towards automobile dashboard displays.

Author Interviews

18:00 – 19:00

Workshop on 3D/Hyper-Realistic Displays and Systems

Thursday, December 4

9:00 - 12:00

Exhibition Hall B

Poster 3Dp: Hyper Realistic and 3D Display

3Dp - 1 **A Novel Autostereoscopic 2D/3D Switchable Display by Switching Barrier**

M.-D. Chou, C.-C. Chang, J.-T. Lien, C.-C. Tsai, C.-P. Su, Y.-I. Chao, C.-L. Tsou, C.-N. Mo

Chunghwa Picture Tubes, Taiwan

We have developed a novel autostereoscopic 2D/3D switchable display by LC barrier can be on/off switching controlled according to image data. As results, an autostereoscopic display which can be switching between 4-view 3D mode and clear 2D mode successfully. Besides, 2D and 3D image can be displayed synchronously.

3Dp - 2 **Volumetric Display System Based on Inclined-Plane Scanning Using Digital Micromirror Device**

D. Miyazaki, K. Ohno, T. Mukai

Osaka City Univ., Japan

A volumetric display system based on inclined image plane scanning was constructed using a digital micromirror device (DMD). It can form three-dimensional images of $1024 \times 768 \times 200$ voxels. Although an image formed by the DMD is binary, multi-level images were achieved by a dithering technique.

3Dp - 3 **Design and Application of a Scent-Emitting Video Display System**

A. Tomono, T. Tomono, S. Otake

Tokai Univ., Japan

We propose a new method where a device that can release pressurized gases is placed behind the display screen filled with tiny pores. Scents are then ejected from this device, traveling through the pores to the front side of the screen. We also present a scent release time control method.

3Dp - 4 Image Distortion and Its Correction Method According to Observer's Rotation Movement in Stereoscopic Display

D.-W. Kim^{,**}, K.-H. Lee^{*}, S.-K. Kim^{*}*

^{}KIST, Korea*

*^{**}Korea Univ., Korea*

The stereoscopic image distortion is made by rotation movement of the observer, which is caused by different horizontal position of each eye of the observer. In this paper, we showed the simulation result about the distortion analysis and the correction of the stereoscopic image in rotation movement of the observer.

3Dp - 5 Crosstalk of Stereoscopic Display Using Patterned Retarder and Corresponding Glasses

Y. Yoshihara^{,**}, H. Ujike^{*,***}, T. Tanabe^{**}*

^{}Japanese Ergonomics Nat. Committee, Japan*

*^{**}Arisawa Manufacturing, Japan*

We develop and manufacture patterned retarders for 3D display. The main subject for the presentation is crosstalk, reporting a measurement method, suggestions for improvement, and improvement results.

3Dp - 6 Depth Perception for Moving Pictures Shown on a Large LED Display with an Aperture Grille

H. Yamamoto^{}, H. Nishimura^{*,**}, K. Uchida^{*,***},*

K. Ono^{,****}, Y. Hayasaki^{*,*****}, S. Suyama^{*}*

^{}Univ. of Tokushima, Japan*

*^{**}Toshiba, Japan*

*^{***}Victor of Japan, Japan*

*^{****}Panasonic, Japan*

*^{*****}Utsunomiya Univ., Japan*

We have experimentally confirmed that binocular delay of moving pictures gives depth perception. Perceived depth caused by the binocular delay was measured experimentally by utilizing a stereoscopic display with an aperture grille. Furthermore, it was found that use of an aperture grille improves depth impression for non-interleaved moving pictures.

3Dp - 7 A Method for Hologram Generation in a Three-Dimensional Imaging System Based on Multi Vision Data Acquisition and Holographic Display

*T. Kurahashi, K. Nitta, O. Matoba
Kobe Univ., Japan*

A method for signal processing of hologram generation in a three-dimensional image system based on multi-vision acquisition and holographic display is reported. In this method, a template data is utilized instead of simulation for wave propagations. This method is verified to be much faster than calculation with the Fresnel propagation.

3Dp - 8 A System of Wavefront Recording and Reconstruction of Moving Three-Dimensional Objects for Wide Angle

Y. Kitamura, M. Tanaka, K. Nitta, O. Matoba, Y. Awatsuji
Kobe Univ., Japan
Kyoto Inst. of Tech., Japan

A system of wavefront recording and reconstruction of three-dimensional objects with wide angle is presented. In the recording system, spatially phase-shifting interferometer is used for recording instantaneously the wavefront of three-dimensional objects. In the reconstruction, time-sharing reconstruction with various directions is presented.

3Dp - 9 Expansion of the Illumination and Reconstruction Area in the Reflection-Type Digital Holography Microscope System

K. H. Choi^{,**}, S. K. Kim^{*}, J.-Y. Son^{***}
*KIST, Korea
**Korea Univ., Korea
***Daegu Univ., Korea*

Digital Holography Microscope system using classical Michelson interferometer have a defect to the restricted within recording and reconstruction of object area. In this research, we developed MRDHMSystem. Applied this new system in Digital Holography Microscope System, as a result we have increase recording and reconstruction of object area.

3Dp - 10 A Real-Time Color Electroholography Using the Space-Division Method and a GPU Cluster

T. Shimobaba, T. Nakajima, A. Urayama, T. Sanbei, Y. Ichihashi, Y. Abe*, H. Nakayama*, N. Masuda*, A. Shiraki**, N. Takada***, T. Ito**

Yamagata Univ., Japan

**Chiba Univ., Japan*

***Kisarazu Nat. College of Tech., Japan*

****Shohoku College, Japan*

We report our electroholography 3D display system that can calculate CGHs in real-time, and reconstruct color 3D objects from the CGHs. In this system, for color reconstruction problem, we used the space-division method and an error diffusion method. For real-time CGH calculation, we used a GPU (Graphic Processing Unit) cluster.

3Dp - 11 Highly Parallelized Special-Purpose Computer System for Flow Velocity Measurement by Digital Holography

Y. Abe, N. Masuda, Y. Hamada, T. Ito, S. Satake, T. Kunugi**, K. Sato****

Chiba Univ., Japan

**Tokyo Univ. of Sci., Japan*

***Kyoto Univ., Japan*

****Toyota Inds., Japan*

In DHPTV, a great amount of time is spent on the hologram reconstruction compared with the time that hangs to the hologram record. In this study, we tried to make the special purpose computer for DHPTV system in parallel and succeeded in speed-up 100 times faster than a personal computer.

3Dp - 12L One-Unit System for Electroholography Using a Special-Purpose Computer with a High-Definition Liquid Crystal Display

Y. Ichihashi, M. Tsuge, T. Mizukami, H. Nakayama, T. Shimobaba, A. Shiraki**, N. Masuda, T. Ito*

Chiba Univ., Japan

**Yamagata Univ., Japan*

***Kisarazu Nat. College of Tech., Japan*

Electroholography is one of the techniques for achieving three-dimensional (3-D) television. We connected a special-purpose computer for holography to a display board with a high-definition reflective liquid crystal display. We succeeded in reproducing 30 frames per second in a 3-D image composed of about 2,000 points using this system.

3Dp - 13L Registration Progress Report for 3-D Object Display

D. Moldovan, S. Yano, N. Inoue
NICT, Keihanna Lab., Japan

A new type of 3-D object display in which the digitized views of the real object are divided into four quarters is presented. Registration starts by aligning consecutive views inside each quarter. By gradually registering and displaying the range views, the registration progresses simultaneously from four directions.

3Dp - 14L Development of the World Largest Parallax Barrier Type Triple View Display

H. J. Park, Y. B. Lee, J. H. Woo, K. B. Park, W. S. Kim
LG Display, Korea

We have developed a parallax barrier type TVD with the world's largest size (47") and the highest resolution (360 X 3 (Left/Center/Right) X 1920). We especially realized the front luminance over 600nit by using a high-luminance backlight. Therefore, TVD could be used not only for indoor but also outdoor applications.

3Dp - 15L Handmade 3D Stereo Adapter Using Commercial DIY Goods

K. Sakamoto, T. Ohara
Konan Univ., Japan

We describe the adapter using grating sold at stores for easy 3D viewing. The screen is divided in half to generate side-by-side images which are in the different position. This disables observers from viewing 3D images easily. To overcome, we developed viewing support unit using DIY goods easy to get.

14:55 - 15:00

Room 301

Opening**Opening Remarks**

14:55

I. Yuyama, Utsunomiya Univ., Japan

15:00 - 16:05

Room 301

3D1: Visual Perception and Human Factor

Chair: *I. Yuyama, Utsunomiya Univ., Japan*
 Co-Chair: *T. Mishina, NICT, Japan*

3D1 - 1: 15:00 *Invited* **Comparison Between Perceived Size of a Real 3D Object and That of Its 2D Image**

H. Kaneko, A. Minami, T. Asano, H. Mizushina
Tokyo Inst. of Tech., Japan

We quantitatively measured the difference between perceived sizes of a real object and its picture. The results showed that perceived horizontal size of 2D image was enlarged relative to that of 3D object. I discuss the cause of the difference from the viewpoint of binocular viewing.

3D1 - 2 15:20 **Appearance Reproduction by High-Density Directional Display: Influence of Ray Sampling and Comparisons to High-Resolution 2D Display**

M. Oguma, Y. Takaki
Tokyo Univ. of A&T, Japan

The subjective evaluation of the 72-direction VGA display was performed to show the dependency of the appearance reproduction on the ray sampling pitch and the observation distance. The comparisons of the appearance reproduction between the 72-direction VGA display and two-dimensional displays having VGA resolution and higher were also performed.

3D1 - 3 15:35 **Subjective Evaluation of the Depth Feeling in Ray Reconstruction 3D Image**

T. Morimoto, R. Odake, M. Ueda, J. Ohsako, C. H. Lee, J. Zhang*, H. Masuda**
Sony, Japan
**Sony Elect. Pte., Singapore*

This paper evaluates, subjectively, how the Depth (3D) Feeling of images, which are reproduced by a Ray-Reconstruction 3D display, is affected when the original images' characteristics change. The characteristics investigated are resolution, contrast, brightness, blur, and distortion.

3D1 - 4 15:50 **A Subjective Evaluation about the Difference of Perceived Resolution between 2D and 3D Images**

*M. Tsuboi, S. Kimura, T. Horikoshi, Y. Takaki**
NTT DOCOMO, Japan
**Tokyo Univ. of A&T, Japan*

A subjective test is used to evaluate the perceived roughness of 2D and 3D images. We find that humans perceive 3D images to be smoother than the 2D equivalents. Other effects triggered by human factors are elucidated.

----- Break -----

16:40 -17:55

Room 301

3D2: Measurement and Standardization

Chair: J.-Y. Son, Daegu Univ., Korea
 Co-Chair: M. Hashimoto, NTT DATA, Japan

3D2 - 1: Invited Ergonomics for 3D Displays and Their Standardization

16:40

G. Hamagishi^{*,*2}, K. Taira^{*,*3}, K. Izumi^{*,*4}, S. Uehara^{*,*5},
 T. Nomura^{*,*6}, K. Mashitani^{*,*7}, A. Miyazawa^{*,*8},
 T. Koike^{*,*9,*10}, A. Yuuki^{*,*11}, T. Horikoshi^{*,*12},
 Y. Yoshihara^{*,*13}, Y. Hisatake^{*,*14}, H. Ujike^{*,*15},
 Y. Nakano^{*}

^{*}Japanese Ergonomics Nat. Committee, Japan

^{*2}Seiko Epson, Japan

^{*3}Toshiba, Japan

^{*4}3D Consortium, Japan

^{*5}NEC LCD Techs., Japan

^{*6}Sharp, Japan

^{*7}Sanyo Elec., Japan

^{*8}NAMCO BANDAI Games, Japan

^{*9}Hitachi, Japan

^{*10}Univ. of Tokyo, Japan

^{*11}Mitsubishi Elec., Japan

^{*12}NTT DOCOMO, Japan

^{*13}Arisawa Manufacturing, Japan

^{*14}Toshiba Matsushita Display Tech., Japan

^{*15}AIST, Japan

The standardization of guidelines for autostereoscopic displays is necessary and it must be based on ergonomic data. ISO/TC 159/SC 4/WG 2 has decided that Technical Report will be prepared as the first step of standardization. Improved standardization through a new ISO proposal will lead to the spread of autostereoscopic displays.

IDW Tutorial in Japanese

Tuesday, December 2, 2008

12:45–17:00

Room 301

Toki Messe Niigata Convention Center

Detailed information will be available:
<http://www.sidchapters.org/japan/index.htm>

Contact Address: idw.tutorial.wz@hitachi.com

3D2 - 2: 16:55 *Invited* **Variation of Autostereoscopic Displays and Their Measurements**

K. Taira^{*,2}, G. Hamagishi^{*,3}, K. Izumi^{*,4}, S. Uehara^{*,5},
T. Nomura^{*,6}, K. Mashitani^{*,7}, A. Miyazawa^{*,8},
T. Koike^{*,9,10}, A. Yuuki^{*,11}, T. Horikoshi^{*,12},
Y. Hisatake^{*,13}, H. Ujike^{*,14}, Y. Nakano^{*}

^{*}Japanese Ergonomics Nat. Committee, Japan

²Toshiba, Japan

³Seiko Epson, Japan

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⁵NEC LCD Techs., Japan

⁶Sharp, Japan

⁷Sanyo Elec., Japan

⁸NAMCO BANDAI Games, Japan

⁹Hitachi, Japan

¹⁰Univ. of Tokyo, Japan

¹¹Mitsubishi Elec., Japan

¹²NTT DOCOMO, Japan

¹³Toshiba Matsushita Display Tech., Japan

¹⁴AIST, Japan

Outlines of the classification and the variation of autostereoscopic displays, the basic concept of the qualified viewing space for stereoscopic viewing, and the required optical measurement items are described. These issues have been studied by the members of the Japanese mirror committee for ISO TC 159/SC 4/WG 2.

IDW Best Paper Award

This award will go to the most outstanding paper selected from those presented at IDW '08.

The 2008 award winners will be announced on the IDW website:

<http://www.idw.ne.jp/award.html>

IDMC/3DSA/Asia Display 2009

April 27–30, 2009

Taipei, Taiwan

3D2 - 3: 17:10 *Invited Methodology of Optical Measurement for Autostereoscopic Displays*

S. Uehara^{,2}, K. Taira^{*,3}, G. Hamagishi^{*,4}, K. Izumi^{*,5},
T. Nomura^{*,6}, K. Mashitani^{*,7}, A. Miyazawa^{*,8},
T. Koike^{*,9,10}, A. Yuuki^{*,11}, T. Horikoshi^{*,12},
H. Ujike^{*,13}*

**Japanese Ergonomics Nat. Committee, Japan*

²NEC LCD Techs., Japan

³Toshiba, Japan

⁴Seiko Epson, Japan

⁵3D Consortium, Japan

⁶Sharp, Japan

⁷Sanyo Elec., Japan

⁸NAMCO BANDAI Games, Japan

⁹Hitachi, Japan

¹⁰Univ. of Tokyo, Japan

¹¹Mitsubishi Elec., Japan

¹²NTT DOCOMO, Japan

¹³AIST, Japan

For standardization of 3D displays based on ergonomics, we propose methodology of optical measurement for autostereoscopic displays. In order to obtain viewing spaces as the requirements of standardization, luminance distributions and chromaticity distributions should be measured. By applying human factors to these results, the requirements can be established.

PDP International Forum '08

Saturday, December 6, 2008

10:30–16:30

Toki Messe Niigata Convention Center
(IDW '08 Venue)

For further information, visit www.pdptm.org/forum/

3D2 - 4: 17:25 Invited Viewing Zones of Autostereoscopic Displays and Their Measurement Methods

A. Yuuki^{*,2}, S. Uehara^{*,3}, K. Taira^{*,4}, G. Hamagishi^{*,5},
K. Izumi^{*,6}, T. Nomura^{*,7}, K. Mashitani^{*,8},
A. Miyazawa^{*,9}, T. Koike^{*,10,11}, T. Horikoshi^{*,12},
H. Ujike^{*,13}

^{*}Japanese Ergonomics Nat. Committee, Japan

²Mitsubishi Elec., Japan

³NEC LCD Techs., Japan

⁴Toshiba, Japan

⁵Seiko Epson, Japan

⁶3D Consortium, Japan

⁷Sharp, Japan

⁸Sanyo Elec., Japan

⁹NAMCO BANDAI Games, Japan

¹⁰Hitachi, Japan

¹¹Univ. of Tokyo, Japan

¹²NTT DOCOMO, Japan

¹³AIST, Japan

We discuss on QBVS(Qualified Binocular Viewing Space) from where users can watch images without visual fatigue caused by stereoscopic displays and Q3DVS (Qualified 3D Viewing Space) from where users can watch qualified 3D image and their measurement methods in case of two and multi-view autostereoscopic displays.

