SOCIETY FOR INFORMATION DISPLAY

Final Program

EURODISPLAY'07

September 17-20, 2007
Moscow

ORGANIZED BY:

SID Russia Chapter
Lebedev Physics Institute of RAS

CO-ORGANIZED BY:

Society for Information Display
SID Belarus Chapter
SID Ukraine Chapter

SPONSORED BY:

Russian Foundation of Basic Research
Russian Academy of Sciences
European Office of Aerospace Research and Development
Society for Information Display
Russian JSC ChipExpo

IDRC at a Glance / September 18-20th / Office Building of the Russian Academy of Sciences

Date	Time	Lobby (1st floor)	Grand Hall	Red Hall	Blue Hall	Events
September 18th, Tuesday	8.00–9.20	Registration				
	9.20–9.40		Opening Remarks			
	9.40–10.40		Plenary Session			
	10.40–11.00		Break			
	11.00–12.40		Plenary Session			
	12.40–14.00		Lunch break			
	14.00–16.00	Registration		Session 1	Session 2	
	16.00–17.00					Transfer
	17.00–18.00					Exhibition inspection
	18.00–20.00					Reception Party
September 19th, Wednesday	8.00–9.20	Registration				
	9.20–10.40			Session 3	Session 4	
	10.40–11.00			Break		
	11.00–12.40			Session 5	Session 6	
	12.40–14.00			Lunch break		
	14.00–15.00	Registration	Poster Session (at Grand Hall Lobby)	Author Interviews	Author Interviews	
	15.00–17.00					
	17.00–18.00					Transfer
	18.00–22.00					Special Event: Moskva-River, the Boat-Restaurant
September 20th, Thursday	8.00–9.20	Registration				
	9.20–10.40			Session7	Session 8	
	10.40–11.00			Break		
	11.00–12.40			Session 9	Session 10	
	12.40–14.00			Lunch break		
	14.00–15.40			Session 11	Session 12	
	15.40–16.00			Break		
	16.00–17.00			Author Interviews	Author Interviews	
	17.00–23.00					Bus-Excursion: Night Moscow

CONTENTS

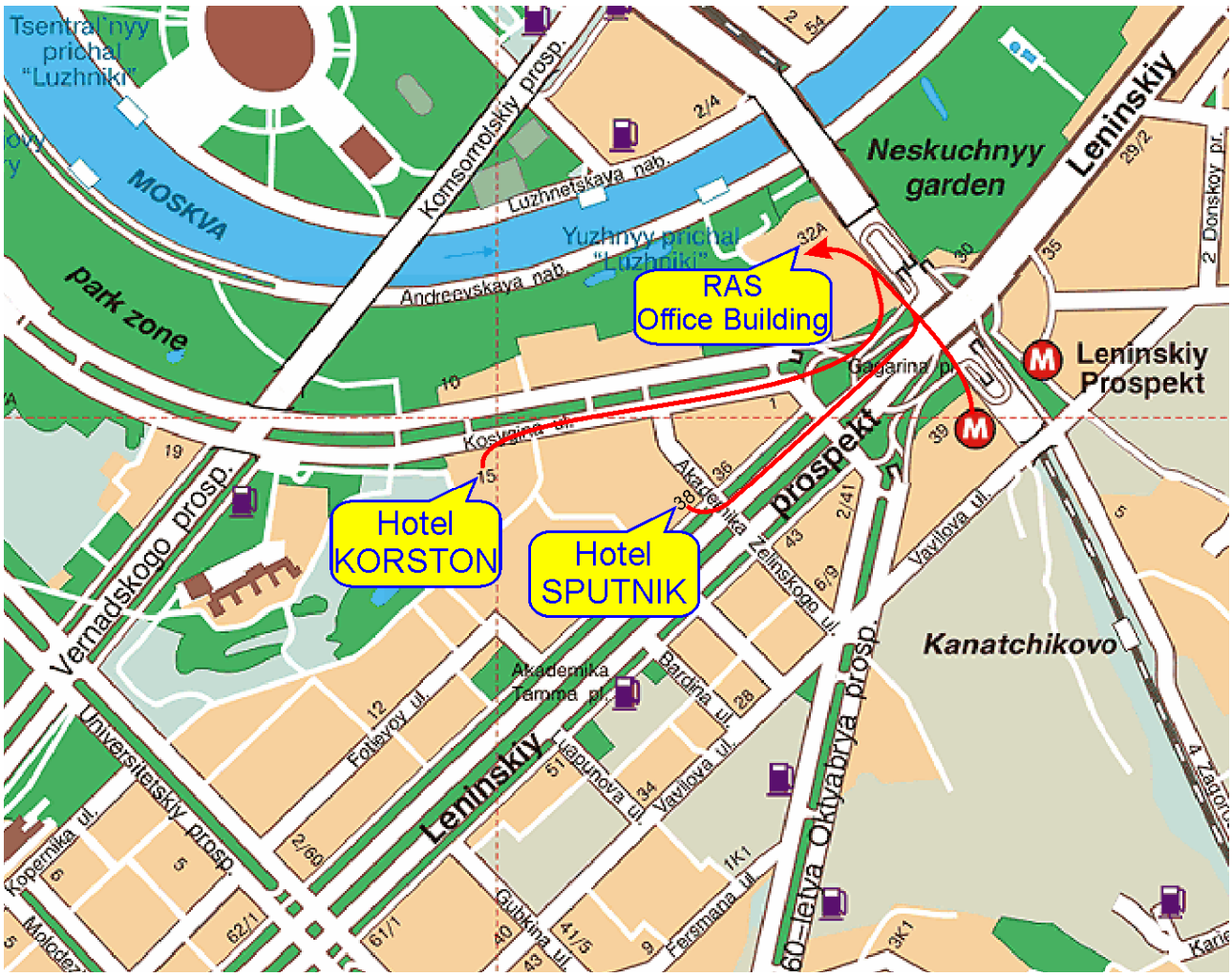
PROGRAM HIGHLIGHTS

SCOPE
EURODISPLAY'07 (ED'07) continues the European series of International Display Research Conferences and Exhibitions that were held in Amsterdam (1990), Strasbourg (1993), Birmingham (1996), Berlin (1999), Nice (2002), and Edinburgh (2005).
ED'07 is the first Eurodisplay Symposium to be held in Russia. ED'07 includes XXVII International Display Research Conference (IDRC), Workshop (business seminar), Tutorials (education seminar) and Exhibition.

ORGANIZERS
ED'07 is organized by SID Russia Chapter and Lebedev Physics Institute of Russian Academy of Sciences. Co-organizers are: Society for Information Display, SID Belarus and Ukraine Chapters.
The Exhibition is organized by Russian JSC "ChipExpo" in contact with SID Russia Chapter.

SPONSORS
ED'07 is sponsored by the following organizations:
Russian Foundation of Basic Research (RFBR),
Russian Academy of Sciences (RAS),
European Office of Aerospace Research and Development of the US AirForce (EOARD),
Society for Information Display (SID), and
Russian JSC ChipExpo.
We thank all these organizations for their contribution to the success of the ED'07.

VENUE
IDRC, Workshop and Tutorials will be held in the Office Building of the Russian Academy of Sciences (address: Leninsky pr., 32a), located in the southern part of Moscow City near the Moskva-river, Gagarin Square and Metro-station "Leninsky prospect".