IDW Outstanding Poster Paper Award

This award will go to the most outstanding paper selected from those presented at IDW '08 poster presentation.

The 2008 award winners will be announced on the IDW website:

<http://www.idw.ne.jp/award.html>

SID 2009

International Symposium, Seminar and Exhibition

May 31 – June 5, 2009

San Antonio, Texas, USA

3D2 - 5: 17:40 *Invited* **Measurement of Multi-View and Integral Photography Displays Based on Sampling in Ray Space**

T. Koike^{,2,3}, A. Yuuki^{*,4}, S. Uehara^{*,5}, K. Taira^{*,6},
G. Hamagishi^{*,7}, K. Izumi^{*,8}, T. Nomura^{*,9},
K. Mashitani^{*,10}, A. Miyazawa^{*,11}, T. Horikoshi^{*,12},
H. Ujike^{*,13}*

**Japanese Ergonomics Nat. Committee, Japan*

²Hitachi, Japan

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⁵NEC LCD Techs., Japan

⁶Toshiba, Japan

⁷Seiko Epson, Japan

⁸3D Consortium, Japan

⁹Sharp, Japan

¹⁰Sanyo Elec., Japan

¹¹NAMCO BANDAI Games, Japan

¹²NTT DOCOMO, Japan

¹³AIST, Japan

We present differences between multi-view and integral-photography 3D-displays based on sampling in ray space. For analyzing differences, we introduce a ray sampling quality function, which calculates the sampling quality of each 3D-display. We also present possible measurement methods for each 3D display, because these differences will relate to measurement methods.

Author Interviews

18:00 – 19:00

EXHIBITION

12:00–18:00 Wednesday, Dec. 3, 2008

10:00–18:00 Thursday, Dec. 4, 2008

10:00–14:00 Friday, Dec. 5, 2008

Exhibition Hall B

Toki Messe Niigata Convention Center

Free admission with your registration name tag.

Friday, December 5

9:00 - 10:15

Room 301

3D3: Hyper Realistic and 3D Display Systems (1)

Chair: M. Hashimoto, NTT DATA, Japan
 Co-Chair: T. Mishina, NICT, Japan

3D3 - 1 **Autostereoscopic 3D Display Characterization Using
 9:00** **Fourier Optics Instrument and Computation in 3D
 Observer Space**

*P. Boher, T. Bignon, T. Leroux
 ELDIM, France*

Autostereoscopic 3D display characterization method based on high angular resolution Fourier optics instrument is presented. From the luminance or color measurements we predict what will be seen by an observer in front of the display. 3D contrast, OVR and OVF can be visualized and quantified in the 3D observer space.

3D3 - 2 **Using Diffusive Adhesives to Reduce Moiré Pattern
 9:15** **of Auto-Stereoscopic Displays**

J.-T. Lian^{,**}, M.-D. Chou^{*}, F.-C. Lu^{*}, C.-C. Chang^{*},
 C.-L. Tsou^{*}, T.-Y. Lin^{**}, C.-N. Mo^{*}
^{*}Chunghwa Picture Tubes, Taiwan
^{**}Nat. Taiwan Ocean Univ., Taiwan*

Auto-stereoscopic displays used a LC panel for the parallax barrier and driven on time multiplexing mode could get high performance. But Moiré pattern is also appeared in the parallax barrier 3D display. We use the diffusive adhesive to reduce Moiré pattern and keep the Auto-stereoscopic effect at the same time.

3D3 - 3 **Autostereoscopic Display Based on Patterned OLED
 9:30** **Backlight**

*U. Vogel, L. Kroker, J. Knobbe, H.-G. Dallmann,
 M. Scholles, C. Grillberger, U. Todt, J. Amelung
 Fraunhofer Inst. for Photonic Microsys., Germany*

A 3.5" 3D QVGA display will be presented, that is based on a highly-efficient, patterned and controllable OLED backlight. This technology demonstrator combines several major achievements: large-area OLED backlight, highly-efficient and fast-response OLED top-emitter, striped patterned backlight, individual electronic driving for adaptive backlight control, 3D mobile display application demonstrated.

3D3 - 4 **Floating 3D-Image Display Using Integral
9:45** **Photography Display and Afocal Lens System**

M. Ota^{}, T. Koike^{*,**}, T. Naemura^{*}*

^{}Univ. of Tokyo, Japan*

*^{**}Hitachi, Japan*

We present a floating 3D-image display using an integral photography display and an afocal lens system. We used an afocal lens system to suppress distortion of 3D-images and reduce the viewing zone caused by a single lens system. Our method enables a widening of the viewing zone of the 3D-display.

3D3 - 5 **Prototyping and Optical Evaluation of 9-in. OCB
10:00** **Time-Division-Multiplexing 18-View 3D Display**

*M. Kashiwagi, T. Saishu, K. Taira, H. Kobayashi,
Y. Hirayama*

Toshiba, Japan

We developed an integral imaging time-division-multiplexing 18-view 3D display, using 9" OCB-LCD, lenticular sheet, and active shutter. By simulating a lens shape and a shutter structure to find the best conditions, depth range and viewing angle, was enhanced and brighter and flicker-less 3D image with smooth motion parallax was obtained.

----- Break -----

10:40 - 11:45

Room 301

3D4: Hyper Realistic and 3D Display Systems (2)

Chair: H. Kaneko, Tokyo Inst. of Tech., Japan

Co-Chair: S. Yano, NICT, Japan

3D4 - 1: ***Invited* Development and Application of
10:40** **NaturalVision: Challenge to Exceed Limit of RGB-
Based Imaging System**

M. Hashimoto

NTT DATA, Japan

NaturalVision is a technique for high accurate color reproduction based on multi-channel image acquisition and display using spectral information. NaturalVision has been developing since 1999 founded by National Institute of Information and Communications Technology (NICT). Past and current NaturalVision and its several applications are presented in this paper.

3D4 - 2 **Study of Stereo Capture System Setup with Image
11:00** **Quality of Depth Map Rendering**

*J. C. Yang, C. S. Wu, K. Lee, S. H. Lai**

ITRI, Taiwan

**Nat. Tsing Hua Univ., Taiwan*

The developed system generates contents with specific format, image plus depth, for 3D display devices from a stereo video/images. This paper studies the image qualities of depth map rendering with different setup parameters for both the converged and parallel captured system.

3D4 - 3 **Fusibility of a Stereo Image Taken from an 8 mm
11:15** **Imaging System**

*J.-Y. Son, D.-S. Lee, D.-H. Jung, S.-H. Kim, K.-T. Kim**

Daegu Univ., Taiwan

**Hannam Univ., Korea*

Stereo image pairs can be obtained from the images created by each elemental horn antenna composing of an 8 millimeter Imaging System's focal plane array. The depth sense from the stereo image pairs can last to 1.1% resolution of the original image but 2% for usual stereo images.

3D4 - 4 **Analysis of Eye Response to Low Brightness 3D
11:30** **Displays and Increase Brightness in 3D RPTV Using
Long Life, High Power DPR System**

K. Li

Wavien, USA

3D display systems reduce the effective screen brightness by as much as 10 times. This paper presents eye response analysis and a low cost approach to increasing brightness in a 3D RPTV using the long life DPR system, increasing the screen brightness by three times, while maintaining acceptable lamp lifetime.

----- Lunch -----

Author Interviews

17:40 – 18:40

Eurodisplay 2009 (IDRC 2009)

September 14–17, 2009

Rome, Italy

Workshop on Applied Vision and Human Factors

Thursday, December 4

9:00 - 12:00

Exhibition Hall B

Poster VHFp: Applied Vision and Human Factors

VHFp - 1 The Proposal of Correction Method of Color-Matching Functions Using Genetic Algorithm

*S. Ozaki, Y. Tokuda, G. Ohashi, Y. Shimodaira
Shizuoka Univ., Japan*

This study corrects color-matching functions to reduce the gap between colorimetric values and human perception of color. Color-matching functions are approximated by Gaussian functions which are controlled by parameters and then are corrected using genetic algorithm to optimize these parameters. Experimental results show perceptual color matching was improved.

VHFp - 2 A Study of 'Quasi' Purity Discrimination Threshold in Mesopic Condition

N. Ishikawa, G. Ohashi, Y. Shimodaira, Y. Shibata,
M. Kitagawa*, H. Serizawa*
Shizuoka Univ., Japan
KOITO Manufacturing, Japan

'Quasi' purity discrimination was examined to examine color perception in the mesopic condition. As the results, the overall tendency is similar to the results of the photopic condition. A small dip was found in green regions near 530 nm, where quasi purity discrimination is lower than those of neighboring wavelengths.

VHFp - 3 Methods of Error Detection by Proofreading on LCD Screen

*J. Yamaguchi, H. Isono
Nippon Inst. of Tech., Japan*

The present study compared a total of three proofreading methods for error detection accuracy on an LCD screen. The results revealed that the methods used were proofreading by mouse dragging (MD) and oral reading methods were more effective than the usual silent reading method for detecting errors.

VHFp - 4 The Influence of Ambient Luminance Level on Perceptual Image Appearances

R. Ho, B.-J. Pong
ITRI, Taiwan

In this study, six test images were selected and rendered to form an image set and assessed by a panel of observers in terms of a number of perceptual appearances including colourfulness, naturalness, sharpness and image quality. The experiment was conducted under three different ambient luminance levels, respectively.

VHFp - 5 Subjective Evaluation for Indistinct Mura of LED Backlight

Y. Masakura, T. Tamura, K. Nagamine, S. Tomioka**
Tokyo Polytechnic Univ., Japan
**Sony, Japan*

We examined subjective evaluations for artificial indistinct Mura images. We revealed that three numerical indexes based on measured luminance of Mura image, those were 1) Mura edge area, 2) low luminance area and 3) maximum of luminance difference between Mura and the uniform image would be important for subjective evaluations.

VHFp - 6 Image Contrast Improvement Based on Histogram of Differential Gray-Levels Feature

Y. Higashi, F. Saitoh
Gifu Univ., Japan

This paper proposes a method that generates a Look-Up-Table from the histogram based on the distributions of differential gray-levels and gradient of differential gray-levels by pixels. The experimental results show that the resultant images with good contrast were generated by the proposed method in comparison with by the conventional methods.

VHFp - 7 Scratched Photographic Image Restoration by Using Variable-Sized Directional Filter

F. Saitoh, D. Takasao
Gifu Univ., Japan

This paper proposes a method to restore a photographic image including some scratches. Three kinds of filters for extracting edges and the variable-sized directional filter are applied to remove continuous long scratches. The experimental results showed most of scratches were removed by the proposed method.

VHFp - 8 Photography Method for Dark Places by Using Moving Image Analysis with Single Light Scanning

*K. Okada, F. Saitoh
Gifu Univ., Japan*

This paper proposes a photography method that uses a moving image in the dark place. When the photography situation is dark, flashbulb function is used generally, but there is the ineffective case. The experimental results showed that the generated image by the proposed method was good contrast.

VHFp - 9 Color Tonal Analysis on 4-Primary Color LCD System

H.-S. Chen, T.-T. Chang, J.-F. Huang*
Nat. Taiwan Univ. of S&T, Taiwan
ITRI, Taiwan

We proposed the effective color tonal analysis method on 4-color display system. To effectively evaluate the tonal smoothness levels, the spatial filtering operations are applied to perform the edge detection. It's shown the Prewitt and Sobel operation work well to detect discontinues edge on 4-color display system.

VHFp - 10 The Design of Ambient Light Compensation on TV Device

B. J. T.-C. Chen, H.-S. Chen, W.-K. Lin, C.-Y. Chang*
Nat. Taiwan Univ. of S&T, Taiwan
TECO, Taiwan

This paper introduces a new method to integrate a system model of building a comfortable and healthy environment for watching TV. This model, which is named as Ambient Light Compensation Unit (ALCU). The TV system will benefit to the promotion of image quality and visual health on FPD field.

VHFp - 11 A Selective Adjustment Method for Image Quality Improvement

*J. Dong, F. Wang, S. L. Wu, C. L. Liu, L. G. Meng,
H. Wang
Xi'an Jiaotong Univ., China*

A selective algorithm is employed to enhance the image brightness by calculation between original and adjusting image derived from the original one. In RGB mode, this algorithm can enlarge the color range and improve saturation through the continuous distribution of grey level in histogram while avoiding the decline of contrast.

VHFp - 12 Moving Blur Edge Measurement Using Adapted Contrast Sensitivity Function

*Y.-Y. Lai, W.-H. Liao, R.-H. Chen, K.-C. Chang
Taiwan TFT LCD Assn., Taiwan*

Perceived blur edge width (PBEW) had become a useful method to evaluate moving picture image quality. Contrast sensitivity function (CSF) is the major component. A novel adapted CSF was made by a subjective test. PBEW using the adapted CSF was verified that PBEW is almost the same as using Barten's CSF.

VHFp - 13 A Novel Analysis Method to Verify Moving Picture Quality in Flat Panel Display

*S. H. Park, K. H. Lee, I. C. Park, M. S. Yang, I. B. Kang
LG Display, Korea*

MPQ related with not only response time, but also color shift. We show behavior of color shift in different displays when picture is rapidly moving with speed of 0ppf. MPCS of PDP and IPS-LCD in blur area of moving pictures shows $\Delta u'v' > 0.03$ and $\Delta u'v' < 0.005$.

VHFp - 14 A Mura Inspection and Quantification System for FPD

*C.-W. Kuo, C.-H. Kuo, K.-C. Chang
Taiwan TFT-LCD Assn., Taiwan*

Mura inspection and quantification system is proposed. Different types of Laplacian of Gaussian (LoG) filter methods and blob analysis are used. We can detect four typical types of Muras: 1 Point, 2 Line, 3 Band, and 4 Light Leak. The developed human vision model can quantify JND by contrast perception.

VHFp - 15 A Contrast Enhancement Method Using Dynamic Range Based on Linear Segmentation

*J.-S. Hwang, G.-H. Park, M. R. Choi
Hanyang Univ., Korea*

In this paper, we propose the linear histogram equalization using parity probability segmentation. Histogram Equalization is an effective method for image contrast enhancement. However, it has unwanted artifact and unnatural look because of over-enhancement in contrast. The experimental results show that the proposed method achieves contrast enhancement and preserving naturalness.

VHFp - 16 Analysis of Human Vision Models and Its Application to Flat Panel Display

B.-W. Wu, Y.-C. Fang, W.-D. Chen

Nat. Kaohsiung First Univ. of S&T, Taiwan

This study explores thermal imaging recognition, and presents a method for effectively choosing the features and processing the images fully. Neural network technology is successfully applied to recognize thermal imaging and predict MRTD (minimum resolvable temperature difference), exceeding thermal imaging recognition under fatigue and the limits of the human eye.

VHFp - 17 The Side Effects of Black Insertion on 26-in. TN TFT-LCD

T.-C. Hsu, L.-H. Yeh, M.-W. Tsai

Chunghwa Picture Tubes, Taiwan

We implement Black Insertion technology on 26" TN TFT-LCD. This technology could improve video image quality and reduce MPRT. However, many side effects cause it could not be applied on mass product. This paper would illustrate these side effects.

VHFp - 18L A Novel Algorithm to Quantify Image Sticking

*C. W. Chen, S. Y. Pen, Y. W. Fang, G. G. Guo,
K. S. Wang*

AU Optronics, Taiwan

Image-sticking is one of thorny problems for LCD panels. In this paper, we use the CCD system to measure the image-sticking patterns generated by a LCD simulator and calculate quantification factor from a novel algorithm. The measured and analyzed results are comparable with human judged levels.

VHFp - 19L An Effective Contrast Enhancement Method for Infrared Imaging System

G. H. Park, J. S. Ko, C.-K. Ahn

Samsung Thales, Korea

We proposed an effective contrast enhancement method for infrared imaging system. Proposed method uses an adaptive histogram redistribution based on histogram partitioning to prevent the side-effect due to the over-enhancement in luminance. The experimental results show that proposed method has more effective performance compared with conventional methods.