IDRC
Four Keynote Addresses, 58 oral (including 17 invited) and 73 poster papers , total 135 papers, will be presented on one plenary, twelve topical and one poster sessions held on September 18th -20th . The speakers are from 20 countries: 41 of them – from Russia, 25 – Korea, 11 – Belarus, 10 – Japan, 9 – PR China, Taiwan and Hong Kong, 8 – from Ukraine, 5 – Germany, 4 – The Netherlands and USA, in 3 – Belgium, Finland, France and Iran, in 2 – UK, in 1 – from Greece, Ireland, Singapore, and Switzerland. Among them 18 papers were prepared by combined international research teams.

Keynote Speakers
Keynote Addresses are leaders in their fields and experts on display future trends. The following speakers and papers will be September 18th on the Plenary Session:
Larry Weber, President of the SID, USA, who will give "The Race for TVs with Higher Luminous Efficiency";
Munisamy Anandan, Organic Lighting Technologies LLC, USA, who will give "LED Backlight for LCD";
John Fan, Kopin Corp., USA, who will give "Emergence of MicroDisplays: New Exciting Advances and Applications";
Karlheinz Blankenbach from ADRIA and Alex Smirnov from SID, who will give jointly "The European Display Landscape – Future Developments and Opportunities".

Invited Speakers
Invited Papers on IDRC will be presented by the following speakers:
Victor Belyaev, Samsung Research Center, Russia, who will give "To-Date Display Technologies and Devices in Russia-100 Years of Russian Electronic Displays";
Vladimir Bezborodov, Institute of Applied Physics Problems, Belarus, who will give "From the Available Intermediates to Advanced Smectic and Nematic LC Compounds";
Vladimir Chigrinov, Hong Kong University of Science and Technology, Hong Kong, who will give "Photoaligned Azo-Dyes Layers for LCD Applications";
Vasily Ezhov, Prokhorov Institute of General Physics, Russia, who will give "3D Displays - Fundamental Physical Classification for Clearing Inherent Technical Features";
Norbert Fruehauf, Universitaet Stuttgart, Germany, who will give "Active Matrix Flat Panel Technologies";
Eliav Haskal, Philips Research, The Netherlands, who will give "Flexible OLED Displays Made with the EPLaR Process";
Alexander Smirnov, Belarusian State University of Informatics and Radioelectronics, Belarus, who will give "Anodizing Technique for Liquid Crystal Displays";
Shunsuke Kobayashi, Tokyo University of Science, Japan, who will give "Physical Interpretation of the Characteristics of LCDs Doped with Nanoparticles;
Marcel Krijn, Philips Research Europe, The Netherlands, who will give "Switchable 2D-3D displays";
Dominique Labilloy, Corning Incorporated, USA, who will give "Key Trends in LCD Substrates";
Shigeo Mikoshiba, University of Electro-Communications, Japan, who will give "Techno-Business Strategy of PDPs";
Yoichiro Nakanishi, Shizuoka University, Japan, who will give "Preparation of SrGa2S4:Eu Thin Films Phosphors for FEDs";
Evgene Pozhidaev, Lebedev Physical Institute, Russia, who will give "Electro-Optical Modes of Ferroelectric Liquid Crystal Display Cells Based on Bi- and Multistability Effects";
Andrew Putilin, Lebedev Physics Institute, Russia, who will give "Application of 2D Focon Arrays in Displays and Planar Illuminators";
Xiaowei Sun, Nanyang Technological University, Singapore, who will give "Florescent and Phosphorescent OLED by Sequential Doping";
Maxim Sychov, St. Petersburg State Institute of Technology, Russia, who will give "Radiation Modification of Powder Phosphors";
Oleg Yaroshchuk, Institute of Physics, Ukraine, who will give "Plasma Beam Equipment and Processes for Liquid Crystal Alignment on the Large-Area Substrates".

WORKSHOP
Four Lectures on the Business Seminar will be given September 17th by the following speakers:
Brian Berkeley, Samsung El. Co., USA, who will give "Advanced Technologies for LCD-TV";
Jyrki Kimmel, Nokia, Finland, who will give "Displays for Mobile Applications";
José Magarino, Thales Avionics, France, who will give "Displays for Avionic Applications";
Barry Young, DisplaySearch, USA, who will give "Review of Display Technologies Market".

TUTORIALS
Three Lectures on the Education Seminar will be given September 17th by the following speakers:
Vladimir Chigrinov, Hong Kong University of Science and Technology, who will give
"LCD: Physics & Applications";
Harm Tolner, South-East University, China, who will give "Plasma Display Panels";
Ian Underwood, Microemissive Displays Co., UK, who will give "Microdisplay Technology and Applications".

PRINTED AND ELECTRONIC MATERIALS
Proceedings will be printed before ED'07 beginning. Proceedings and electronic copies will be presented to participants.

EXHIBITION
The exhibition of display components and systems opens Tuesday morning, September 18th at 10:00 and concludes at 16:00 on Thursday, September 20th . The exhibition is held in "Expocenter" (Pavilion 7) that is the best Russia Exhibition Center located at Krasnaya Presnya. Shuttle-Buses will be arranged to transfer display specialists from "Expocenter" to RAS Office Building and back.

SOCIAL PROGRAM
Special sightseeing program for participants and satellites is possible. Visiting the famous historical and cultural places of Moscow-city, Moscow region, S.-Petersburg, and "Golden Ring" cities will be proposed. Besides the special bus-trip to Korolev-city will be arranged for visiting the unique museum of Energiya Corp. with many original space ships including Y.Gagarin's one and visiting the Space Mission Center with its Largest Wall Display.

SPECIAL EVENT
The journey on a boat along the Moskwa-river is proposed. The boat-restaurant with free dishes and beverages will be available. The journey will get around four hours and will be accompanied with explanation of different Moscow landscapes and music.

WEATHER
During this season the air is dry and warm (high temperature of 20-22 centigrade, low temperature 10-14 centigrade). This period of Indian summer with gold-red dress of trees makes Moscow very attractive.

EURODISPLAY'07 WILL BE SERVED by Nicko Travel Group: http://eurodisplay.nicko.ru
Contact: Mikhail Prusakov (prusakov@nicko.ru) or Alexander Novozhilov (novozhilov@nicko.ru)
Phone: +7(495)775 3171 ext (380), Fax: +7(495)775 3170.

GENERAL INFORMATION

Logistics
Eurodisplay'07 will be held September 17-20 in Moscow, Russia.
IDRC Technical Sessions and Workshop and Tutorial Seminars will be held at the Office Building of the Russian Academy of Sciences (32a, Leninsky prospect, Moscow 119991 Russia).
The Exhibition will be held in "Expocenter" (Pavilion 7) located at Krasnaya Presnya. Bus-shuttles will be available to transfer display specialists from "Expocenter" to RAS Office Building and back.

Language
English is the official language of ED'07.

Registration Desk Hours
Registration Desk will be located at the third floor of the Office Building in front of Conference Halls. It will be found due to guide signs indicating the way from Main Entrance to Registration Desk. It will be open from 8:30 am to 6:00 pm Monday through Wednesday, and from 8:30 am to 13:00 pm on Thursday.
Speakers may preview their presentations at the Registration Desk.
Internet, information and assistance may be obtained here as well.

Poster Preparation
The Poster Session will be held September 19, from 2:00 pm to 5:00 pm. This day the authors can prepare posters from 11:00 am to 2:00 pm.

Tea-coffee breaks
Tea, coffee and soft drinks will be served in the Winter Garden adjoining to Conference Halls during all Conference days (September 17-20).

Conference Reception
Conference Reception Party will be held at "Expocenter" (Krasnaya Presnya) from 6:00 pm to 8:00 pm on September 18. Participants will be delivered there from RAS Office Building by buses.

Eurodisplay'07 Program

September 17 – 20, 2007
(Monday – Thursday)

Office Building of
The Russian Academy of Sciences

Moscow, Russia

ED'07 WORKSHOP PROGRAM

Monday, September 17th

Red Hall

Chair: Vladimir Chigrinov, *University of Science and Technology, Hong Kong*

9.20 – 10.05 W 1 **Review of Display Technologies Market**
Barry YOUNG, *DisplaySearch, USA*

10.05 – 10.50 W 2 **Advanced Technologies for LCD-TV**
Brian BERKELEY, *Samsung Electronics Co., USA*

10.50 – 11.10 **Break**

11.10 – 12.40 W 3 **Displays for Avionic Applications**
José Magarino, *Thales Avionics, France*

12.40 – 14.00 **Lunch break**

14.00 – 15.30 W 4 **Displays for Mobile Applications**
Jyrki KIMMEL, *Nokia, Finland*

ED'07 TUTORIALS PROGRAM

Monday, September 17th

Blue Hall

Chair: Victor Belyaev, *Samsung Research Center, Moscow, Russia*

11.10 – 12.40 T 1 **Plasma Display Panels**
Harm Tolner, *South-East University, China*

12.40 – 14.00 **Lunch break**

14.00 – 15.30 T 2 **Microdisplay Technology and Applications**
Ian Underwood, *Microemissive Displays Co., UK*

15.30 – 15.50 **Break**

15.50 – 17.20 T 3 **LCD: Physics & Applications**
Vladimir Chigrinov, *University of Science and Technology, Hong Kong*

IDRC PROGRAM

Tuesday, September 18

Opening Remarks / 9.20 – 9.40 / Grand Hall

Chair: **Victor Belyaev**
ED'07 Executive Chair, Moscow Samsung Research Center, Russia

Speakers: **Oleg Krokhin**
ED'07 General Chair, Lebedev Physics Institute, Russia Academy of Sciences
Larry Weber
President of the SID, USA
Igor Kompanets
ED'07 Program Chair, Lebedev Physics Institute, Russia

Plenary Keynote Session / 9.40 – 12.40 / Grand Hall

Chair: **Igor Kompanets,** *Lebedev Physics Institute, Moscow, Russia*

9.40–10.20 **The Race for TVs with Higher Luminous Efficiency**
K-1 *Larry Weber,* President of the SID, USA

The major display contenders: LCDs, CRTs, PDPs, projection displays, FEDs, SEDs and OLEDs are each examined in terms of the most critical display characteristic, the luminous efficiency. Each technology has great opportunity for improvement, but which one will win the race?

10.20–11.00 **LED Backlight for LCD**
K-2 Munisamy Anandan, *Organic Lighting Technologies LLC, USA*

Recent explosion of white LED backlight for cell phone LCD is a testimony of LEDs migration to displays. White LED backlight in notebook PC is going to be another explosion. This key-note reviews the advancement in LEDs, light guides, LED backlight system for edge-lit mode for LCD in notebook PC and direct-lit mode for LCD in LCD TV.

11.00–11.20 **Coffee-break**

11.20–12.00 **Emergence of MicroDisplays: New Exciting Advances and Applications**
K-3 John Fan, *Kopin Corp., USA*

Exciting applications of microdisplays will be reviewed and discussed. Various microdisplay technologies and their performances will be compared for different applications. The presentation will then review Cyberdisplay technology, a patented and exciting display technology that Kopin has pioneered.

12.00–12.40 **The European Display Landscape – Future Developments and Opportunities**
K-4 Karlheinz Blankenbach *(ADRIA)* and Alex Smirnov *(SID)*

This lecture will showcase European research, technologies and innovation that are integrated in products sold worldwide - European competence mapped by the European project "ADRIA" (Advanced displays research integration action). This evaluation leads to future projections and scenarios for different application areas in the advanced displays roadmap. Major challenges which need to be addressed to establish new markets and speed the transition of new ideas from laboratories into successful products will be identified.

12.40–14.00 Lunch Break

Session 1: Non-Emissive Display Technologies / 14.00 – 16.00 / Red Hall

Chair: **Vladimir Chigrinov,** *Hong Kong University of Science and Technology, Hong Kong*
Co-Chair: **Eugene Pozhidaev,** *Lebedev Physical Institute, Moscow, Russia*

14.00–14.20 ***Invited Paper:*** **To-Date Display Technologies and Devices in Russia- 100 Years of Russian**
S1-1 **Electronic Displays**
Victor Belyaev, Samsung Research Center, Moscow, Russia

History, recent results and trends of display technologies in Russia are reviewed. Main organizations dealing with both R&D and production of display components and devices are listed.

14.20–14.40 ***Invited Paper:*** **Key Trends in LCD Substrates**
S1-2 Dominique Labilloy, *Corning Incorporated, USA*

This presentation will discuss the future of a-Si and LCD-TV in the context of substrate performance and its impact, the introduction of larger and larger Gen sizes and the 2006 launch of Corning's environmentally friendly EAGLE XG™ glass substrates.

14.40–15.00 S1-3 ***Invited Paper:*** **From the Available Intermediates to Advanced Smectic and Nematic LC Compounds**

V.S.Bezborodov, V.I.Lapanik, G.M.Sasnouski
Institute of Applied Physics Problems, Minsk, Belarus

We summarize and show how the advanced smectic and nematic liquid crystalline derivatives of cyclohexane, cyclohexene, biphenyl and terphenyl can be synthesized by the transformations of the the easly available 3,6-disubstituted cyclohex-2-enones, 2,5-disubstituted cyclohexanones, 3,5-disubstitiuted 2-isoxazolines and other intermediates.

15.00–15.20 S1-4 **Temperature Stable On-Glass Coatable Retarders for In-Cell LCD Applications**

Arthur Geivandov, Irina Kasianova, Ellina Kharatiyan, Alexander Lazarev, Pavel Lazarev
Crysoptix Ltd., Moscow, Russia
Serguei Palto
Institute of Crystallography RAS, Moscow, Russia

Crysoptix Ltd. has developed coatable Thin Birefringent Films (TBF^{TM}) retarders based on molecular engineering of organic materials. The films possess negative C-type and biaxial retardation functions. The TBF^{TM} retarders exhibiting high temperature stability meet the requirements for in-cell application and create new opportunities for quality enhancement and cost reduction of LCDs. Application of internal TBF^{TM} retarders for optical compensation of IPS LCD is considered.

15.20–15.40 S1-5 **The Advantage of Circular Polarized LCD-TV Compared with Normal LCD-TV on Visual Fatigue**

X.L-Yan, Dong Fu，C.C-Zhu，X.W-Xie，X.W-Sun，Hong Zhang，W.D-Huang
TCL Corporate Research，Shenzhen, China
D.Z.-Wu，S.X-Long
Zhongshan Ophthaimic Center, Guangzhou, China

The circular polarized LCD-TV, a novel LCD television, is reported for the first time in the paper. Compared with normal LCD-TV, a 1/4λ wave plate with anti-reflective layer and anti-glare layer was employed on the LCD panel surface. The experiments on visual fatigue were performed in details. The results show that circular polarized LCD-TV causes less visual fatigue compared with normal LCD-TV during a long time watching. That will benefit a lot for the human beings.