16:40 - 18:00

Marine Hall

VHF1/DES5: Contrast Enhancement

Chair: S. Clippingdale, NHK, Japan
 Co-Chair: M. A. Klompenhouwer, Philips, the Netherlands

**VHF1/
DES5 - 1
16:40** **Tone Mapping Method Using Local Contrast
Enhancement for High Dynamic Range Images**

*B.-Y. Kim, B.-H. Hwang, J.-H. Yun, M.-R. Choi
Hanyang Univ., Korea*

In this paper, a tone mapping method using contrast enhancement for High Dynamic Range (HDR) is proposed. By applying the Modified Histogram Adjustment (MHA) and the Local Contrast Enhancement Volume (LCEV) with decomposed layers, the tone mapping is performed effectively. The experimental results show that the proposed method preserves local contrast and global dim and bright impression with the naturalness of original images.

**VHF1/
DES5 - 2
17:00** **Gradation Quality Enhancement without Degradation
in Texture Areas**

*Y. Okuno, T. Nakano, M. Yoshiyama, J. Asano
Samsung Yokohama Res. Inst., Japan*

We have developed a gradation enhancement method for flat-panel displays (FPD) that can display at resolutions of greater than eight bits. This method allows appropriate distinction of gradation areas and textured areas, making it possible to improve the smoothness of gradation regions without loss of quality in textured regions.

**VHF1/
DES5 - 3
17:20** **Contrast Enhancement Method Using Limited
Histogram Binding**

*H.-W. Kang, G.-H. Park, B.-H. Hwang, S.-J. Lee,
J.-H. Yun, M.-R. Choi
Hanyang Univ., Korea*

In this paper, Limited Histogram binding (LHB) is proposed for contrast enhancement. LHB binds the low frequency histogram components according to criterion and unbinds to preserve detail of original image. The experimental results show that LHB suppresses the washed out appearance or color distortion compared with conventional methods.

**VHF1/
DES5 - 4
17:40** **Pixel Based Image Enhancement (PBIE) Technology
to Enhance Image Quality without Memory at
Portable System**

*C.-L. Wu, J.-S. Liao, Y.-N. Chu, W.-T. Tseng, H.-T. Yu
Chunghwa Picture Tubes, Taiwan*

Chunghwa Picture Tubes, LTD. has performed the PbIE technology at middle size display. This technique could real time enhancing image quality without any frame buffer or image data distribution of pervious n-1 frames, then the moving picture quality are enhanced automatically and adaptively based on the character of each pixel.

Author Interviews

18:00 – 19:00

Friday, December 5

9:00 - 10:30

Marine Hall

VHF2: Image Quality (1)

Chair: J. Miseli, Sun Microsystems., USA

Co-Chair: H. Isono, Nippon Inst. of Tech., Japan

VHF2 - 1: *Invited* An Integrating Sphere System to Realize Very-Low-Luminance Reference Light Sources

*S. Kubota, T. Matsumoto, T. Shimura
Univ. of Tokyo, Japan*

Double integrating spheres method is proven to be most reliable way to reduce luminance on the first sphere wall to the second into very dark region down to 3×10^{-5} cd/m², which is quite useful in testing sensitivity and linearity of spectrophotometers.

VHF2 - 2 **Evaluation of FPD Mura Grade Using a Contrast
9:30** **Sensitivity Function Filter**

*T. Asano, Y. Morimoto, T. Ikeda
Hiroshima Inst. of Tech., Japan*

A novel method that can be used to evaluate mura grade on FPDs has been developed. This method is capable of evaluating the edge gradients of the mura. This is accomplished by converting the mura image into a visual sensitivity image using a contrast sensitivity function filter.

VHF2 - 3 **The Parameters and Quantification Factor for the
9:50** **Inspection of Image Sticking**

*Y.-C. Chen, S.-Y. Pan, P.-M. Liu, C.-C. Kuo, T.-J. Chang,
W.-L. Liao, A. Lien
AU Optronics, Taiwan*

This paper investigated and clarified the influence of the external parameters on the inspection of image sticking. Furthermore, a quantification factor derived from the measurement and analysis was proposed, which is able to scientifically express the level of the image sticking and well link to the perception of human.

VHF2 - 4 **Effects of Culture, Ambient Illumination, and Resolution on the Perceived Image Quality of Mobile Displays**
10:10

P.-H. Lin, P. Patterson^{}, S.-H. Hwang*
Nat. Tsing Hua Univ., Taiwan
^{*}*Texas Tech. Univ., USA*

Effects of Culture, Ambient Illumination, and Resolution on Image quality of Mobile displays were studied. The results indicated that the Chinese subjects were more sensitive than the American subjects when evaluating the image quality on mobile displays.

----- Break -----

10:40 - 11:50

Marine Hall

VHF3: Image Quality (2)

Chair: S. Kubota, Univ. of Tokyo, Japan
 Co-Chair: K. Masaoka, NHK, Japan

VHF3 - 1: *Invited* ICDM Display Measurement Standard for Flat Panel Displays
10:40

J. Miseli
Sun Microsystems., USA

2008 will mark the introduction of the most ambitious display metrology standard yet written - the ICDM DMS (Display Measurement Standard). It will be for flat panels and other displays, from module level to completed display assemblies.

VHF3 - 2 FPD Test Image Creation and Image Quality Analysis
11:10

H. S. Chen, S. H. Chen^{}, Y. C. Chen, W. K. Lin^{*},
 B. J. Pong^{**}*
Nat. Taiwan Univ. of S&T, Taiwan
^{*}*TECO Elec. & Machinery, Taiwan*
^{**}*ITRI, Taiwan*

This paper aims to establish FPD image quality analysis procedures from the viewpoints of standard test images and image color difference. The psychophysical experiment of skin-color differences was performed. The evaluated results hints the skin-images on Adobe RGB monitor with 2 color difference units are similar to sRGB monitor.

VHF3 - 3 **Perceptual Resolution of FPD Obtained by
11:30** **Combination of Slanted-Edge SFR and Contrast-
Sensitivity Function**

S. W. Hsu, C. H. Chen, Z. Y. Chung
ITRI, Taiwan

Based on a slanted-camera and step-edge patterns method, the spectral-frequency responses (SFR) were calculated and multiplied with contrast sensitivity functions (CSF) to find out perceptual and objective resolutions of flat-panel display (FPD). Digital inputs of step-edge patterns were varied to study the dependence of resolution by average luminance and macro-contrast.

----- Lunch -----

13:20 - 14:40

Marine Hall

VHF4: Color

Chair: Y. Shimodaira, Shizuoka Univ., Japan
Co-Chair: T. Matsumoto, Univ. of Tokyo, Japan

VHF4 - 1 **Study of the Optimal and Allowable Limits for Color
13:20** **and Luminance Difference in Electronic Displays**

Y. Hisatake, A. Ikeda, H. Ito, M. Obi, Y. Kawata,
A. Murayama
Toshiba Matsushita Display Tech., Japan

We have studied the dependency on color chromaticity and types of images of allowance for luminance and color difference in CIELAB color space. ΔL^* limit value is smaller than ΔE_{ab}^* and ΔC_{ab}^* values for fruits, vegetable and artificial objects, while for flower objects, the score doesn't depend on ΔL^* value.

VHF4 - 2 **Measurement of Color Viewing Angle for Displays
13:40**

N. Funabiki, K. Adachi, S. Minami, J. Hashiguchi,
M. Kasahara
Advanced PDP Dev. Ctr., Japan

APDC has determined the criteria to define color viewing angle at which a display maintains the same colors as viewed from straight on. Through the several subjective experiments, the color shift $\Delta u'v'$, being equal to 0.015, proved to be a reasonable threshold, assuring the same color impression.

VHF4 - 3 **Wide Color-Gamut LCMs Using Multi-Phosphor
14:00** **White LED and Image-Processing Engine**

*J.-S. Li, C.-C. Lai, T.-Y. Chang, C.-F. Hsu, W.-C. Wang
Wintek, Taiwan*

The MPW LEDs improve 13% NTSC ratio of LCD in comparison with standard white LEDs under the assumption of equal power consumption and brightness. The pixel-level image-processing engine obtains separately about 45% image saturation expansion and 96% image contrast improvement without hue distortion.

VHF4 - 4 **The Main Effects of Color Shift Increase in Wide
14:20** **Color Gamut for Mobile-MVA Application**

*S. L. Yang, S. C. Fan Jiang, C. J. Hu, W. M. Huang
AU Optronics, Taiwan*

In MVA type display, color shift will increase when the color gamut is wider. Since color wash out is not the only main effect to cause the color shift. There is other effects included color filter spectrum shape and light leakage will dominate the color shift in different color range.

----- Break -----

15:00 - 16:20

Marine Hall

VHF5: Vision and Human Factors

Chair: H. Isono, Nippon Inst. of Tech., Japan
Co-Chair: N. Hiruma, NHK, Japan

VHF5 - 1 **Effects of TV Display Size on Visual Fatigue in a
15:00** **Domestic Viewing Environment**

K. Sakamoto, S. Aoyama, S. Asahara, K. Yamashita,
A. Okada**

Panasonic, Japan

**Osaka City Univ., Japan*

We measured the effect of TV display size on visual fatigue using 42-inch and 65-inch. Our results indicate that the optimum viewing distance for minimizing visual fatigue lies between 165 and 220 cm, a semi-absolute distance, rather than a strict relative distance such as three times the screen height (3H).

VHF5 - 2 **Perceived Threshold of Brightness Gradient in Display Devices**
15:20

*B. Katagiri, K. Sekiya, T. Kawakami, T. Uchida,
Y. Kuratomi, K. Takamura, H. Sato, Y. Suzuki
Tohoku Univ., Japan*

In this study, we noticed the gradient of the brightness modulation as a candidate of parameters in the perception of human eyes. Then we clarified one of the concerns on relation between the perception of human eyes and the gradient of the brightness change by an experiment.

VHF5 - 3 **Car Navigation Systems in which Perceived Depth of Virtual Traffic Signs Presented over Windscreen**
15:40

*M. Suzuki, K. Uehira
Kanagawa Inst. of Tech., Japan*

Depth perception of virtual objects in mixed/augmented reality is controllable by artificial motion parallax simulating motion parallax caused by motion of observers. Three-dimensional displays using the artificial motion parallax technique would enable new car navigation systems that depth perception of the virtual traffic signs presented above the windshield is controlled.

VHF5 - 4 **Area Segmentation for Road Image Based on Categorical Colors**
16:00

T. Yaguchi, T. Ashiguchi, K. Kijima, S. Ishida,
Y. Nakanishi*, K. Syouji, M. Ayama
Utsunomiya Univ., Japan
Honda R&D, Japan

Area segmentation for road images using categorical colors is presented. Basic map of categorical colors is constructed in the $L^*a^*b^*$ space based on the color naming experiment and further adjustment. A shifted database of categorical colors for images with orangish tone is also prepared by trial and error.

----- Break -----

IDMC/3DSA/Asia Display 2009

April 27–30, 2009
Taipei, Taiwan

16:40 - 17:40

Marine Hall

VHF6: Moving Image Quality

Chair: J. Bergquist, Nokia Japan, Japan
 Co-Chair: H. Isono, Nippon Inst. of Tech., Japan

VHF6 - 1 **Evaluation on Motion Blur Indexes by Subjective**
16:40 **Tests**

*Y. W. Fang, J. K. Luo, J. F. Chen, R. L. Dong,
 K. S. Wang, C. C. Chen*
AU Optronics, Taiwan

For verifying motion blur by quantified indexes, we design a subjective testing method. Through this testing method, the correlations between perceived blur width and motion blur indexes are investigated. The contrast-based blur edge width (CBEW) for characterizing motion blur is also proposed from subjective testing results.

VHF6 - 2 **Motion Blur Characterization with Dynamic**
17:00 **Modulation Transfer Functions**

Y. Zhang, Y. Xu, W. Song, X. Li, K. Teunissen,
 I. Heynderickx**,****
Southeast Univ., China
**Philips Consumer Lifestyle, the Netherlands*
***Philips Res. Labs., the Netherlands*
****Delft Univ., the Netherlands*

The dynamic MTF is proposed to characterize the temporal behavior of LCDs. It is based on an inter-level transition measurement. The results of two perception experiments show that the model correlates well with perception, except for quasi-static patterns. While model predictions, based on measured impulse responses, are less accurate.

VHF6 - 3 **Color Breakup: Taxonomy, Measurement, and**
17:20 **Remedy**

C.-N. Wu, W.-C. Cheng, W.-C. Tai, C.-C. Chang*,
 K.-H. Cheng***
Nat. Chiao Tung Univ., Taiwan
**Chunghwa Picture Tubes, Taiwan*
***Nat. Central Univ., Taiwan*

Saccade-induced color breakup was measured on a saccadic display and a contingent display was designed to minimize color breakup by detecting eye movement with electrooculogram signals.

Author Interviews

17:40 – 18:40

Supporting Organization:

Technical Group on Information Display, ITE

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

Wednesday, December 3

13:20 - 13:25

Room 201

Opening

Opening Remarks

13:20

Z. Tajima, Mobara Atecs, Japan

13:25 - 14:40

Room 201

LAD1: Solid State Light Sources

Chair: C. L. Bruzzone, 3M, USA

Co-Chair: S. Shikama, Mitsubishi Elec., Japan

**LAD1 - 1 LED Brightness Increase for Projection Displays
13:25 Multiplexing and Recycling**

K. Li

Wavien, USA

LED has gained its importance in micro-projectors to potentially high output, home theater systems. In these systems, the outputs are lower and sizes are larger than desirable. This paper describes practical, and compact, recycling and multiplexing systems that provide brightness increases, and allow projectors to achieve outputs beyond current levels.

**LAD1 - 2 High Power LED Light Source for Projection System
13:45**

T. Kaneko, R. Mori, K. Takahashi

Saitama Univ., Japan

We proposed the high power LED light source for projection system using a three-dimensional LED array and ellipsoidal reflection mirror. The light source enables the high condensing rate of light and the increase of the LED current by liquid cooling. This system can achieve high intensity light source.

LAD1 - 3 **Withdrawn****LAD1 - 4L Speckle-Reduced Holographic Laser Projector**

14:05

*E. Buckley**Light Blue Optics, USA*

Light Blue Optics' holographic laser projection technology exploits the physical process of two-dimensional diffraction to form video images. The Light Blue Optics (LBO) technology takes an entirely new approach to hologram generation and display enabling, for the first time, a high quality, real-time holographic projector.

LAD1 - 5L: *Invited* Super-Slim Laser TV with Newly Developed Laser Light Sources

14:20

H. Sugiura, T. Sasagawa, A. Michimori, M. Kuwata, A. Nagase, E. Toide, T. Yanagisawa, S. Yamamoto, Y. Hirano, M. Usui, S. Teramatsu*, J. Someya*

*Mitsubishi Elec., Japan***Mitsubishi Digital Elect. America, USA*

A new light source for laser TVs has been developed along with a 65-inch super slim laser TV that employs the light source. In this stylish laser TV set, a depth of 255 mm has been realized.

----- Break -----

15:00 - 16:25

Room 201

LAD2: LCOS Light Valves

Chair: K. Gutttag, Syndiant, USA

Co-Chair: H. Nakano, Barco, Japan

LAD2 - 1 Analysis of Fringe-Field Effects in VA Microdisplays for Image Quality Improvement

15:00

D. Cuypers, H. De Smet, A. Van Calster***IMEC, Belgium***Ghent Univ., Belgium*

Characterizing the distortions caused by fringe fields is important in LCOS projection panels for professional applications. The effects of reverse tilt due to fringe fields in high resolution devices are explored in detail. Special attention is given to often overlooked items such as dielectric layers and oblique incidence.

**LAD2 - 2 854x600 Pixel LCOS Microdisplay with 5.4 μ m Pixel
15:20 Pitch for Pico-Projectors**

*K. Guttag, J. Lund, C. Waller
Syndiant, USA*

This paper describes the world's smallest SVGA (800x600) and WVGA (854x480) microdisplay that enables high-resolution images in ultra-portable products. The device uses Liquid Crystal on Silicon (LCOS) technology, supports single panel field sequential color operation, has a 5.4-micron pixel pitch, and is less than 7mm tall.