15.40–16.00 S1-6 **High Reflective & Bi-Stable Electrowetting Displays**

K. Blankenbach, A. Schmoll
Display Lab, Pforzheim University, Pforzheim, Germany
A. Bitman, F. Bartels
Bartels Mikrotechnik GmbH, Dortmund, Germany
D. Jerosch
ADT GmbH, Bad Soden, Germany

A novel display technology was developed using a droplet moved by electrowetting effect. Mechanical bi-stable and high reflective monochrome as well as color devices can be achieved. Because no high temperature processes are required, flexible plastic substrates are applicable. Our universal driving system enabled studying and optimizing the EW display effect.

Author Interviews will be September 19th, 14.00–15.00 (during Poster Session) at the Red Hall

Session 2: Flexible Displays / 14.00 – 16.00 / Blue Hall

Chair: **Xiaowei Sun,** *Nanyang Technological University, Singapore*
Co-Chair: **Victor Sorokin,** *Lashkaryov Institute of Semiconductor Physics, Ukraine*

14.00–14.20 S2-1 ***Invited Paper:*** **Flexible OLED Displays Made with the EPLaR Process**

E.I. Haskal , H. Lifka, P. Bouten
Philips Research, Eindhoven, The Netherlands
I. D. French
Philips Research Laboratories, Surrey, United Kingdom,
R. Sanders
Philips Applied Technologies, Eindhoven, The Netherlands
T. Kretz, E. Chuiton, G. Gomez, F. Mazel
Thales Avionics LCD, Moirans, France
C. Prat, F. Templier
CEA-LETI-MINATEC, Grenoble, France
M.D. Campo
Applied Materials, Alzenau, Germany
F. Stahr
FAP GmbH Dresden, Dresden, Germany

Flexible displays offer significant advantages due to their light weight, thin form factor, robustness and conformal shape. OLED ("organic light-emitting device") displays can be especially attractive when made flexible, as the single-substrate, emissive display effect has a wide viewing-angle and good video reproduction. In previous work, the EPLaR ("Electronics on Plastic by Laser Release") process for making flexible displays in standard amorphous Si-TFT based active-matrix display factories was described for electrophoretic displays. This paper reports on recent results on the world's-first, flexible active-matrix OLED on plastic made with the EPLaR process.

14.20–14.40 ***Invited Paper:*** **Active Matrix Flat Panel Technologies**
S2-2 Norbert Fruehauf, Bastian Diehm, Silke Goettling, Steffen Hergert, Efstathios Persidis, Axel Schindler
Universitaet Stuttgart, Stuttgart, Germany

Processes for low temperature polysilicon, organic and carbon nanotube thin film transistor arrays are investigated. Their viability is verified by entirely in-house built active matrix display demonstrators employing liquid crystals and organic light emitting diodes as electro-optic media. Special focus is given to our most recent results in the area of organic and carbon nanotube based display technologies.

14.40–15.00 **PLED on Steel Foil with inorganic sputtered Hole-Injection Layer**
S2-3 Steffen Hergert, Martin Kiesel, Steffen Hoehla, Norbert Fruehauf
Universität Stuttgart, Stuttgart, Germany

We have demonstrated a polymer OLED on a flexible steel foil, where we replaced the organic hole injection layer by an inorganic layer of molybdenum tantalum / molybdenum tantalum oxide resulting in an increase of luminance and efficiency. The PLED device is protected by a thin film encapsulation against environmental influences.

15.00–15.20 **High Performance Ni-induced Polysilicon Thin-Film Transistors on Flexible**
S2-4 **PET Substrates, Suitable for Display Applications**
S. Paydavosi, A. Tamaddon, S. Mohajerzadeh
Department of Elec. & Comp. Eng, University of Tehran, Tehran, Iran

High performance thin-film transistors have been realized on flexible PET substrates. A sequence of hydrogenation/annealing in the presence of an external mechanical stress is used to laterally crystallize the channel region at temperatures below 170°C. Thin-film transistors with an electron mobility of 25cm^2/Vs and an on/off ratio of 2000 have been obtained.

15.20–15.40 **High Performances Flexible a-Si AMOLED Display**
S2-5 C. Prat , G. Haas, T. Maindron, D. Vaufrey, H. Doyeux, F. Templier,
CEA/LETI - DRT/LETI/DIHS/LTCV - 17, Grenoble Cedex 9, France
H. Cloarec, C. Pinot
Thomson R&D - 1, Cesson-Sévigné, France
T. Kretz, G. Gomez, E. Chuiton, F.Mazel
Thales Avionics LCD, Moirans, France
M. D. Campo
Applied Materials, Alzenau, Germany
F. Stahr
FAP , Dresden, Germany

Application of OLED display in mobile products is very demanding in terms of stability and resistance to thermal and to mechanical stress. In the work presented hereafter, a particular emphasis is put on the stability of the OLED devices obtained as a well as on their ability to be deposited and encapsulated onto a flexible active matrix backplane.

15.40–16.00 **Active Matrix Driven Organic Light Emitting Diodes Panel Using Organic Thin-Film Transistors**
S2-6 A. Saboundji, Y. Bonnassieux, D. Aldakov
Laboratoire de Physique des Interfaces et des Couches Minces, Palaiseau Cedex, France
B. Geffroy, D. Tondelier
CEA / DRT / LITEN/DTNM Laboratoire Composants Hybrides, Cedex. France
G. Horowitz
ITODYS, University Paris 7, Paris, France
J.L. Fave
Institut des NanoSciences de Paris, University Paris 6, Paris, France

In this paper, organic thin-film transistor (OTFT) driven organic light-emitting diodes (OLED) on glass substrate are presented. These bottom-emission OLED pixels consist of two bottom-contact pentacene TFT's working as switching and driving transistors. The W/L (where W and L are the OTFT's channel width and length, respectively) was 100µm/5µm for switching OTFTs and 1000µm/5µm for driving OTFTs. The mean field-effect mobility and the current on/off ratio of the pentacene TFTs was 0.25 cm^2/V.s and higher than 10^5, respectively. The electrical stress was applied to verify the use of pentacene TFTs for AMOLED displays. After 5200 s of stress application time, the off-current was even lowered and mobility variation was less than 5%. Fabrication method and performances of pentacene TFT with good mobility, uniformity and stability will be discussed.

Author Interviews will be September 19th, 14.00–15.00 (during Poster Session) at the Blue Hall

16.00–17.00 Transfer

Exhibition / 17.00 – 20.00 / Exhibition Center

17.00–18.00 Exhibition inspection

18.00–20.00 Reception

Wednesday, September 19

Session 3: LC Alignment / 9.20 – 10.40 / Red Hall

Chair: Victor Belyaev, *Moscow Samsung Research Center, Russia*
Co-Chair: Valery Loiko, *Stepanov Institute of Physics, Minsk, Belarus*

9.20–9.40 S3-1 ***Invited Paper:*** **Photoaligned Azo-Dyes Layers for LCD Applications**

Vladimir Chigrinov, Hoi Sing Kwok
Hong Kong University of Science and Technology, Hong Kong
Hiroshi Hasebe, Haruyoshi Takatsu, Hirokazu Takada
Dainippon Ink and Chemicals Incorporated, Japan

The advantages and drawbacks of various photo-aligning materials are analyzed from the point of view of practical applications. The description of the diffusion photo-aligning in azo-dye materials is provided. The characteristics of azo-dye photoaligning LC layers are compared with those ones prepared by other photoaligning materials. A controllable pretilt angle and anchoring energy are demonstrated, thus enabling to develop a new generation of the LC devices: with low voltage, fast response and wide viewing angles.

9.40–10.00 S3-2 ***Invited Paper:*** **Anodizing Technique for Liquid Crystal Displays**

Serguei Lazarouk, Pavel Jaguiro, Vladimir Labunov, Dmitri Sasinovich, and Alexander Smirnov
Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus
Anatoli Muravski, Vladimir Chigrinov, and Hoi Sing Kwok
Center for Display Research, Hong Kong University of Science and Technology, Hong Kong

Specific self organized nanoscale structures, process of its formation by electrochemical treatment and its application for Liquid Crystal Displays (LCDs) are considered in this paper. Special pillar titania formation technology is proposed to overcome some restriction incidental to porous alumina alignment layers. Both materials allow designing extremely time-, ultraviolet (UV) - and temperature stable alignment layers. A new method based on anodizing in meniscus region at high current densities has been developed for adjustable tilt porous structures formation. Masking and changing of anodizing parameters can be used to control properties and shapes of the structures.

10.00–10.20 S3-3 ***Invited Paper:*** **Plasma Beam Equipment and Processes for Liquid Crystal Alignment on the Large-Area Substrates**

Oleg Yaroshchuk, Ruslan Kravchuk, Leonid Dolgov, Andriy Dobrovolskyy, I. Protsenko,
Institute of Physics, Kyiv, Ukraine
Alexander Khokhlov, Eugene Khokhlov, and Eugene Telesh
Izovac Ltd., Minsk, Belarus

This paper surveys plasma beam processes of LC alignment recently developed to overcome shortcomings of rubbing technique. The ion beam etching, ion beam sputtering deposition and their combinations are considered. The alignment modes, alignment parameters in these modes, alignment uniformity and stability issues are discussed. The focus is made on the equipment and process for the large area substrates, including fabs of modern generations. It is shown that the processing equipment based on the linear sources with a closed electron drift suits very well for the alignment treatment of large area substrates.

10.20-10.40 S3-4 **Influence of Electric Field and Light on an Easy Axis of NLC Confined by Rectangular Channel at Weak Surface Anchoring**

S.V. Pasechnik, A.V. Dubtsov, D.V. Shmeliova, V.A. Tsvetkov,
Moscow State University of Instrument Engineering & Computer Science, Moscow, Russia
Y.P. Panarin
School of Electronic & Communications Engineering, Dublin Institute of Technology, Ireland
V.G. Chigrinov
Hong Kong University of Science & Technology, Hong Kong

New experimental results are presented on combined action of light and electric field on a nematic liquid crystal in a rectangular channel at a weak surface anchoring. The first experimental study of slow surface dynamics at combined action of electric field and polarized light in new experimental geometry was performed. Influence of polarized light on spatial twist-like deformation of a director field induced by electric field was established.

Author Interviews of the Session 3 will be this day, 14.00–15.00 (during Poster Session) at the Red Hall

10.40–11.00 Coffee-break

Session 4: Field Emission Display Technologies / 9.20 – 10.40 / Blue Hall

Chair: **Gerrit Oversluizen,** *Philips, The Netherlands*
Co-Chair: **Maxim Sychov,** *St. Petersburg State Institute of Technology, Russia*

9.20–9.40 ***Invited Paper:*** **Preparation of $SrGa_2S_4$:Eu Thin Films Phosphors for FEDs**
S4-1 Y. Nakanishi, H.Kominami and K.Hara
Research Institute of Electronics, Shizuoka University, Japan
Y.Arai, T.Seino
The Japan Steel Works, Ltd, Yokohama, Japan

Green-emitting $SrGa_2S_4$:Eu thin film phosphors were prepared by the multi-source deposition and the RF magnetron sputtering techniques, and a thermal annealing at 850°C in atmosphere of 1% H_2S diluted with Ar. The films annealed at 850°C showed a maximum luminance of 58000 cd/m^2 under excitation with 10 kV and 60 μA/cm^2. The preparation of green-emitting $SrGa_2S_4$:Eu thin film phosphors by thermal annealing at temperatures higher than 850°C, and thermal annealing at lower than 600° under an assist with a laser annealing technique after the deposition or sputtering were investigated. Results indicate that the process of the laser annealing assists the improvement of both structural and luminescent properties.

9.40–10.00 **Emission Properties of Cathode from Randomly Oriented Carbon Nanotubes for FED**
S4-2 A.I. Zhbanov, Y.-C. Chang
Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan
N.I. Sinitsyn, and G.V.Torgashov
Saratov Branch of Institute of Radio Engineering and Electronics of RAS, Saratov, Russia

Emission properties of cathode from carbon nanotube film are experimentally and theoretically investigated. Our cathode resembles a dense carpet consisting from randomly wreathed nanotubes. Under the action of electric field the free ends of nanotube are built in parallel lines of intensity of a field. Emitting tubes come off at certain electrostatic forces. At further voltage increase other tubes begin to emit till the force is still insufficient to tear them off of a substrate.

10.00–10.20 **Big Video Screen Element with Field Emission Cathodoluminescent Light Sources as Pixels**
S4-3 A.S. Leychenko, N.N. Chadaev, E.P. Sheshin
Moscow Institute of Physics and Technology, Dolgoprudny, Russia
V.D.Blank, S.G.Buga
Technological Institute for Superhard and Novel Carbon Materials, Troitsk, Moscow Region, Russia

A big video screen module with cathodoluminescent light elements based on field emission is represented. Cathodoluminescent finger-size lamps photoelectric characteristics are discussed. The principle of video information representation by means of the lamps is shown.

10.20-10.40 **LCD-Backlighting Lamp Based on Field Emission**
S4-4 A.S. Leychenko, N.N. Chadaev, E.P. Sheshin
Moscow Institute of Physics and Technology, Dolgoprudny, Russia

Cathodoluminescent lamp with the field emission cathode made of carbon nanostructured materials is proposed as LCD-backlighting element. The principle of operation is discussed. Static and dynamic backlighting applications observed.

Author Interviews of the Session 4 will be this day, 14.00–15.00 (during Poster Session) at the Blue Hall

10.40–11.00 Coffee-break

Session 5: Liquid Crystal Display Technologies –1 / 11.00 – 12.40 / Red Hall

Chair: **Antony Lowe,** *Lambent Consultancy, UK*
Co-Chair: **Sergey Studentsov,** *R&D Institute "Volga", Russia*

11.00–11.20 ***Invited Paper:*** **Physical Interpretation of the Characteristics of LCDs Doped with Nanoparticles**
S5-1 S.Kobayashi, T.Miyama, Y.Sakai, K.Takatoh, T.Kineri, and H.Hoshi
Liquid Crystal Institute and Faculty of Science and Technology
N.Toshima
Advanced Material Institute and Faculty of Science and Technology, Tokyo University of Science, Yamaguchi, Japan

A physical interpretation of the characteristics of LCDs doped with the nanoparticles of metals and dielectric inorganic materials is presented. It is shown that LCDs doped with the nanoparticles of metal such as Pd and Ag/Pd are well characterized by dielectric characterization; while, those doped with the nanoparticles of inorganic oxides such as MgO and other oxides are also well characterized by the reduction of order parameter.