**LAD2 - 3 Color-Filter LCOS Microdisplay with Space Dithering
15:40 for Virtual Resolution Improvement**

H. C. Huang, C. H. Wong, Y. Y. Ho, J. Lai*
Hong Kong Univ. of S&T, Hong Kong
Himax Display, Taiwan

We present a color-filter LCOS microdisplay with space dithering for virtual resolution improvement. This 0.38" LCOS microdisplay has 320x240xRGBW sub-pixels for an improved panel reflectivity from 20% of R, G and B sub-pixels to 35%. With the space dithering algorithm, this QVGA microdisplay can exhibit a virtual VGA resolution.

**LAD2 - 4: *Invited* The D-ILA Device for the World's Highest
16:00 Definition (8K4K) Projection System**

*T. Nagoya, T. Kozakai, T. Suzuki, M. Furuya, T. Iwasa
JVC, Japan*

JVC has developed the world's highest resolution D-ILA device for the Super High-Vision projector. So, we reduced pixel size and increased pixel resolution to 8192 x 4320 (8K4K). Additionally, we have realized the world's highest definition image and 1,000,000:1 contrast ratio, applying this device to HDR(High Dynamic Range) projector.

----- Break -----

BANQUET

Wednesday, December 3, 2008

19:30–21:30

Room "Continental" (4F)

Hotel Okura Niigata

See page 9 for details

16:40 - 17:45

Room 201

LAD3: Illumination and Projection Optics

Chair: K. Sarayeddine, Optinvent, France

Co-Chair: T. Hayashi, 3M, Japan

LAD3 - 1: *Invited* A New Approach for 3D in Digital Cinema

16:40

*R. Matsuura, M. Fushiki**Dolby Japan, Japan*

Historically, 3D movies had never quite achieved a phenomenal and sustaining success despite having reached scattered peaks of excitement. In this paper, we discuss 3D technologies for cinema along with our development and try to understand the past failures and consider if the current wave is real this time.

LAD3 - 2 Ultra Wide Angle Optical System for Laser TV and Short Through Distance Front Projector

17:05

*K. Sarayeddine, P. Benoit**Optinvent, France*

We've developed a wide angle optical engine using either UHP or Laser sources. In this paper, we present the description of this optical engine. The system could be used for Short Throw Distance to display large image with a projector located near the screen.

LAD3 - 3 Super-Wide Angle Projection Lens with Free-Form Lens and Free-Form Mirror for Projector

17:25

*M. Yatsu, K. Hirata**Hitachi, Japan*

By using 2 free-form Lenses and 1 free-form Mirror for the first time in the world, we developed "Super-wide angle projection Lens". It realized 60 inches image at projection distance 415 mm, and the angle of incident at screen center is about 57 degree.

Author Interviews

18:00 – 19:00

IDW Best Paper Award

This award will go to the most outstanding paper selected from those presented at IDW '08.

The 2008 award winners will be announced on the IDW website:

<http://www.idw.ne.jp/award.html>

Thursday, December 4

9:00 - 10:25

Room 201

MEMS1/LAD4: Novel MEMS Projection Optical Technologies

Chair: N. W. Hagood, Pixtronix, USA
 Co-Chair: H. Kanayama, Sanyo Elec., Japan

MEMS1/ LAD4 - 1: *Invited* Miniaturized MEMS-Based Laser Projectors Suited for Integration into Mobile Devices

9:05

*M. Scholles, H. Dallmann, K. Frommhagen, C. Gerwig, J. Knobbe, M. Schwarzenberg
 Fraunhofer IPMS, Germany*

This contribution describes recent results in the development of miniaturized laser projectors, which use MEMS micro scanning mirrors for light deflection. Advancements include increase in system performance, miniaturization of the electronics by ASIC integration of the analog front end for the mirror, and ways for reduction of Speckle artifacts.

MEMS1/ LAD4 - 2: *Invited* Compact, High Brightness Sequential LED Illumination for Projectors

9:25

C. L. Bruzzone, R. E. English Jr.
 3M, USA
 REE Optical Syss., USA

An arrangement of polarizing beam splitter, retarders, and dichroic mirrors provides a compact and efficient combiner for red, green, and blue light from separate LED packages. A 0.55" DMD engine based on this illuminator produced on-screen flux of 188 lumens from 58W of LED input power, using an F/2.4 pupil.

MEMS1/ LAD4 - 3: *Invited* Emerging Projection System

9:45

*M.-L. Chen, C.-S. Chen
 Young Optics, Taiwan*

LED and Laser are new generation light source for projection system. (i) The new illumination architecture and evolutionary de-speckle method are the core challenges and accomplishment in laser illumination design. (ii) LED, focus on lighting efficiency utilization in LED light engine development especially for portable projection system.

MEMS1/ LAD4 - 4: *Invited Making MEMS Devices at a Standard CMOS Foundry*
10:05 *M. Bellis*
Miradia, USA

Miradia is pioneering the ability to design and manufacture MEMS devices at a standard CMOS semiconductor foundry. This paper will focus on the tools and processes that Miradia put in place to enable the production of complex MEMS devices.

----- Break -----

13:20 - 16:20

Exhibition Hall B

Poster LADp: Projection

LADp - 1 **DPR Lamp for Projection Display Systems - Today and Tomorrow**
K. Li
Wavien, USA

Arc lamps provide the most cost effective solution for projection display systems. Whether arc lamps will be obsolete and replaced by LEDs and Lasers will be of great importance. In this talk, various applications using DPR that are feasible today and anticipated needs of tomorrow will be presented.

Author Interviews

18:00 – 19:00

Supporting Organizations:

Technical Group on Information Display, ITE

Laser Display Technology Research Group, Optical Society of Japan

**IDW Outstanding
Poster Paper Award**

This award will go to the most outstanding paper selected from those presented at IDW '08 poster presentation.

The 2008 award winners will be announced on the IDW website:

<http://www.idw.ne.jp/award.html>

Workshop on Electronic Paper

Wednesday, December 3

13:20 - 14:45

Room 302

EP1: Electrophoretic Displays

Chair: T. Kitamura, Chiba Univ., Japan
Co-Chair: N.-S. Roh, Samsung Elect., Korea

EP1 - 1: *Invited* Bright Color Electronic Paper

13:20

*K.-M. H. Lenssen, P. J. Baesjou, M. H. W. M. van Delden, L. W. G. Stofmeel, A. R. M. Verschueren, J. J. van Glabbeek, J. T. M. Osenga, R. M. Schuurbiens
Philips Res., the Netherlands*

We have developed an in-plane electrophoretic concept, which enables realization of full-color reflective panels with a higher brightness than present e-paper technologies, without compromising paper-like properties like large viewing angle and ultra-low power consumption. An additional advantage (e.g. for future low-cost manufacturing) is that a passive-matrix configuration is also possible.

EP1 - 2: *Invited* Recent Developments in Microcup Electrophoretic Displays

13:45

*R. Sprague
SiPix Imaging, USA*

This paper will describe recent developments in microcup electrophoretic displays. New media is available that enables high brightness (>30%), high contrast (>9:1), and high speed (<.5 second response), along with excellent lifetime and bistability. Results will be shown using active matrix backplanes for applications in ereaders and retail signs.

EP1 - 3: **Active Matrix Electrophoretic Display with Micro-Cup Structure**

14:10

*Q.-M. Lu, H.-H. Chen, J.-S. Liao, Y.-N. Chu, W.-T. Tseng, H.-T. Yu
Chunghwa Picture Tubes, Taiwan*

Chunghwa Picture Tubes, LTD. has successfully developed 6" and 8" Active Matrix Electrophoretic Display modules with the micro-cup structure. The characteristics of AMEPD comprise reflective paper-like appearance, readability, portability, affordability, ultra-low power consumption and high resolution.

EP1 - 4L **The Effect of Introducing Metal Bus Electrode into Fully Transparent TFT Array for Color Electronic Paper**
14:30

N. Ikeda, M. Ito, C. Miyazaki, K. Murata, Y. Kokubo, M. Ishizaki, Y. Ugajin
Toppan Printing, Japan

In order to realize large-area "transparent electronics", we propose to introduce narrow metal bus electrodes into transparent TFT array. The 5 μm width Al-alloy bus electrode was integrated into ITO electrodes without deteriorating the transmittance. We have successfully driven 5.35 inch QVGA color electronic paper by Front Drive Structure.

----- Break -----

15:00 - 16:05

Room 302

EP2: Electrowetting Displays and Others

Chair: A. Suzuki, Ricoh, Japan
 Co-Chair: H. Arisawa, Fuji Xerox, Japan

EP2 - 1: ***Invited* Electrowetting-Based Displays for Portable Multi-Media Devices**
15:00

*R. Hayes, A. Giraldo**, *F. Li**, *J. Feenstra**
Liquavista, Hong Kong
**Liquavista, the Netherlands*

Electrowetting-based displays combine high optical and electrical efficiency with milli-second switching times. As such they can be used to enable video content to be shown on portable paper-like displays. The optical properties of EWD panels and their further enhancement are reported in this symposium paper.

EP2 - 2: ***Invited* Droplet Driven Electrowetting Displays: Ambient Light Performance and Color Reproduction**
15:25

*K. Blankenbach, A. Schmoll, A. Bitmann**, *F. Bartels**,
*J. Rawert***, *D. Jerosch***
Pforzheim Univ., Germany
**Bartels Mikrotechnik, Germany*
***Advanced Display Tech., Germany*

ADT developed bi-stable electrowetting displays (e-paper) with high reflectivity and wide temperature range. They are suitable for low resolution (status indicators, 8-Segment) and billboards. Pixel size covers 0.5 to 10 mm, color is reproduced by printer-like CMY-stacks. Our measurements and simulations demonstrate sunlight readability and good color reproduction.

**EP2 - 3L Mobile-Phone Centric Viewer System with 13.1-inch
15:50 4096-color Electronic Paper Display**

*K. Nishimura
KDDI R&D Labs., Japan*

A novel viewer system that brings break-through into display size of mobile phone is demonstrated. Using the system, pictorial data stored in a mobile phone can be viewable on a large-size full-color electronic paper display. Potential applications for the system are proposed and discussed.

----- Break -----

16:40 - 17:45

Room 302

EP3: Various EP Technologies

Chair: M. Omodani, Tokai Univ., Japan
Co-Chair: Y. Toko, Stanley Elec., Japan

**EP3 - 1: *Invited* Multi-Color Electronic Papers Using Organic-
16:40 Metallic Hybrid Polymers**

M. Higuchi^{,**}
*NIMS, Japan
**JST, Japan*

Organic-metallic hybrid polymers have a specific color based on MLCT absorption. Their electrochromic functions are caused by electrochemical redox of the metal ions in the polymer. The polymer with two different metal ions shows multi-color electrochromic properties. Electrochromic devices using the polymers serve as a new type of electronic papers.

**EP3 - 2 High Performance Pen Tracking on Electronic Paper
17:05 Displays**

*G. Feng, M. J. Gormish, S. Chemishkian, K. F. Gudan,
J. Barrus
Ricoh Innovations, USA*

On most electronic paper displays (EPDs), low update rates lead to a poor user experience especially for pen-based markups. Also, ghosting artifacts often occur when pen markups are updated. This paper presents a real-time pen tracking system with significant ghosting reduction implemented on an unmodified E Ink display system.

EP3 - 3 Reflective Electronic Paper by Polarization and Electrophoresis of Toner in Oil
17:25

C.-H. Hsu, C.-P. Chiu, M.-T. Chiang, C.-N. Mo*, S.-K. Fan*

Nat. Chiao Tung Univ., Taiwan

**Chunghwa Picture Tubes, Taiwan*

Toners were manipulated by polarization and electrophoresis in oil. By polarization, toners were aligned in particle chains, yielding a bright state. When electrophoresis exerted on the toners, negatively charged particles were attracted on the positively-biased electrode and delivered a dark state. The e-paper was characterized with frequency, voltage and concentration.

Author Interviews

18:00 – 19:00

Thursday, December 4

13:20 - 16:20

Exhibition Hall B

Poster EPp: Electronic Paper Technologies

EPp - 1 Near Point Measurement on an Electronic Paper for Assessment of Eye Fatigue

S. Inoue, M. Sakamoto, M. Omodani

Tokai Univ., Japan

The measurement procedure based on near point decrement showed superior correlation with subjective fatigue assessment and so is a reasonable metric for assessing eye fatigue. Near point distance is measured on three media, LCD, Electronic Paper, and paper, revealing that Electronic Paper is less fatiguing, like paper, than LCD.

EPp - 2 Multiline Addressing of Quick Response Liquid Powder Display (QR-LPD) Using Non-Negative Matrix Factorization

S. Kaneko, M. Asakawa, R. Hattori, Y. Masuda,*

N. Nihei, A. Yokoo*, S. Yamada**

Kyushu Univ., Japan

**Bridgestone, Japan*

The availability and possibility of multiline addressing (MLA) for Quick Response Liquid Powder Display (QR-LPD™) using Non-negative Matrix Factorization (NMF) were discussed. The NMF adopted to generate the multiline data was processed by MATLAB®. The multiline data were sent to QR-LPD™ panel and displayed the image on the panel successfully.

Epp - 3 Preparation of Microcapsules by Interfacial Polycondensation and Its Application in Electrophoretic Display

S. J. Hwang, L. L. Wang^{}, J. C. Huang^{*}, J. Y. Jheng^{*},
W. M. Chou^{*}, H. H. Yu^{*}*

Nat. United Univ., Taiwan

^{}Nat. Formosa Univ., Taiwan*

Cationic surfactants modified P-type semiconductor material was shelled by Jelly Fig pectin and Gelatin first. Then a new microcapsules electrophoretic display device was designed and its image contrast was influenced by the particle sizes of the microcapsules.

Epp - 4 Preparation of Conductive Absorber Layer for Cholesteric LCDs

C.-C. Weng, S.-W. Wu

ITRI, Taiwan

Herein, we used exfoliated graphite to substitute the conductive polymer or carbon in the absorber layer solution. The surface resistivity of absorber layer decrease 3 orders from 10E13 to 10E10. The conductive polymer amount could be reduced from 16% to 4%wt with only 2%wt of exfoliated graphite substituting.

Epp - 5 Reflective Electronic Paper by Particle Polarization on a 5x5 Pixel Array

C.-P. Chiu, C.-H. Hsu, M.-T. Chiang^{}, C.-N. Mo^{*},
S.-K. Fan*

Nat. Chiao Tung Univ., Taiwan

^{}Chunghwa Picture Tubes, Taiwan*

A reflective electronic paper based on particle polarization was investigated on a 5x5 pixel array. The device was packaged without trapped air bubbles by treating the surface to be hydrophilic with O₂ plasma. Different alphabets have been displayed on the 5x5 pixel array, demonstrating the controllability of the device.

Epp - 6L Liquid Powder Display with Nano-Composite Particle

*E. H. Hwang, E. J. Cho, C. G. Jhun, B. S. Bae,
S.-B. Kwon, C. H. Lee^{*}, J. G. Kim^{*}, Y. S. Ahn^{*}, S. Lee^{*},
I. Park^{*}, K. H. Choi^{*}*

Hoseo Univ., Korea

^{}KITECH, Korea*

To improve the operational reliability, we propose core-shell type of nano-composite polymer particles for LPD. We have developed a prototype of flexible LPD with our new particles and ITO coated PET substrates. We demonstrate the electro-optical characteristics and operational reliability.

Epp - 7L Development of Fast Moving Ball Actuator Mode for Electronic-Paper Displays

D. Kim, H. Choi, D. Lee, M. Hong, S. Kim^{}, J. Lee^{*},
B. Bae^{*}, D. Jung^{**}, B. Kim^{**}, C. Lee^{**}*

Korea Univ., Korea

^{}Hoseo Univ., Korea*

*^{**}Dongjin Semichem, Korea*

We demonstrate the novel display mode as called Fast Moving Ball Actuator (FMBA) using micro-sized metal balls for the light shutter; surface of the balls can be charged up by contacting with electrode and their locations are controlled by small applied field to obtain optically on and off state.

Supporting Organization:

The Imaging Society of Japan

IDW Tutorial in Japanese

Tuesday, December 2, 2008

12:45–17:00

Room 301

Toki Messe Niigata Convention Center

Detailed information will be available:

<http://www.sidchapters.org/japan/index.htm>

Contact Address: idw.tutorial.wz@hitachi.com

IDW Outstanding Poster Paper Award

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Workshop on MEMS for Future Displays and Related Electron Devices

Thursday, December 4

9:00 - 9:05

Room 201

Opening

Opening Remarks

9:00

M. Nakamoto, Shizuoka Univ., Japan

9:05 - 10:25

Room 201

MEMS1/LAD4: Novel MEMS Projection Optical Technologies

Chair: N. W. Hagood, Pixtronix, USA

Co-Chair: H. Kanayama, Sanyo Elec., Japan

MEMS1/ LAD4 - 1: *Invited* Miniaturized MEMS-Based Laser Projectors Suited for Integration into Mobile Devices

9:05

*M. Scholles, H. Dallmann, K. Frommhagen, C. Gerwig,
J. Knobbe, M. Schwarzenberg*

Fraunhofer IPMS, Germany

This contribution describes recent results in the development of miniaturized laser projectors, which use MEMS micro scanning mirrors for light deflection. Advancements include increase in system performance, miniaturization of the electronics by ASIC integration of the analog front end for the mirror, and ways for reduction of Speckle artifacts.

MEMS1/ LAD4 - 2: *Invited* Compact, High Brightness Sequential LED Illumination for Projectors

9:25

*C. L. Bruzzone, R. E. English Jr.**

3M, USA

**REE Optical Syss., USA*

An arrangement of polarizing beam splitter, retarders, and dichroic mirrors provides a compact and efficient combiner for red, green, and blue light from separate LED packages. A 0.55" DMD engine based on this illuminator produced on-screen flux of 188 lumens from 58W of LED input power, using an F/2.4 pupil.

MEMS1/ Invited Emerging Projection System

LAD4 - 3: *M.-L. Chen, C.-S. Chen*
9:45 *Young Optics, Taiwan*

LED and Laser are new generation light source for projection system. (i) The new illumination architecture and evolutional de-speckle method are the core challenges and accomplishment in laser illumination design. (ii) LED, focus on lighting efficiency utilization in LED light engine development especially for portable projection system.

MEMS1/ Invited Making MEMS Devices at a Standard CMOS Foundry

LAD4 - 4: *M. Bellis*
10:05 *Miradia, USA*

Miradia is pioneering the ability to design and manufacture MEMS devices at a standard CMOS semiconductor foundry. This paper will focus on the tools and processes that Miradia put in place to enable the production of complex MEMS devices.

----- Break -----

10:40 - 12:15

Room 201

MEMS2: Emerging MEMS Technologies

Chair: *M. Esashi, Tohoku Univ., Japan*
 Co-Chair: *T. Komoda, Panasonic Elec. Works, Japan*

MEMS2 - 1: Invited Recent Molecular Nano Device Progress

10:40 *I. Ohdomari*
Waseda Univ., Japan

The recent progress in nano device technology as an approach to give solutions to MM, MTM and BC is reviewed in terms of novel fabrication processes, novel device structures and novel materials. Importance of so-called "experimental science based on computation" also is addressed.

MEMS2 - 2: Invited Microfluidic Technology for Tissue Engineering

11:00 *Y. Tsuda, Y. Morimoto, S. Takeuchi*
Univ. of Tokyo, Japan

We describe a three-dimensional (3D) cell culture system using monodisperse gel beads. Cells were non-invasively encapsulated in biocompatible hydrogels by using a 3D microfluidic axisymmetric flow-focusing device. This technique holds great promise for the further study of fundamental cell-cell communication and reconstruction of viable tissues for the regenerative medicine.

MEMS2 - 3 Nano Porous Silica Structures for Thermally Insulated MEMS Devices
11:20

*Y. Nishijima, H. Yamanaka, M. Kirihara
Panasonic Elec. Works, Japan*

In this paper, we report on the first successful incorporation of nano porous silica into MEMS structure. A novel nano porous silica based suspended structure was proposed and the prototype was fabricated for the demands of the MEMS devices that need thermal insulation characteristic.

MEMS2 - 4 Development of Micro Reflector Type Light Guide Plate Stamper by Advanced Dry Etching Process
11:35

*T. Miyaguchi, T. Sato, M. Hiraishi, H. Saito
Ind. Res. Inst. of Niigata Pref., Japan*

Light guide plates of LCDs need to be thinner and more efficient in brightness. The newly developed dry etching process made it possible to produce cone shaped reflectors with a required height of several tens of micrometers and the taper angle on the light guide plate.

MEMS2 - 5 Novel Power Saving Design for LED Backlight System with Color Filter-Less LCD System
11:50

L. Li, K.-H. Chen^{}, C.-L. Liu, M.-T. Ho, C.-N. Mo
Chunghwa Picture Tubes, Taiwan
^{*}Nat. Chiao Tung Univ., Taiwan*

Novel driving architect of an LED backlight system using field sequential color algorithm on color filter-less TFT-LCD has been developed. It can be treated as a power saving solution which consists of a single DC voltage converter and an integrated LED driving system for RGB-LED backlight.

MEMS2 - 6L The Effect of Microstructure on the Reflectivity Loss of Single Crystal Silicon
12:05

C. Wei, Y. Shih, Y. Chien, J. Chen^{}
Tatung Univ., Taiwan
^{*}Chunghwa Picture Tubes, Taiwan*

The alkaline texture etching has the advantages for integrating damage removal and structure texturing in a single step. The microstructure produced by different concentration, temperature and the associated reflectivity is investigated. The results show there seems to different optimal texture mechanism which leads to reduction of reflectivity loss.

----- Lunch -----

13:20 - 14:40

Room 201

MEMS3: Fundamental Process Technologies

Chair: I. Ohdomari, Waseda Univ., Japan
 Co-Chair: Y. Bonnassieux, Ecole Polytech., France

MEMS3 - 1: *Invited* Application Oriented MEMS

13:20

M. Esashi
Tohoku Univ., Japan

Silicon MEMS as electrostatically levitated rotational gyroscope and 2D optical scanner, and wafer level packaged devices as integrated capacitive pressure sensor and MEMS switch are described. MEMS which use non-silicon materials as LTCC with electrical feedthrough, SiC (silicon carbide) and LiNbO₃ are also described.

MEMS3 - 2 Debris-Free Laser Dicing for Multi-Layered MEMS

13:40

M. Fujita^{,**}, Y. Izawa^{**}, Y. Tsurumi^{**}, S. Tanaka^{***},
 H. Fukushi^{***}, K. Sueda^{**}, Y. Nakata^{**}, N. Miyanaga^{**},
 M. Esashi^{***}*

**Inst. for Laser Tech., Japan*

***Osaka Univ., Japan*

****Tohoku Univ., Japan*

A novel debris-free in-air laser dicing technology has been developed, which combines two processes: dicing guide fabrication and wafer separation. The first process is the internal transformation using a pulsed laser. The second process is mechanical separation by bending stress or thermally-induced crack propagation using a CO₂ laser.

MEMS3 - 3 “BEANS Project” : Heterogeneous Technology Convergence Process Development Project

13:55

J. Adachi, Y. Takei, M. Takeda, A. Yusa
Micromachine Ctr., Japan

The new Japanese national project named “Hetero-Functional Integrated Device Process Development Project (BEANS Project)” had been launched in July, 2008. Target areas of process development are “Bio/Organic Materials Integration Process”, “Novel fabrication technology for 3-D Nano-structures” and “Large Area Continuous Process of Micro/Nano Structure”.

**MEMS3 - 4 Conditions of Micromirror Lifted by Buckled Bridges
14:10 Using Film Stress**

M. Sasaki, K. Hane^{}, D. Briand^{**}, W. Noell^{**}, N. de Rooij^{**}
Toyota Technological Inst., Japan
^{*}Tohoku Univ., Japan
^{**}Univ. of Neuchatel, Switzerland*

Bridges buckled by the film stress can realize three-dimensional structures such as vertical comb drive actuator. We have demonstrated the micromirror lifted by the buckled bridges. The detailed profiles of the buridge and the lifted micromirror are examined. This clears the effect of the bend and the design differences.

**MEMS3 - 5 A Novel 15.4-in. Transflective Color Sequential LCD
14:25**

C.-L. Liu, C.-N. Mo, C.-F. Huang^{}, H.-F. Yin, W.-C. Tai,
S.-J. Chiou, M.-D. Chou
Chunghwa Picture Tubes, Taiwan
^{*}Tatung Univ., Taiwan*

A novel transflective liquid crystal display uses a structure of color sequential. This present design combines such a new structure reflective backlight to improve reflective light to meet the specification being sunlight readable, and a digital feedback system to probe environment for the purpose of power saving.

----- Break -----

15:00 - 15:50

Room 201

MEMS4/AMD4: MEMS Displays and Imaging

Chair: M. Scholles, Fraunhofer IPMS, Germany
Co-Chair: M. Bellis, Meradia, USA

**MEMS4/ *Invited* MEMS-Based Direct View Displays Using
AMD4 - 1: Digital Micro Shutters
15:00**

*N. W. Hagood, L. Steyn, J. Fijol, J. Gandhi, T. Brosnihan,
S. Lewis, G. Fike, R. Barton, M. Halfman, R. S. Payne
Pixtronix, USA*

The Pixtronix DMS™ (Digital Micro Shutter) display technology, based on MEMS micro-shutters, is presented. Experimental performance achieved on 2.5" QVGA samples is shown, including 24-bit color, 145% NTSC (CIE 1976) color gamut, 400:1 contrast ratio, and 170° view angles, all at 1/4 the power consumption of comparable TFT-LCD display modules.

**MEMS4/
AMD4 - 2
15:20** **MEMS Membrane Switches Backplane for Matrix
Driven Large Sign Display**

K. Senda, B. S. Bae^{}, M. Esashi^{**}
Sumitomo Precision Prod., Japan
^{*}School of Display Eng., Korea
^{**}Tohoku Univ., Japan*

We successfully developed membrane switches using FPC (flexible printed circuit) material and process. Such a process has the progress of low cost backplane for flexible large signage display. We applied fabricated membranatne switches to electrophoretic display for active matrix driving.

**MEMS4/
AMD4 - 3
15:35** **Active Matrix Flexible Display Array Fabricated by
MEMS Printing Techniques**

C. Lo, O.-H. Huttunen^{}, J. Iitola-Keinanen^{*}, J. Petaja^{*},
J. Hast^{*}, A. Maaninen^{*}, H. Kopola^{*}, H. Fujita,
H. Toshiyoshi
Univ. of Tokyo, Japan
^{*}VTT Tech. Res. Ctr. of Finland, Finland*

A fully printing techniques fabricated active matrix display array was demonstrated on flexible substrate by using Fabry-Perot interference effect. Printing techniques of flexography, lift-off, gravure, and lamination were used for roll-to-roll-ready process on 125 μ m polymer substrate. Red, green, and blue colors were successfully tuned for realization of full color.

**MEMS4/
AMD4 - 4** **Withdrawn**

----- Break -----

PDP International Forum '08

Saturday, December 6, 2008

10:30–16:30

Toki Messe Niigata Convention Center
(IDW '08 Venue)

For further information, visit www.pdptm.org/forum/

16:35 - 18:00

Room 201

MEMS5: Optical MEMS and Device Technologies

Chair: M. Nakamoto, Shizuoka Univ., Japan

Co-Chair: J. Jang, Kyung Hee Univ., Korea

MEMS5 - 1: *Invited* Field Emission from Carbon Nanotubes and Metallic Nanowires

C. S. Cojocaru, Y. Bonnassieux, N. Le Sech^{},
B. Marquart, S. Xavier^{*}, P. Legagneux^{*}, D. Pribat
Ecole PolyTech., CNRS, France
^{*}Thales Res. & Tech., France*

In this paper, we present some comparisons concerning field emission as well as processing parameters from two types of nanostructures, namely multiwall carbon nanotubes grown by plasma enhanced chemical vapor deposition and metal nanowires grown by electrochemical deposition in porous membranes. Various treatments are presented, either during or after deposition.

MEMS5 - 2: *Invited* Direct Excitation of Xenon by Ballistic Electrons Emitted from Nanocrystalline Silicon Planar Cathode and Vacuum-Ultraviolet Light Emission

T. Ichihara, T. Hatai, N. Koshida^{}
Panasonic Elec. Works, Japan
^{*}Tokyo Univ. A&T, Japan*

The effect of electron incidence into xenon gas molecules has been investigated using a nanocrystalline silicon (nc-Si) ballistic emitter. Vacuum-ultraviolet (VUV) light emission is observed without discharging. Energetic electrons directly excite xenon molecules followed by radiative relaxations. Discharge-free light emission is expected to lead to high efficacy mercury-free fluorescent lamps.

MEMS5 - 3 Selective Growth of Vertically Aligned Carbon Nanotubes on Metal Foil

*I. O. Jeong, J. H. Ryu, S. Manivannan, H. E. Lim,
J. W. Lim, B. T. Son, K. C. Park, J. Jang
Kyung Hee Univ., Korea*

A simple method is proposed for the growth of vertically aligned CNTs on metal foil using the tri-ode dc-PECVD for practical device applications. The metal surface was treated by an acid and then used for the growth of CNTs. The selective growth is realized using barrier layer on metal surface.

**MEMS5 - 4 Electron Emission Properties of Carbon Nanotube
17:30 Emitters Grown with Micro Molding in Capillary
 (MIMIC) Assisted Process**

*H. E. Lim, N. Y. Song, J. H. Ryu, J. W. Lim, B. T. Son,
J. Jang, K. C. Park*

Kyung Hee Univ., Korea

Carbon nanotube arrays were selectively patterned using micro molding in capillary (MIMIC) process. Also we can control the thickness of the seed forming resist using MIMIC process. The structures of CNTs can be easily controlled depending on the thickness of resist film. The turn-on field for $10 \mu\text{A}/\text{cm}^2$ was $2.2 \text{ V}/\mu\text{m}$.

**MEMS5 - 5 Simulation of Nanostructure Transfer Mold Field
17:45 Emitter Arrays**

J. H. Moon, M. Nakamoto

Shizuoka Univ., Japan

By a numerical analysis, field emission characteristics for the nanostructure transfer mold field emitter arrays were depend on tip-radius of emitter as well as their integration. The smaller emitter tips with tip-radius of less than 5 nm can exhibit enhanced electron emission properties due to the higher field enhancement factor.

Author Interviews

18:00 – 19:00

IDW '09

The 16th International Display Workshops

December 9-11, 2009

World Convention Center Summit

Phoenix Seagaia Resort

Miyazaki, Japan

<http://www.idw.ne.jp/>

Workshop on Display Electronic Systems

Wednesday, December 3

13:20 - 16:20

Exhibition Hall B

Poster DESp: Display Electronic Systems

DESp - 1 **Improvement of Displayed Image Quality via Zero-D LCD Backlight Modulation**

L. Kerofsky

Sharp Labs. of America, USA

Backlight modulation is shown to improve the static contrast of displayed dim images. Static contrast is improved not by improving the display contrast ratio itself but by modulation of the backlight combined with image compensation to adjust the display range based on the image display range.

DESp - 2 **Design Choices in LED Backlight LCD TV**

P. A. Cirkel, A. Ševo, E. H. A. Langendijk***

Philips Consumer Lifestyle, Belgium

**Philips Consumer Lifestyle, the Netherlands*

***Philips Res., the Netherlands*

An LED backlit LCD TV was developed. Properties like contrast, motion portrayal, color performance, and TV set thickness were optimized by tuning the type and number of LEDs, the number of dimmable segments, the type of LED drivers and the type of LCD panel in our LCD TV set.

DESp - 3 **LCD Power Saving Using Adaptive Global Backlight Dimming**

*M. Chen, H. J. Peng, W. Zhang, W. H. Niu, C.-K. Hung,
G. P. Qiu*

ASTRI, Hong Kong

We proposed a method to adaptively dim the LCD backlight and tune the image signal to preserve display brightness and save display power simultaneously. We achieved a power saving more than 20% by average and effectively minimize image distortion. This method can be applied for either CCFL or LED backlight.

DESp - 4 Adaptive Selection Algorithm for LED Backlight of LCD-TVs

*H. S. Cho, H. Kim, O. K. Kwon
Hanyang Univ., Korea*

A new adaptive dimming algorithm is proposed to reduce backlight power consumption and improve image quality in LCD-TVs. The proposed algorithm is a local dimming algorithm to use mapping function selectively. The backlight power consumption is reduced to 23~45% and the distortion value is 7~30% by applying the proposed algorithm.

DESp - 5 Adaptive Local Dimming Backlight for Liquid-Crystal Displays

J.-Y. An, S.-E. Kim, W.-J. Song, T.-W. Lee, C.-G. Kim*
POSTECH, Korea
LG Display, Korea

To increase the contrast ratio, local dimming algorithms have been proposed. In the local dimming algorithms, a dimming duty controls the backlight luminance of each local block, so the dimming duty is to be determined considering the original image. In this paper, we propose how to determine the dimming duty.