11.20–11.40 **Liquid Crystal Display with Special Response Improvement of the Nematic Mesophase**
S5-2 Natalie V. Kamanina, Peter Ya. Vasilyev,
Vavilov State Optical Institute, St. Petersburg, Russia
Andrey D. Shcherbina
Polar-TV, Moscow, Russia
Sergey S. Studentsov, Vladimir A. Brezhnev
Research&Development Institute "Volga", Saratov, Russia

As a new way to enhance the speed of the liquid crystal display elements, the fullerene- or nanotubes doping of the nematic mesophase has been used. The procedure indicated above improves the local and macropolarisation of the structures, thus it permits to increase the speed of the LC elements. The re-orientation of the liquid crystal dipoles under field action can be observed in the time range that is less than the one indicated for the non-sensitized structures. Thus, new way of the speed enhancement of nanoobjects-doped nematic liquid crystal has been demonstrated. In particular, a reaction time improves in 2...15 times, depending on LC type. Unique way to improve the relaxation time will be discussed.

11.40–12.00 S5-3 **Improvement of Electro-Optical Characteristics of PVA Mode Using UV-Curable Reactive Mesogen Monomer**

Seong Jin Hwang, Sung Min Kim, Sang Gyun Kim, Youn Sik Kim, Seong Han Hwang, Anoop Kumar Srivastava, and Seung Hee Lee
Polymer BIN Fusion Research Center, School of Advanced Materials Engineering, Chonbuk National University, Chonbuk, Korea

In the patterned vertical alignment (PVA) cell in which multi-domains are formed from the perfect vertical alignment through an oblique field only, the formation of disclinations between liquid crystal (LC) molecules is inevitable in the presence of an electric field, which lowers transmittance and the response time. In the proposed PVA device, the pretilt angle is formed in four different directions through the polymerization of an UV curable reactive mesogen monomer at the surface. In this way, the reorientation of LC responding to an electric field is well defined, and thus the device shows reduced threshold voltage and much improved response time in all gray scales.

12.00–12.20 S5-4 **Fast In-Plane Switching Mode in Cholesteric Liquid Crystals**

M.I. Barnik, L.M. Blinov, S.P. Palto, N.M. Shtykov, B.A. Umanskii
Shubnikov Institute of Crystallography, Moscow, Russia

A fast electro-optical modulation is discussed, which is based on the in-plane switching mode in a helical structure of a cholesteric liquid crystals. Experimentally, a contrast ratio of 140:1 (at $\lambda = 633$ nm) and sum of the both switch-on and switch-off times of about 2.7 ms are obtained. The numerical simulation shows that the contrast exceeding 1000:1 and switching times less that 1 ms could be achieved.

12.20–12.40 S5-5 **A Novel Design of the X Shape Pixel on Fringe Field Switch (FFS) Mode TFT LCD**

Andy Chao, C. H. Yu, and H. H. Wu
Tainan Science Park, Tainan County, Taiwan

A multi domain design of the pixel electrode structure in FFS Mode TFT-LCDs is presented. We simulated an X shape pattern for improving color shift and high transmittance. From analysis of LC texture and transmittance we could find out a four domains even eight domains by different X shape arrangements. Then, a novel FFS pixel structure with high transmittance and good color shift was proposed and demonstrated. As compared to traditional slant and zigzag FFS pixel, almost 6-20% transmittance improvement could be obtained.

Author Interviews of the Session 5 will be this day, 14.00–15.00 (during Poster Session) at the Red Hall

Session 6: Emissive Display Technologies –1 / 11.00 – 12.40 / Blue Hall

Chair: **Shigeo Mikoshiba,** *University of Electro-Communications, Japan*
Co-Chair: **Victor Vorobiev**, *SSC RAS, Russia*

11.00–11.20 S6-1 **Grayscale Linearity Improvement Using Modeling of Light Emission and Phosphor Saturation in PDP**

Sung-Jin Kang, Sang-Chul Kim, and Sung-Il Chien
School of Electrical Engineering & Computer Science, Kyungpook National University, Daegu, Korea

Estimating the output luminance for whole gray-levels is quite needed for high-quality image enhancement. To improve PDP grayscale linearity, a new modeling method is proposed to more exactly estimate an output luminance for the whole gray-levels by consideration of phosphor saturation and its recovery.

11.20–11.40 S6-2 **Technologies of Electrode Designs and Sustaining Pulse Conditions in High Xe Content Condition for High Efficacy PDP**

Toshiyuki Akiyama, Takashi Yamada, Yasuyuki Noguchi, Koji Shinohe, Masatoshi Kitagawa, Tsutae Shinoda
Central Research Laboratory, Advanced PDP Development Center Corporation, Hyogo, Japan

Under high Xe content conditions, the luminous characteristics are evaluated for the sustaining electrodes width and the sustaining pulse period. The proper designs for them in a high Xe content make it possible to obtain high luminous efficacy. It is found that narrower electrodes width gains higher luminous efficacy in a high Xe content.

11.40–12.00 S6-3 **Efficiency and Stability of RGB Phosphor Luminescence Excited by Low- Energy Electrons**

A.O.Dmitrienko, S.V.Kudryavtsev
Saratov State University, Saratov, Russia
A.V.Strel'tsov
Saratov Division, Institute of radioengineering and radioelectronics of RAS, Saratov, Russia
B.I. Gorfinkel, A.A. Khazanov
R&D Institute "Volga", Saratov, Russia

Factors determining the efficiency and stability of low-voltage (50-100 V) and middle-voltage (100-1000 V) cathodoluminescence of phosphors based on complex oxides, sulfides, and oxosulfides of some transition metals in full-color screens of flat vacuum fluorescent displays and field emission displays are considered. Special attention is paid to comparative cathodoluminescent characteristics of oxide and sulfur-containing red phosphors. The crystal matrix structure of RGB phosphors promising as the red, green, and blue components of full-color cathodoluminescent screens of vacuum fluorescent

displays and field emission displays has been determined.

12.00–12.20 S6-4 **Improvement of Optical Efficiency in White Light Emitting Organic Devices by Lateral Color Conversion**
Akiyoshi Mikami and Takahiro Koyanagi
Kanazawa Institute of Technology, Dept. of Electrical Engineering, Ishikawa, Japan

A high efficiency white-OLED has been developed based on a Side-Coupling-Color-Conversion-Method (SC^3M), in which the blue emission from an organic layer is laterally transferred to an adjacent orange color-conversion material. A highly efficient deep blue OLED was also developed and used as an exciting light source for color-conversion. A white-OLED with SC^3M structure showed an external quantum efficiency of approximately 9% with keeping (0.35, 0.26) in CIE color coordinates as long as fluorescent material is used. Basic concept is theoretically discussed.

12.20–12.40 S6-5 **Adaptive Gray-Level Method Based on Block-Based Motion Information for Enhancing Image Quality in PDP-TV**
Sang-Chul Kim, Sung-Jin Kang, Sung-Il Chien, Dong-Ho Lee, and Heung-Sik Tae
School of Electrical Engineering & Computer Science, Kyungpook National University, Daegu, Korea

Reducing DFC is quite needed for image quality enhancement under the ADS driving scheme, while keeping a good gray scale rendition. Proposed system can considerably improve the picture quality by using adaptive gray-levels according to the block-based motion information in PDP-TV.

Author Interviews of the Session 6 will be this day, 14.00–15.00 (during Poster Session) at the Blue Hall

12.40–14.00 Lunch Break

Author Interviews of Sessions 1,3,5 / 14.00 – 15.00 / Red Hall
Author Interviews of Sessions 2,4,6 / 14.00 – 15.00 / Blue Hall

Poster Session / 14.00 – 17.00 / Grand Hall Lobby

LCD Technologies

P 1: Transient Response Characteristics of Polymer Stabilized Bend Cell
Youichi Asakawa, Naoki Takatuka, Taiju Takahashi, Susumu Saito
Dept. of Electronic Engineering, Kogakuin University, Tokyo, Japan

It is shown that the transient response characteristics of the PSB cell are deteriorated by the polymer stabilization treatment. The increase of rotational viscosity γ_1 due to polymer stabilization is experimentally confirmed by the transient displacement current method. It is shown that the deterioration of transient characteristics of the PSB cell is caused by the increase of rotational viscosity and the decrease of flow velocity due to the changes of Leslie viscosities resulted from the polymer stabilization treatment.