DESp - 6 Pre-Compensated X-Y Channel-Driving-White LED Backlight for 46-in. LCD TV

*D. Y. Cho, W. S. Oh, S. W. Choi, K. M. Cho, G. W. Moon,
B. C. Yang*, T. S. Jang*
KAIST, Korea
Samsung Elect., Korea

A conventional X-Y channel driving can achieve the comparable image improvement and reduced power consumption with much fewer converters than those of block driving. However, there are two drawbacks to the conventional one. To solve these problems, an average current control system with pre-compensation 2D channel driving algorithm is proposed.

DESp - 7 Low-Power Consumption Color-Filterless 15.4-in. TN-TFT Notebook

*S.-J. Chiou, W.-C. Tai, C.-C. Chen, C.-L. Liu, C.-N. Mo
Chunghwa Picture Tubes, Taiwan*

A novel color filterless LCD has been developed in the field sequential color notebook platform. The RGB-LED backlight maintains 200 nits brightness and power consumption at 3W by using the multi-area control algorithm. Further, it is still readable clearly without backlight. FSC-NB can achieve low cost and power.

DESp - 8 Dynamic Contrast Enhancement Method for Digital Image Display

Z.-H. Liang^{,**}, Z.-G. Wang^{*}, C.-L. Liu^{*}, X.-N. Zhang^{*}*

^{}Xi'an Jiaotong Univ., China*

*^{**}Sichuan Changhong Elect. Group, China*

An enhancement degree controllable histogram equalization (EDCHE) method is developed in this paper. In this method, the drawback of histogram equalization applied to digital video signal, which could produce unrealistic effects in images because it does not have the mechanisms that adjust the degree of enhancement, is overcome.

DESp - 9 Integration of an External Display System in Mobile Phone and Microdisplay for Multimedia Applications

C.-F. Huang, C.-C. Weng, C.-L. Liu^{}, C.-N. Mo^{*}*

Tatung Univ., Taiwan

^{}Chunghwa Picture Tubes, Taiwan*

The present work is to design an interface, by which the video content of a mobile phone can be forwarded to an external microdisplay. Such a display system is easier for people to appreciate the content of multimedia communication, since the microdisplay is able to provide a virtual large screen.

DESp - 10 Accurate Estimation of Component Thermal Stress

M.-L. Tai, W.-J. Chen, T.-K. Yeh, W.-L. Huang, S.-K. Wei

Chunghwa Picture Tubes, Taiwan

We had proposed fast and accurate component thermal stress estimation and the experiments show that the proposed fast thermal stress estimation methodology with adaptive filtering methodology can get good prediction efficiently. Now, we will propose one complete solution to the component thermal stress survey for the display electronic system.

DESp - 11 An Experimental Approach to Super High Resolution Image Generation using Image Shift

H. Okamura, T. Hashimoto, H. Okui, Y. Shimodaira

Shizuoka Univ., Japan

We propose the generation method of the high resolution image using shifted images. Our method uses images that are taken with high precise and very small moving. In this paper, we challenged the generation of double-digit of times higher resolution image using 100 pictures.

DESp - 12 Low Power Driving for TFT-LCD Application

*S.-P. Choi, K.-W. Seo, J.-S. Kim, M.-H. Lee, M.-K. Han**
Samsung Elect., Korea
**Seoul Nat. Univ., Korea*

This work presents two methods of low power consumption for TFT-LCD application. The first : periodical control of static power consumption, the second : gradual driving capacity adjustment. Compared to the conventional, the proposed methods show the overall decrease of power consumption 11% and 12%, respectively.

DESp - 13 A Simple Method to Implement Overdrive Technology in a Display System

M. O. Tareq, A. Bhowmik, S. W. Lee*
Kyung Hee Univ., Korea
**Intel, USA*

A simple overdrive implementation technology in a display system is presented. Overdrive values are easily calculated using a third order equation that for all the transitions. The parameters of the equation can be extracted by a few measurements.

DESp - 14 Withdrawn**DESp - 15 Dynamic Frame Compensation for LCD Motion Blur Reduction**

*E. G. Chen, T.-F. Chiang, A. Cho, K.-F. Li, K.-C. Chan,
S.-H. Chen, T.-H. Hsieh*
InnoLux Display, Taiwan

An improvement over conventional flexible black insertion, dynamic frame compensation with enhanced motion blur reduction and less flicker, is proposed. The new technique has similar hardware complexity as conventional dynamic frame compensation. MPRT was reduced by 24% and flicker reduction of 17%.

DESp - 16 Adaptive Block Motion Estimation Based on Frame Difference for Frame Rate Upconversion

T. I. Kwak, J. H. Yun, H. H. Cho, M. R. Choi
Hanyang Univ., Korea

In this paper, we propose adaptively expanded block motion estimation based on frame difference for frame rate up conversion. The proposed algorithm executes using an adaptively expanded block in order to get more accurate motion vector. In experiments, the proposed algorithm shows better performance and lower complexity than conventional algorithm.

DESp - 17 Motion Adaptive Frame Interpolation Based on Shortest Path Correlation

*S. J. Lee, J. H. Yun, B. H. Hwang, M. R. Choi
Hanyang Univ., Korea*

In this paper, we propose a motion adaptive frame interpolation method which provides image quality enhancement by shortest path motion correlation. It consists of motion detection with morphological operation and motion directional adaptive frame interpolation. It can achieve a clear image with a low computational amount and simple structure.

DESp - 18 Advanced Algorithms for Fast Motion Estimation

*B.-H. Hwang, S.-W. Choi, T.-I. Kwak, J.-H. Yun,
M.-R. Choi
Hanyang Univ., Korea*

Motion estimation is an important and computationally intensive task in video coding applications. In this paper, we introduce Advanced Algorithms for Fast Motion Estimation (AAFME) classifying blocks and performing separate processing. Experimental results show that AAFME reduces computation and increases PSNR compared with conventional algorithms.

DESp - 19L Electronic Invisible Code Display Unit for Collaborative Activity

Y. Matsumoto, K. Sakamoto, S. Nomura^{}, T. Hirotsu^{**},
K. Shiwa^{**}, M. Hirakawa^{**}
Konan Univ., Japan
^{*}Nagaoka Univ., Japan
^{**}Shimane Univ., Japan*

The invisible codes provide us with an operating environment using pen-like device. However, this technology is applied to the only paper media. The authors think we want to realize an interaction using the invisible code on an electrical media. In this paper, we propose an electronic invisible code displaying unit.

DESp - 20L 4-Views Display System for Collaborative Work on Round Table

T. Yamanari, K. Sakamoto, S. Nomura^{}, T. Hirotsu^{**},
K. Shiwa^{**}, M. Hirakawa^{**}
Konan Univ., Japan
^{*}Nagaoka Univ., Japan
^{**}Shimane Univ., Japan*

On the life review activity, a therapist puts pictures on the table so as to trigger a talk. However some observers may perceive upside down images if they sit down opposite the therapist. To overcome this problem, we have developed the display system which can be viewed from any direction.

16:35 - 16:40

Snow Hall A

Opening**Opening Remarks**

16:35

H. Okumura, Toshiba, Japan

16:40 - 17:55

Snow Hall A

DES1: Novel Electronic Display and Driving

Chair: H. Okumura, Toshiba, Japan

Co-Chair: Y. Kudo, Hitachi, Japan

DES1 - 1: *Invited* Application of Bi-Axial MEMS Technology for Enabling Miniature Projection Display

16:40

*M. Niesten, R. Hannigan, A. Tokman**Microvision, USA*

A projector with a height of less than 7 mm has been developed. The projector, based on proprietary PicoP_{tm} technology, uses a two dimensional MEMS scanner and lasers to display images with a WVGA resolution while consuming as little as 1.5 W.

DES1 - 2: *Invited* A Full Color Eyewear Display Using Holographic Planar Waveguides

17:00

*H. Mukawa, K. Akutsu, I. Matsumura, S. Nakano, T. Yoshida, M. Kuwahara, K. Aiki**Sony, Japan*

A full color eyewear display with over 85% see-through transmittance and 16-degree horizontal field of view was developed. Very low color crosstalk, less than 0.008 $\Delta u'v'$ uniformity and 120% NTSC color gamut were achieved. Waveguides with two in- and out-coupling hologram elements enabled simple configuration with side-mounted optical engines.

DES1 - 3: A Multi-bit/cycle 12-bit Cyclic-DAC for TFT-LCD Column Drivers

17:20

H. N. Nguyen, Y. S. Jang, Y. S. Son^{}, S. T. Ryu, S. G. Lee**Info. & Commun. Univ., Korea**^{*}Silicon Works, Korea*

A 12-bit cyclic DAC with multi-bit conversion per cycle is proposed. Passive conversion has been used for low power high speed conversion. 12-bit conversion is done within 1.5 μ s and the output is driven during the rest of 1-H time. The DAC has been designed for a 0.35- μ m CMOS technology.

DES1 - 4L The Design of Adaptive Anti-Aliasing Filter for Subpixel-Based Down-Sampling

17:40

*L. Fang, O. C. Au**Hong Kong Univ. of S&T, Hong Kong*

Subpixel-based down-sampling causes color fringing artifacts. We propose an adaptive filter based on edge detection to suppress color fringing. Both horizontal and vertical down-samplings are considered. Moreover, a good cut-off frequency is chosen to obtain extra information. The proposed filter can remove visible color fringing while retaining the luminance sharpness.

Author Interviews

18:00 – 19:00

Thursday, December 4**9:00 - 10:20****Marine Hall****DES2: High Dynamic Range Display Technologies**

Chair: M. Klompenhouwer, Philips, the Netherlands

Co-Chair: A. Nagase, Mitsubishi Elec., Japan

DES2 - 1: *Invited* Advanced High Dynamic Range Displays

9:00

*H. Seetzen, T. Wan, P. Longhurst**Dolby Canada, Canada*

High Dynamic Range displays utilize local dimming technology to increase luminance, contrast, color gamut and power efficiency of conventional LCD. We describe techniques to optimize color performance and power efficiency of HDR displays through the use of advanced backlight designs and algorithms.

DES2 - 2 Novel Algorithm for LCD Backlight Dimming by Simultaneous Optimization of Backlight Luminance and Gamma Conversion Function

9:20

M. Baba, R. Nonaka, G. Itoh, S. Araki, S. Kawaguchi*,**M. Takeoka*, K. Nakao***Toshiba, Japan***Toshiba Matsushita Display Tech., Japan*

In this paper, a novel LCD backlight dimming algorithm to improve a contrast ratio and power consumption of an LCD is proposed. In this algorithm, backlight luminance and a gamma conversion function of an input image are optimized simultaneously. Prototype LCDs introducing the proposed backlight dimming algorithm were developed.

DES2 - 3 **Three-Primary LEDs Used Adaptive Local Dimming Backlight for High Contrast LCD-TV**
9:40

W. Zhang, H.-J. Peng, C.-K. Hung, C.-J. Tsai, K.-W. Ng, D.-D. Huang

Hong Kong Appl. S&T Res. Inst., Hong Kong

With local dimming colored LED backlight, wide color gamut, large power saving and high contrast can be achieved. However, color crosstalk could damage image quality. We propose an algorithm to avoid color distortion and maintain aforementioned advantaged performance. The algorithm is successfully implemented in a 47 inch high contrast LCD-TV.

DES2 - 4 **A Local Dimming Color-Sequential Liquid-Crystal Display**
10:00

C. C. Tsai, C. P. Su, H. M. Chen, W. C. Tai, C. L. Liu, C. N. Mo

Chunghwa Picture Tubes, Taiwan

A Local Dimming Color-Sequential Liquid-Crystal Display doesn't have color filters. The driving method of the provided Field Sequential Color display is a combination of Multi-area Scanning algorithm and Local Dimming method. It can greatly reduce the power consumption and increase the contrast and color situation.

----- Break -----

10:40 - 12:00

Marine Hall

DES3: High Image Quality Display Technologies

Chair: H. Sasaki, Toshiba, Japan

Co-Chair: S. Ono, Panasonic, Japan

DES3 - 1: *Invited* Dynamic Resolution of Video Display Systems
10:40

M. Klompenhouwer, F. van Heesch

Philips Res. Labs., the Netherlands

A video display system must reproduce moving images with high resolution, i.e. it should have a high 'dynamic resolution'. This paper discusses dynamic resolution from a system perspective, taking into account properties of the display as well as the video signal. It is shown how dynamic resolution can be characterized, and examples are given.

**DES3 - 2 Realization of Multiple Color Gamuts in OCB Field
11:00 Sequential Color LCDs Using LED Scanning
Backlights**

H. Murai, K. Sekiya, K. Wako, T. Kishimoto, T. Ishinabe,
T. Uchida**

*Res. Inst. for Advanced Liquid Crystal Tech., Japan
Tohoku Univ., Japan

We produced a 6.5inch-diagonal full-HDTV LCD portable monitor. Since we adopted field sequential color method combined with a blockwise scanning backlight with RGB LEDs for it, we could easily add a feature to switch the LED's wide color gamut to the standard sRGB color gamut on user's demand.

**DES3 - 3 Motion Quality Improvement of Double Frame Rate
11:20 LCD by Real Response Overdrive**

*H.-T. Lin, C.-C. Chiu, C.-H. Chen
Chunghwa Picture Tubes, Taiwan*

RROD (Real Response OverDrive) has been developed for accurately controlling high frame rate liquid crystal panel, proposed method only store up one frame image could sequentially control two frames over drive image and efficiently reduce response time of liquid crystal.

**DES3 - 4 Reconsideration of 45dB-PSNR Criterion for FPD
11:40 Peripheral Devices**

*H. Sasaki
Toshiba, Japan*

A proposed "bit depth analysis" promotes deeper understanding on "45dB curse": a widely-accepted, but usually-misunderstood 45dB PSNR criterion for image compression. Our analysis shows useful guideline to investigate further cost-down of high-quality display peripheral devices. The Barten model well predicts our 2AFC experimental results.

----- Lunch -----

IDMC/3DSA/Asia Display 2009

April 27-30, 2009

Taipei, Taiwan

15:00 - 16:20

Marine Hall

DES4: Color Fidelity Systems

Chair: N. Ohta, Rochester Inst. of Tech., USA

Co-Chair: H. Okumura, Toshiba, Japan

DES4 - 1: *Invited* Some Issues on Imaging and Display Technologies and a Proposal of an Image System for Colorimetric Reproduction

15:00

Y. Shimodaira

Shizuoka Univ., Japan

Drawbacks on color reproduction in image systems are analyzed when they are applied to fields required strict color control. Discussions are focused on color reproduction that is an un-developed factor within overall image system in future. According to the discussions, a CMS is proposed where colorimetric color reproduction is essential.

DES4 - 2: *Invited* DisplayPort Version 1.1a and Projected Deep Color Extension

15:20

A. Kobayashi

ST Microelect., USA

DisplayPort is scalable and extensible by design, capable of transporting an HD A/V stream over one high-speed pair. Without field of use restrictions, it is applicable from hand-held devices to public video walls. Technical overview of DisplayPort Version 1.1a and projected, upcoming extensions of this open standard will be provided.

DES4 - 3: *Invited* Development of New Evaluation Method for Display Image Quality: Color Distribution Index

15:40

T. Fujine, T. Kanda, Y. Yoshida, M. Sugino, M. Teragawa, Y. Yamamoto, N. Ohta***

Sharp, Japan

**CIS Labs., Japan*

***Rochester Inst. of Tech., USA*

We developed new evaluation method for display image quality using Color Distribution Index. It considers gamut, contrast, maximum luminance, gamma, bit depth and JND to evaluate the ability for reproducing visibly smooth gradation. We clarified 12bit is needed for latest LCD-TV, and suggested overall characteristics of TV should be balanced.

DES4 - 4 **Six-Primary LCD Color Separation for Wide-Gamut
16:00** **xvYCC Images**

P.-L. Sun, H.-S. Chen^{}, C.-K. Chang*
Shih Hsin Univ., Taiwan
^{}Nat. Univ. of S&T, Taiwan*

We present a method to transform color from wide gamut xvYCC space to six-primary color signals with its best-available display gamut. It contains three stages: (1) generate RGB-to- RGBCMY data for different sub-gamuts, (2) create xvYCC-to-RGBCMY transfer matrices based on the above data, (3) select a proper matrix for transformation.