P 2: Formation of Bi-Stable Anchoring Surface for Nematic LCs by Unidirectional Rubbing
Kazunori Shimoyama , Taiju Takahashi and Susumu Saito
Kogakuin University, Tokyo, Japan

A novel method is proposed to adapt bi-stable anchoring properties on the substrate. A mixed solution of PVCi and PI in same weight was used as an alignment material. The alignment material was coated on the substrate surface by a spin coater. After baking treatment, a conventional unidirectional rubbing was conducted. As an LC material, a single nematic compound, 5CB was used. It has been confirmed that two types of domains coexist in the sample cell, and molecules of liquid crystal align with the angle of +45 degree and -45degree with respect to the rubbing direction. When a voltage was applied using interdigital electrode, homogeneous state of alignment changed to twisted alignment. The twisted state memorized for a longer time than 50 h after the transition.

P 3: Study of Q- Tensor and Vector Approaches for OCB Mode
Sang Yeong Cho, Seung Soo Yang, Tae Young Won
Inha University, Incheon, Korea
Hyoung Jin Yoon
Sanayi System Co. Ltd, Incheon, Korea

We report our comparative study on the implementation of Q tensor method into three-dimensional finite element method (FEM) numerical solver to the conventional vector approach. Our study confirmed that Q Tensor implementation is more appropriate for OCB analysis than the vector method.

P 4: A Driving Method for Enhancing the On-Off Response Time at Low Temperature
Jong deuk Moon, Eung sang Lee, Han Gu Lee
Development Center, LCD Business, Samsung Electronics CO., Asan, Korea
Suk ki Kim
Korea University, Seoul, Korea

A compensation for slow response time in low temperature condition has been designed and simulated. LC Response time depends on several factors such as mechanical or electrical one. In this work, we proposed compensation method by using the characteristics of voltage dependency that could compensate temperature dependency of LC. For this, we adopted variable white gamma voltage instead of conventional fixed one in gamma reference voltage generator.

P 5: A Driving Method for Enhancing the Driving Capability at Low Temperature

Jong deuk Moon, Eung sang Lee, Han Gu Lee
Development Center, LCD Business, Samsung Electronics CO., Asan, Korea
Suk ki Kim
Korea University, Seoul, Korea

Integration of driving circuits in TFT glasses could make a-Si TFT LCDs more competitive due to overall cost reduction, compactness and improved mechanical reliability. However, it has some limitations such as low carrier mobility, high parasitic capacitances and the instability of a-Si TFTs with time and temperature for integrated row driver circuits. Generally, it has been used for compensation method for these limitations to enhance driving capability low temperature using diode temperature characteristics. But, this method can make a side effect such as gamma change and increase the power consumption due to increased gate level. This work suggests driving method that compensates the driving capability in low temperature through gradual change of gate on voltage with gate line.

P 6: STN Liquid Crystal Display with 3-D Electrodes

S.A. Studentsov, V.A. Brezhnev
R & D Institute "Volga", Saratov, Russia
V.G.Chigrinov, A.A Muravsky
Hong Kong University of Science and Technology, Hong Kong

The main lacks of passive matrix STN LCDs are frame response and "off-state" charge accumulation. As result, the multiplex level is limited, electro-optical parameters are worsened and the power consumption is increased. Construction without those imperfections is suggested in this article. Multi-layer 3D electrodes consist of conventional electrode on the substrate surface and conducting film on isolating pedestal tops. Those pedestals are placed between the surface electrode rows or columns like a black mask. The pedestal thickness is equal to 1/4 - 1/2 of the LC-layer one. The received results allow improving electro optical characteristics of passive-matrix displays. Contrast ratio up to 220:1 is realized at the total response less than 20 ms for static drive. Contrast ratio 100:1 and total response 75 ms for multiplex 1/64 has made with initial 1/16 limited LC mixture.

P 7: Liquid Crystal Display with Controllable Viewing Angle

Woo-Jung Shin and Taeyoung Won
School of Electrical Engineering, Inha University, Incheon, Korea

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

P 8: Diffraction Properties of Holographically Formed Polymer-Dispersed Liquid Crystals

G.M. Zharkova, I.V. Samsonova, S.A. Streltsov, V.M. Kchachaturyan, A.P. Petrov
Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk, Russia

We present the results of the experimental investigation of polarization characteristics of electrically-controlled Bragg transmission gratings formed with the holographic recording on polymer-dispersed liquid crystals (PDLC). Field dependencies of the diffraction efficiency of the gratings for s- and p-polarization of the reading beam have been obtained, and the alignment of the nematic liquid crystal director has been defined in the PDLC-planes of the grating for the diffraction state.

P 9: Behaviour of Compensation Voltage in LCOS Panels

Dieter Cuypers
IMEC vzw, TFCG, Technologiepark B-914, Zwijnaarde, Belgium
André Van Calster, Herbert De Smet
Ghent University, ELIS Department, TFCG, Technologiepark B-914, B-9052 Zwijnaarde, Belgium

Measurement data on the Vcom drift behaviour of LCOS panels with inorganic alignment layers is presented. Differences with polyimide coated cells are observed, as well as an influence of alignment layer thickness, the initial electrical field and the driving frequency on the evolution of Vcom with time.

P 10: Electrooptics and Dynamics of Light-Scattering FLC Structures

Alexander L. Andreev, Tatiyana B.Andreeva, Evgene P.Pozhidaev, Igor N.Kompanets, Yury P.Bobylev, Vadim M.Shoshin
Lebedev Physical Institute, Moscow, Russia

Devices based on helix free FLC with high spontaneous polarization (P_s>100nC/cm^2) reveal unique properties. One of them a strong light scattering with fast switching on/off is observed in a display cell at definite conditions, and this phenomenon is very desirable for polarizer-free fast optical shutters. It is shown that mentioned properties are based on common physical background, namely: on spatial non-uniformities of the FLC director that is a consequence of the spontaneous polarization excess.

P 11: Ferroelectric Liquid Crystals for Volumetric Displays: Optical Model of Transient Light Scattering

Valery A. Loiko, Alexander V. Konkolovich, and Alexander A. Miskevich
Stepanov Institute of Physics, Minsk, Belarus

A model to describe transient light scattering in ferroelectric liquid crystal cells is proposed. The dependence of electrooptical response on characteristics of the medium and applied electric field is investigated. The results for coherent transmittance of the liquid crystal cell at the square pulses of applied voltage are presented.

P 12: Modulation of Light Polarization by Polymer Films with Small Nematic Liquid Crystal Droplets

Valery A. Loiko, Alexander V. Konkolovich, Polina G. Maksimenko
Stepanov Institute of Physics, Minsk, Belarus

Light transmission through a polymer cell with nanosized bipolar liquid crystal droplets is considered theoretically. Methods of scattering-media optics are used to describe the coherent (regular, ballistic) component of light transmitted through polymer-dispersed liquid crystal cell. Main attention is devoted to the description of the field controlled polarization state of the transmitted light. The conditions providing linear and circular polarization of light are studied in details. Concept of multilevel order parameters to describe the alignment of LC molecules in the cell is used. The obtained theoretical results are in reasonable agreement with available experimental data.