16:40 - 18:00

Marine Hall

VHF1/DES5: Contrast Enhancement

Chair: S. Clippingdale, NHK, Japan
Co-Chair: M. A. Klompenhouwer, Philips, the Netherlands

VHF1/ **Tone Mapping Method Using Local Contrast
DES5 - 1** **Enhancement for High Dynamic Range Images**
16:40

B.-Y. Kim, B.-H. Hwang, J.-H. Yun, M.-R. Choi
Hanyang Univ., Korea

In this paper, a tone mapping method using contrast enhancement for High Dynamic Range (HDR) is proposed. By applying the Modified Histogram Adjustment (MHA) and the Local Contrast Enhancement Volume (LCEV) with decomposed layers, the tone mapping is performed effectively. The experimental results show that the proposed method preserves local contrast and global dim and bright impression with the naturalness of original images.

VHF1/ **Gradation Quality Enhancement without Degradation
DES5 - 2** **in Texture Areas**
17:00

Y. Okuno, T. Nakano, M. Yoshiyama, J. Asano
Samsung Yokohama Res. Inst., Japan

We have developed a gradation enhancement method for flat-panel displays (FPD) that can display at resolutions of greater than eight bits. This method allows appropriate distinction of gradation areas and textured areas, making it possible to improve the smoothness of gradation regions without loss of quality in textured regions.

**VHF1/
DES5 - 3
17:20** **Contrast Enhancement Method Using Limited Histogram Binding**

*H.-W. Kang, G.-H. Park, B.-H. Hwang, S.-J. Lee,
J.-H. Yun, M.-R. Choi
Hanyang Univ., Korea*

In this paper, Limited Histogram binding (LHB) is proposed for contrast enhancement. LHB binds the low frequency histogram components according to criterion and unbinds to preserve detail of original image. The experimental results show that LHB suppresses the washed out appearance or color distortion compared with conventional methods.

**VHF1/
DES5 - 4
17:40** **Pixel Based Image Enhancement (PBIE) Technology to Enhance Image Quality without Memory at Portable System**

*C.-L. Wu, J.-S. Liao, Y.-N. Chu, W.-T. Tseng, H.-T. Yu
Chunghwa Picture Tubes, Taiwan*

Chunghwa Picture Tubes, LTD. has performed the PbIE technology at middle size display. This technique could real time enhancing image quality without any frame buffer or image data distribution of pervious n-1 frames, then the moving picture quality are enhanced automatically and adaptively based on the character of each pixel.

Author Interviews

18:00 – 19:00

Supporting Organizations:

Technical Group on Consumer Electronics, ITE

Technical Committee on Electronic Information Displays, Electronics Society, IEICE

IDW '09

The 16th International Display Workshops

December 9-11, 2009

World Convention Center Summit
Phoenix Seagaia Resort

Miyazaki, Japan

<http://www.idw.ne.jp/>

Topical Session on Display Technologies for Professional Use

Thursday, December 4

13:20 - 13:25

Marine Hall

Opening

Opening Remarks

13:20

K. Sekiya, Tohoku Univ., Japan

13:25 - 14:40

Marine Hall

DPU1: Display Technologies for Professional Use

Chair: K. Sekiya, Tohoku Univ., Japan

Co-Chair: T. Matsumoto, Univ. of Tokyo, Japan

DPU1 - 1: *Invited* Required Characteristics for Flat Panel Displays as a Broadcast Master Monitor in the Transition Era from Cathode Ray Tube

13:25

M. Sugawara

NHK, Japan

The master monitors used in broadcast program production play a crucial role in keeping the picture quality high and consistent. The transition from CRTs to FPDs will entail identifying the requirements for FPD master monitors. This paper describes the work of standardization bodies on this issue and the current status.

DPU1 - 2: *Invited* Master Monitors - The European View

13:40

R. A. Salmon^{,**}*

^{*}*BBC Res., UK*

^{**}*EBU*

This paper presents the work of the EBU technical group P/Display (of which the Author is chairman) which has, over the last two years, been considering the Broadcasters' requirements for monitors in the television production environment.

DPU1 - 3: *Invited* The Most Appropriate Characteristics as a Master Monitor for Broadcasting Use

13:55

*H. Kouchi**NHK, Japan*

In TV broadcasting field, TV monitor as a master monitor is very important to keep the good picture quality. This paper describes the monitor performances required the master monitor and the most appropriate characteristics of a Flat Panel Display based on the comparative picture quality assessment test.

DPU1 - 4: *Invited* Consistent Image Presentation for Color-Critical Work and Medical Diagnosis

14:10

*T. Matsui, S. Yamaguchi, H. Moriwaki, J. Yonemitsu, A. Deyama, J. Sakuta, N. Hashimoto, T. Yasuda**Eizo Nanao, Japan*

What may happen unless consistent presentation is guaranteed? Color-critical professionals may see final output different from what they saw on the display screen. Accuracy of medical diagnosis may be damaged. This paper enumerates requirements to realize consistent presentation in each application and describes technologies to meet each requirement in detail.

DPU1 - 5: *Invited* A Software Simulation Framework to Predict Clinical Performance of Medical Displays

14:25

T. Kimpe, C. Marchéssoux, G. Spalla, B. Goossens, H. Hallez**, E. Vansteenkiste*, S. Staelens**, W. Philips***BARCO NV, Belgium***TELIN-IPI, Ghent Univ.-IBBT, Belgium****IBiTech, Ghent Univ.-IBBT, Belgium*

This paper describes a software simulation framework that can predict clinical performance of medical displays without the need to build prototypes or perform extensive clinical studies. Therefore design alternatives can be evaluated more quickly and in a cost-effective way.

----- Break -----

Author Interviews

18:00 – 19:00

Organizers

Workshop on Display Electronic Systems

Workshop on Applied Vision and Human Factors

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

Topical Session on Flexible Displays

Thursday, December 4

9:00 - 10:00

Snow Hall A

FLX1: Flexible OLED Technologies

Chair: K. Nakayama, Yamagata Univ., Japan
 Co-Chair: J. J. Brown, Universal Display, USA

FLX1 - 1 3M Barrier Film Solutions and Light Extraction Technology

F. McCormick, S. Lamansky, M. Roehrig, A. Nachtigal, J. Ramos, J. Pieper, S. Finley, D. Stegall, J.-Y. Zhang
 3M, USA

Transparent barrier films for flexible OLEDs have been made by vacuum roll-to-roll coating. WVTRs in the 10^{-6} g/m²/day range have been demonstrated. Pressure sensitive adhesives have been developed for use with the barrier films. The films have been combined with nanostructure-based light extractors to enable brighter, lower power consumption OLEDs.

FLX1 - 2 Thin Film Encapsulation of AMOLED Displays with Polyurea/Al₂O₃ Hybrid Multi-Layers

Y. G. Lee, I. S. Kee, H. S. Shim, Y. H. Choi, X. Bulliard, Y. W. Jin, S. Y. Lee
 Samsung Advanced Inst. of Tech., Korea

Thin film encapsulation of OLEDs based on alternated Polyurea/Al₂O₃ hybrid multi-layers is investigated. All process steps were performed at room temperature. Device operating lifetime performance was over 86%, as compared with glass encapsulation, and the transmittance of thin film multilayered structure was over 90% in the visible region.

FLX1 - 3 Permeation Measurements on Ultra-High Barrier Layers for Encapsulation of Flexible Electronic Devices

H. Nörenberg
 Technolox, UK

OLEDs for display applications and lighting, and other devices based on plastic substrates may need barrier layers as protection against ingress of water vapour. We have developed permeation measurement instruments based on the total pressure method that can measure permeation rates in the low 10^{-5} or even 10^{-6} g/m²/day range.

FLX1 - 4 **Solution Processed Thin Film Transistors**
9:45 **Incorporating a Soluble Pentacene Semiconductor**

*C. J. Newsome, J. J. M. Halls, T. Kugler, C. E. Murphy,
 G. L. Whiting, J. H. Burroughes
 Cambridge Display Tech., UK*

High mobility, solution processed thin film transistors have been developed using 6,13-bis(triisopropylsilylethynyl) pentacene (TIPS pentacene). We show that by optimising the conditions for crystallisation of the material and by reducing the contact resistance using source and drain electrode pre-treatments, field effect mobilities can be improved from <0.10 to $1.75 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$.

----- Break -----

10:40 - 11:40

Snow Hall A

FLX2: Flexible Electronic Papers

Chair: G. F. Zhou, Philips Res., the Netherlands
 Co-Chair: Y. Masuda, Bridgestone, Japan

FLX2 - 1: 10:40 ***Invited* 10-in. Flexible Active-Matrix QR-LPD for Fast Image Refreshing with Printed OTFTs**

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

A 10 inch, 80 dpi and 4 inch, 150 dpi Active Matrix Organic-TFT backplanes were fabricated on flexible substrate with solution process. Driving with this backplane, Exceeds 10:1 of high contrast image was displayed in QR-LPD. The displayed image was refreshed with 300 micro seconds of gate pulse width, successfully.

FLX2 - 2 **Integration of Carbon Nanotube Based Common**
11:05 **Electrode in Active-Matrix Electrophoretic Flexible**
Display

*N. Saran, N.-S. Roh, S. Kim, W. Lee, J. S. Kim,
 T. Hwang, W. Hong, J. Kim, S. J. Baek, M.-S. Park,
 M. Kim, S. Lim, D. Hecht, Y.-B. Park*, L. Hu*, C. Ladous*,
 T. Huang*, G. Irvin*, P. Drzaic*
 Samsung Elect., Korea
 Unidym, USA

We have successfully realized B/W 2.3-inch QVGA a-Si based Active-Matrix Electrophoretic Display using highly transparent, conductive and flexible carbon nanotube film instead of sputtered IZO. The CNT film was coated by roll-to-roll coating technique. In this way, we have shown the possibility of CNT in the reflective-based flexible display architecture.

FLX2 - 3L **A 160 ppi All-printed Organic TFT Backplane for Flexible Electrophoretic Displays**
11:25

K. Suzuki, K. Yutani, A. Onodera, T. Tano, H. Tomono, A. Murakami, M. Yanagisawa, K. Kameyama, I. Kawashima
Ricoh, Japan

We have demonstrated a 160 ppi all-printed OTFT backplane for flexible EPDs. To achieve such a high-resolution backplane, we have developed a surface energy controlled ink-jet printing with UV irradiation on novel polyimide for Ag electrode on plastic substrate. A short channel length below 5 μm was successfully fabricated.

----- Lunch -----

13:20 - 14:20

Snow Hall A

FLX3: Materials and Components for Flexible Displays

Chair: Y. Iimura, Tokyo Univ. of A&T, Japan
 Co-Chair: T. Unate, Sekisui Chem., Japan

FLX3 - 1 **Internal Stress in Transparent Conductive Ga-Doped ZnO Films on Polymer Substrates**
13:20

A. Miyake, T. Yamada, H. Makino, N. Yamamoto, T. Yamamoto
Kochi Univ. of Tech., Japan

Transparent conductive Ga-doped ZnO (GZO) films have been prepared on polymers substrates at various substrate temperatures below 100°C by ion-plating. The internal stress of the GZO films increases with increasing T_s . This finding indicates that the thermal stress contributes mainly to the internal stress at higher substrate temperature.

FLX3 - 2 **Nano-Silver Pastes for Conducting Film**
13:40

R.-H. Jin^{,**}, S. Lee^{*}, K. Matsuki^{*}, A. Takahashi^{*}, K. Matsuda^{*}*
^{*}DIC, Japan
^{**}Kawamura Inst. of Chem. Res., Japan

Silver nanoparticles, which were composed of more than 95wt % silver and a few quantity of polymeric capping agent, were synthesized and used for silver thin film formation on the glass and plastic substrates. It was revealed that the film showed high electronic conductivity after thermal curing within 120~180°C.

FLX3 - 3 **A Novel High-Tg Polycarbonate Substrate for Inkjet-Printed Organic Thin-Film Transistors**
14:00

Y. Ikeda, H. Itoh, T. Shiro, A. C. Arias, T. N. Ng*,
 B. Krusor*, R. A. Street**
TEIJIN, Japan
**Palo Alto Res. Ctr., USA*

We have developed a novel substrate SS120 for O-TFTs. SS120 has high T_g (215 °C), good dimensional stability, and a barrier layer against moisture. We fabricated O-TFTs on SS120 by a jet-printing process. The mobility and a current on/off ratio of O-TFT on SS120 were 0.01-0.03 cm²/Vs and 10⁵.

----- Break -----

15:00 - 16:25

Snow Hall A

FLX4: Flexible LCD Technology

Chair: D. Kang, Soongsil Univ., Korea
 Co-Chair: T. Takahashi, Kogakuin Univ., Japan

FLX4 - 1: *Invited* Dual-Mode Operating LCDs for Multi-Functional Mobile Applications
15:00

J. C. Kim, S. R. Lee, C. P. Chen, C. G. Jhun, S. H. Lee**,
 T.-H. Yoon*
Pusan Nat. Univ., Korea
**Hoseo Univ., Korea*
***3M Korea, Korea*

Two configurations of dual-mode operating liquid crystal displays (LCDs) are introduced. Dual-mode operation of LCDs allows the display application to work as both dynamic and memory modes. The former and latter modes are responsible for gray-scale generation with fast LC response and permanent memory time for power-saving, respectively.

FLX4 - 2 **Flexible Field-Effect Transistors Fabricated on Polymer Films Using LC Semiconductors with Solution Process**
15:25

*M. Funahashi, F. Zhang, N. Tamaoki**
Univ. of Tokyo, Japan
**AIST, Japan*

Thin-film transistors based on Liquid crystalline oligothiophene derivatives were fabricated. The field-effect mobility of the hole reached 0.04 cm²/Vs with the on/off ratio of 10⁷. Furthermore flexible thin-film transistors could be fabricated on polymer thin films. They maintained the performance when the strain reached 3%.

FLX4 - 3 Ultra-Thin Reflective LC Film

15:45

*C. W. Kuo, K. H. Liu, C. K. Ku, C. Y. Chang, M. J. Lee,
C. C. Liao*

ITRI, Taiwan

An ultra-thin reflective flexible liquid crystal (LC) film has been demonstrated. The 30% thickness of the display can be reduced by applying a quarter-wave-plate (QWP) film as upper substrate. A low temperature alignment material and special designed photo spacers were applied in this new display.

FLX4 - 4 Optimization of Photo-Alignment Layer Suitable for Plastic Substrates

16:05

*Y. Kuwana, H. Hasebe, I. Nishiyama, K. Takeuchi,
H. Takatsu, V. Chigrinov*, H. S. Kwok**

DIC, Japan

**Hong Kong Univ. of S&T, Hong Kong*

Application of the alignment layer to a plastic substrate is important from the practical point of view. However, properties of photo-alignment layer are different between plastic substrates and glass substrates. Thus, we have investigated and optimized materials and manufacturing processes to improve uniformity, thermal stability and adhesion.

----- Break -----

16:40 - 17:50

Snow Hall A

FLX5: Flexible Active-Matrix Displays

Chair: T. Noguchi, Univ. of the Ryukyus, Japan

Co-Chair: K. Nomoto, Sony, Japan

FLX5 - 1: *Invited* Low-Voltage Operating CMOS Circuits with High Field-Effect Mobility Organic Transistors

16:40

M. Kitamura, J.-H. Na, Y. Arakawa

Univ. of Tokyo, Japan

Low-voltage operating organic CMOS circuits are reviewed in the manuscript. The CMOS circuits consist of p-channel pentacene and n-channel C₆₀ thin-film transistors, which have mobilities of 0.2 to 1.1 cm²/Vs and operate at 1 to 7 V. CMOS inverters, NAND and ring oscillators were demonstrated.

**FLX5 - 2: Invited Fabrication of Flexible Field-Sequential-Color
FLCD Panels Driven by LTPS TFTs**

17:05

*K. Motai, Y. Naitou, M. Kadowaki, Y. Iwamoto,
K. Ichimura, H. Sato*, Y. Fujisaki*, T. Yamamoto*,
H. Fujikake*, T. Kurita**

Dai Nippon Printing, Japan

**NHK, Japan*

A novel flexible ferroelectric liquid crystal display (FLCD) panel driven by poly-Si TFTs has been developed. A 5.1-inch diagonal active matrix panel with 128x72 pixels was fabricated using polymer stabilized FLC and poly-Si TFTs formed directly onto plastic substrate. Color moving images were demonstrated on the fieldsequential-color display panel.

**FLX5 - 3 5.8-in. Phosphorescent Color AM-OLED Display
Driven by OTFTs on Plastic Substrate**

17:30

*M. Suzuki, H. Fukagawa, Y. Nakajima, T. Tsuzuki,
T. Takei, T. Yamamoto, S. Tokito*

NHK, Japan

We have demonstrated a phosphorescent color OLED display driven by OTFTs on a plastic substrate. A pentacene layer was patterned by photolithography using a double protection layer. Phosphorescent polymer materials were used for emitting layer, which were patterned by ink-jet printing. Color moving images were successfully shown on the display.

Author Interviews

18:00 – 19:00

Organizers

Workshop on LC Science and Technologies
Workshop on Active Matrix Displays
Workshop on FPD Manufacturing, Materials and Components
Workshop on Organic LED Displays
Workshop on Electronic Paper

Eurodisplay 2009 (IDRC 2009)

September 14–17, 2009

Rome, Italy

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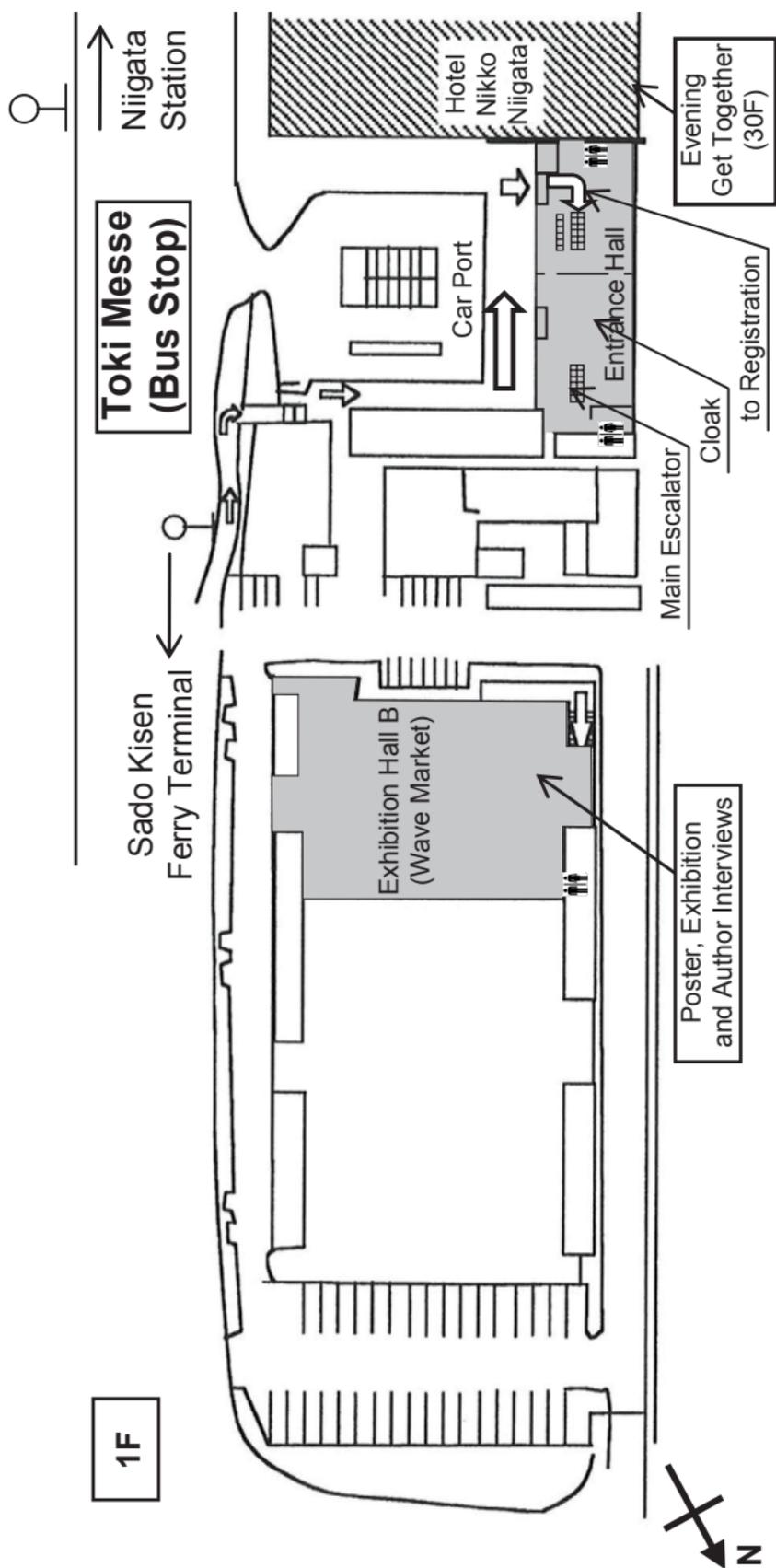
Workshop on MEMS for Future Displays and Related Electron Devices

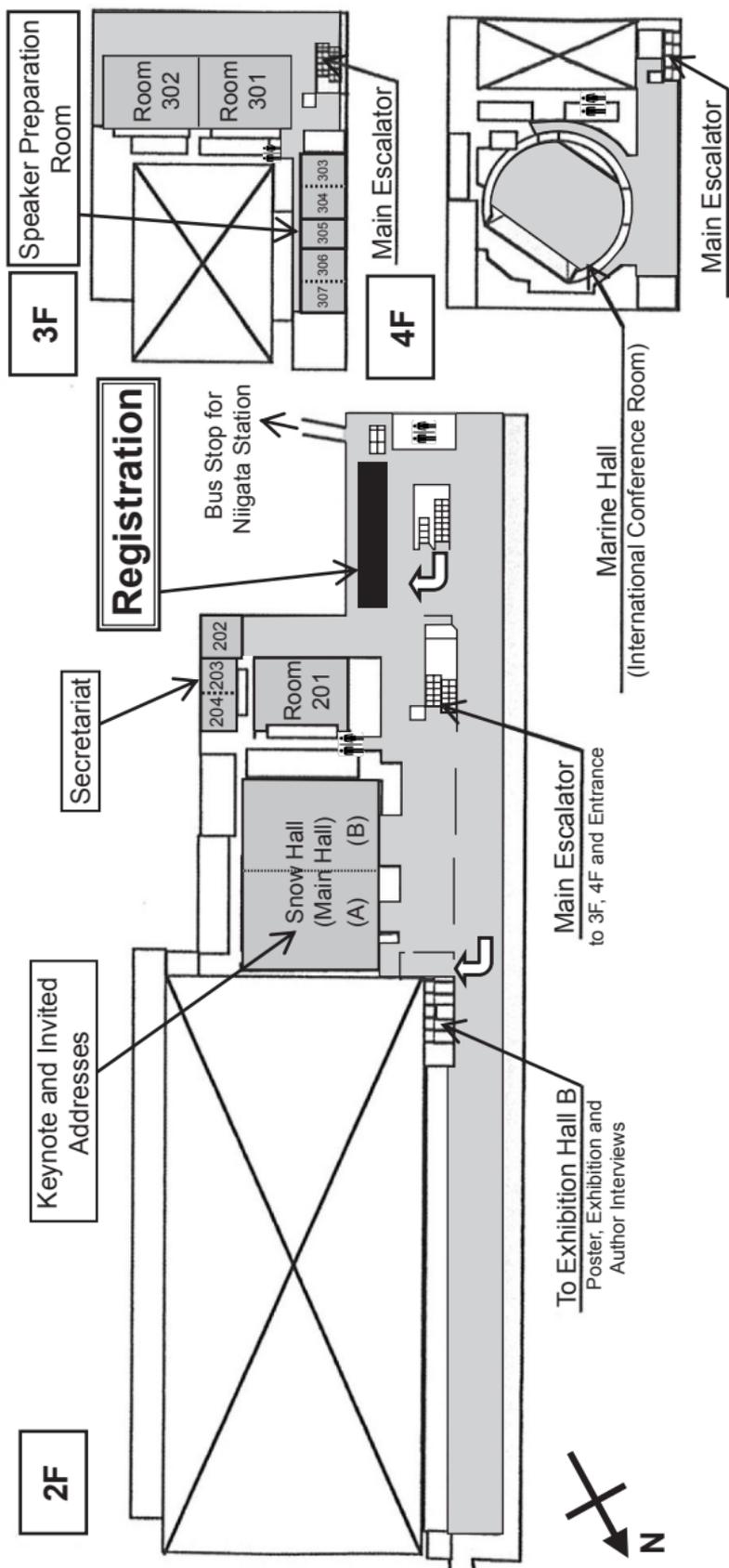
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FLOOR PLAN





IDW '08 Session Navigator

	Location	Wednesday, Dec. 3					Thursday, Dec. 4					Friday, Dec. 5						
		9:30-11:50	PM			18:00-19:00	AM		PM		18:00-19:00	AM		PM		17:40-18:40		
Keynote & Invited	Snow Hall	Opening, Keynote & Invited Addresses																
LCT	Snow Hall B							LC Alignment Patterning		Moving Picture Analysis			Progress of LC Materials	State-of-the-Art LCD Modes	Novel LCD Modes	High Performance LCDs (1)	High Performance LCDs (2)	
	Marine Hall		Fascinating LC Materials	Characterization of LC Alignment	Image Sticking Measurement													
	Exhibition Hall B					A.I.	Posters					A.I.						A.I.
AMD	Snow Hall A		Organic TFT	LCD Applications									Poly-Si TFT	System On Glass	Amorphous Oxide TFT	Crystalline Oxide TFT		
	Snow Hall B							*AM-OLED										
	Rm. 201									*MEMS Displays & Imaging								
FMC	Exhibition Hall B					A.I.												A.I.
	Rm. 301		Manufacturing I	Manufacturing II	Manufacturing III		Optical Films	Backlight							Materials I	Materials II	Materials III	
PDP	Exhibition Hall B					A.I.												A.I.
	Rm. 302						Cell Technology	Driving & Discharge										
	Rm. 201														Protective Layer (1)	Protective Layer (2)	Fabrication	
PH	Exhibition Hall B																	A.I.
	Rm. 302								Phosphors for LEDs	Phosphors for PDPs	Phosphors in EL & General			*Phosphors for FEDs				
FED	Exhibition Hall B																	A.I.
	Rm. 302												FEDs	*Phosphors for FEDs	CNT Emitters for FEDs	FE Materials & Characteristics		
OLED	Exhibition Hall B					A.I.												
	Snow Hall B		OLED Materials	OLED Device Technologies (1)	OLED Device Technologies (2)													
3D	Exhibition Hall B																	A.I.
	Rm. 301									Visual Perception & Human Factor	Measurement & Standardization		Hyper Realistic & 3D Display Systems (1)	Hyper Realistic & 3D Display Systems (2)				
VHF	Exhibition Hall B																	A.I.
	Marine Hall												*Contrast Enhancement	Image Quality (1)	Image Quality (2)	Color	Vision & Human Factors	Moving Image Quality
LAD	Exhibition Hall B																	
	Rm. 201		Solid State Light Sources	LCOS Light Valves	Illumination & Projection Optics				*Novel MEMS Projection Optical Technologies									
EP	Exhibition Hall B					A.I.												
	Rm. 302		Electrophoretic Displays	Electrowetting Displays & Others	Various EP Technologies													
MEMS	Exhibition Hall B																	
	Rm. 201								*Novel MEMS Projection Optical Technologies	Emerging MEMS Technologies	Fundamental Process Technologies	*MEMS Displays & Imaging	Optical MEMS & Device Technologies					
DES	Exhibition Hall B																	
	Marine Hall				Novel Electronic Display & Driving													
	Exhibition Hall B																	A.I.
DPU	Exhibition Hall B																	
	Marine Hall									Display Technologies for Professional Use								
FLX	Exhibition Hall B																	A.I.
	Snow Hall A								Flexible OLED Technologies	Flexible Electronic Papers	Materials & Components for Flexible Displays	Flexible LCD Technology	Flexible Active-Matrix Displays					

LCT: Workshop on LC Science & Technologies
 AMD: Workshop on Active Matrix Displays
 FMC: Workshop on FPD Manufacturing, Materials & Components
 PDP: Workshop on Plasma Displays
 PH: Workshop on EL Displays & Phosphors
 FED: Workshop on Field Emission Display & CRT
 OLED: Workshop on Organic LED Displays

3D: Workshop on 3D/Hyper-Realistic Displays & Systems
 VHF: Workshop on Applied Vision & Human Factors
 LAD: Workshop on Projection & Large-Area Displays, & Their Components
 EP: Workshop on Electronic Paper
 MEMS: Workshop on MEMS for Future Displays & Related Electron Devices
 DES: Workshop on Display Electronic Systems
 DPU: Topical Session on Display Technologies for Professional Use
 FLX: Topical Session on Flexible Displays

A.I.: Author Interviews
 *: Joint Session

IDW '08 Timetable

Date	2F Lobby	Snow Hall A	Snow Hall B	Marine Hall	Room 301	Room 302	Room 201	Exhibition Hall B		
Tue., Dec. 2	Registration 17:00-20:00	Evening Get-Together at Houou Room (30F), Hotel Nikko Niigata 18:00-20:00								
	Wednesday, December 3	Opening, Keynote Address 9:30-11:00			Break					
Invited Address 11:10-11:50			Lunch							
Registration 8:00-18:00		AMD1 13:20-14:40	OLED1 13:20-14:40	LCT1 13:20-14:55	FMC1 13:20-14:40	EP1 13:20-14:45	LAD1 13:20-14:40	DESp 13:20-16:20	Exhibition 12:00-18:00	
		Break								
		AMD2 15:00-16:30	OLED2 14:50-16:00	LCT2 15:00-16:20	FMC2 15:00-16:00	EP2 15:00-16:05	LAD2 15:00-16:25			
		Break								
		DES1 16:35-17:55	OLED3 16:35-17:45	LCT3 16:40-18:00	FMC3 16:40-17:40	EP3 16:40-17:45	LAD3 16:40-17:45			
		Banquet at Continental Room (4F), Hotel Okura Niigata 19:30-21:30								Author Interviews 18:00-19:00
Thursday, December 4		Registration 8:00-18:00	FLX1 9:00-10:00		DES2 9:00-10:20	FMC4 9:00-10:20	PDP1 9:00-10:20	MEMS1/LAD4 9:00-10:25	LCTp, PHp, 3Dp, VHFp 9:00-12:00	Exhibition 10:00-18:00
			Break							
	FLX2 10:40-11:40		AMD3/OLED4 10:40-12:05	DES3 10:40-12:00	FMC5 10:40-12:00	PDP2 10:40-12:00	MEMS2 10:40-12:15	AMDp, OLEDp, LADp, EPp 13:20-16:20		
	Lunch									
	FLX3 13:20-14:20		LCT4 13:20-14:25	DPU1 13:20-14:40		PH1 13:20-14:50	MEMS3 13:20-14:40			
	Break									
	FLX4 15:00-16:25			DES4 15:00-16:20	3D1 14:55-16:05	PH2 15:00-16:30	MEMS4/AMD4 15:00-15:50			
	Break									
	FLX5 16:40-17:50		LCT5 16:40-17:40	VHF1/DES5 16:40-18:00	3D2 16:40-17:55	PH3 16:40-18:15	MEMS5 16:35-18:00	Author Interviews 18:00-19:00		
	Friday, December 5		Registration 8:00-15:00	AMD5 9:00-10:20	LCT6 9:00-10:30	VHF2 9:00-10:30	3D3 9:00-10:15	FED1 9:00-10:10		
Break										
AMD6 10:40-12:05		LCT7 10:40-12:40		VHF3 10:40-11:50	3D4 10:40-11:45	FED2/PH4 10:40-12:20				
Lunch										
AMD7 13:20-14:40		LCT8 13:40-14:45		VHF4 13:20-14:40	FMC6 13:20-14:40	FED3 13:20-15:00	PDP3 13:20-14:40			
Break										
AMD8 15:00-16:15		LCT9 15:00-16:25		VHF5 15:00-16:20	FMC7 15:00-16:20	FED4 15:10-16:50	PDP4 15:00-16:15			
Break										
		LCT10 16:40-17:40		VHF6 16:40-17:40	FMC8 16:40-17:55		PDP5 16:40-17:40		Author Interviews 17:40-18:40	

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