P 13: Threshold Voltage in PDLC Film Depending on Nematic Droplet Form

A.V. Shabanov, O.O. Prishchepa, V.Ya. Zyryanov
Kirensky Institute of Physics, Krasnoyarsk Scientific Centre of SB RAS, Krasnoyarsk, Russia

The reorientation processes in polymer dispersed nematic liquid crystal films are considered by numerical simulation for the case of the strong tangential anchoring at the interface. The dependence of threshold field (electric and magnetic) on the droplet's form is analyzed. As shown, it is approximately a linear function at small deviation of the droplet's form from the spherical one.

P 14: Light Valve Based on Photonic Crystal with LC Layer

V.A. Gunyakov, V.Ya. Zyryanov, S.A. Myslivets, V.G. Arkhipkin, V.F. Shabanov
L.V. Kirensky Institute of Physics, Krasnoyarsk Scientific Centre of SB RAS, Krasnoyarsk, Russia

Photonic crystal/liquid crystal cell consists of two identical multilayer mirrors deposited on the glass substrates with ITO electrodes. The gap between the mirrors was filled by the nematic liquid crystal aligned planar in the initial state. The nematic layer plays a part of the defect in the regular structure causing the appearance of the spectral windows (defect modes) inside the photonic crystal bandgap. The cell was placed between two crossed polarizers. The transmittance for the light passed through the valve depends on the matching of wavelengths for the defect modes of two polarizations and their relative phase retardation. In turn the spectral position of defect modes and the phase retardation are controlled by applied voltage that may result both in the addition and diminution of the defect modes intensities. This effect has been demonstrated within the spectral range corresponding to one of the defect modes.

P 15: Diffraction on Birefringent Elements with Sine Surface Microrelief

V.V. Belyaev
Samsung Research Center, Moscow, Russia
V.M. Novikovich
Moscow Region State University, Moscow, Russia

Light diffraction on optically anisotropic substrates with the sine surface microrelief has been calculated by using the OAGSM method. Varying the microrelief depth and material birefringence allows to realize different polarization state of the light beam transmitted or reflected by the substrate. The approach can be used in LCD backlight and control of light beams propagation for different purposes.

P 16: The 7-(4-Arylidene)Hexahydroindazoles as a New Type of Chiral Dopants to Liquid Crystalline Systems

V.V.Abakumov, L.A. Kutulya, N.I. Shkolnikova, N.B.Novikova, N.S. Pivnenko,
STC "Institute for single crystals", Academy of sciences of Ukraine, Kharkov, Ukraine

Chiral dopants of new type, *viz*., (7*E*)-7-(4-alkyloxybenzylidene)-3,3a,4,5,6,7-hexahydro-3-(4-alkyloxyphenyl)-2,6-dimethyl-2H-indazoles (alkyl = OCH_3, OC_2H_5) have been synthesized by the interaction of the corresponding chiral 2,6-*bis*-arylidene-(3*R*)-methylcyclohexanone with the methylhydrazine. LC compositions with the visible selective light reflection were prepared on the base of the E-63 nematic containing 11 mass % of chiral dopant. Chiral compounds of such a type are of significant interest as chiral components to induced cholesteric liquid crystals.

P 17: Inverse Electromechanical Effect in Ferroelectric Liquid Crystals

E.V.Popova, A.P.Fedoryako, L.A.Kutulya, V.V.Vashchenko
STC "Institute for Single crystals", Kharkov, Ukraine

Inverse electromechanical effect in ferroelectric liquid crystals (FLC) with various macroscopic parameters, *viz*, a spontaneous polarization, a rotational viscosity and a smectic tilt angle has been investigated. The nonlinear electromechanical connection has been found. The effectiveness of the inverse electromechanical transformation under different temperatures has been researched. The correlation between the inverse electromechanical response parameters and the macroscopic FLC parameters has been revealed. The satisfactory description of experimental data was obtained by the theory of the nonlinear electromechanical response.

P 18: Functional Optical Films with Negative Birefringence Based on Lyotropic Chromonic Liquid Crystals

O.P. Boiko, R.M. Vasyuta, and V.G. Nazarenko
Institute of Physics NAS Ukraine, Kyiv, Ukraine
Yu.A. Nastishin
Institute of Physical Optics, MES of Ukraine, Lviv, Ukraine

We present a result of study of optical properties of films with high negative birefringence. Thin films are produced from an aqueous solution of lyotropic chromonic liquid crystals (LCLC) molecules and may be successfully implementated in LCD technology as compensating layers of different types.

P 19: Modeling of Compaction of Display Glass Substrate by Relaxation Model of Glass Transition Based on Published Data

Yurii Startsev
Glass Properties Department, Thermex Ltd., St.-Petersburg, Russia

The presented paper has been illustrated applying of relaxation model of glass transition (RMGT) to the problem of compaction value predicting of display glass substrate. Because we compare our calculated results with published data, where some details of experiments were omitted, some of our results are not so good yet. Anyway, we came to conclusion that there is not any universally accepted model for compaction but RMGT.

P 20: The Dependence of Optical Properties of Si_3N_4 Films on Technological Regimes of Deposition

E. Khokhlov, Nastochkin S.M., Boyarenko T.B, Kostuchenko V., Yurevich D.N
IZOVAC Ltd, Minsk, Belarus

The dependence of optical properties of films of silicon nitrogen on ion beam sputtering technological regimes is presented. The dependence of refractive index and absorption coefficient on ion source power, distance between target and substrate, gas mixture proportion, residual pressure in vacuum chamber, and also type of target is shown. The analysis of films, which were deposited by ion beam sputtering from silicon target and ceramic target of silicon nitrogen, was curried out. Moreover the possibility of production of SiO_xN_y structure is shown. Refractive indexes of deposited Si_3N_4 films are in range 1.95 – 2.05. It magnitude depend on technological regime and its reproducibility is +/- 0,01.

P 21: Optimize Radiant Intensity of Backlight System by Taguchi Method

Yi-Chin Fang, Shih-Hao Chemg
Institute of Electro-Optical Engineering, National Kaohsiung First Univ. of Science and Technology, Taiwan
Kuo-Ying Wu
Institute of Engineering Science and Technology, National Kaohsiung First Univ. of Science and Technology, Taiwan

This research proposes a newly developed method for the optimization of a backlight mould by advanced research into light scattering with different optical materials; the task of reflecting the passive factor of the colormetry on the board, the influence of the reflecting ratio, numbers of particles, the diameter of particles and the surface area are comprehensively considered. Optical simulation software is employed in this research in order to achieve the greatest possible efficiency of light transmission and uniformity from the point of view of variable optical materials and their optical properties. The system optimization employs the Taguchi method to optimize performance. Results show success in the optimization of the backlight module, especially in larger ones applied to liquid crystal display television.

P 22: Simulation for Minimizing the TFT-LCD Flicker and Gray Scale Error

Jung Bok Lee, Bum Gu Cho and Taeyoung Won
School of Electrical Engineering, Inha University, Incheon, Korea

We present a novel method to minimize flicker and gray scale errors automatically across the entire panel by using a compensation of the gray levels of image. It was realized by image simulation with feedback structure. As a result of simulation, we observed flickers from the simulated image. And we compensated the gray scale levels for original image. The compensated gray scale levels correspond to flickers which are generated by difference of pixel voltage in odd and even frame. And we simulated repetitively the compensated image by our block diagram for reduction flicker. Consequently, we confirmed flickers have been decreased more than 87%. Furthermore, our method provides visualization and valid prediction for improvement of TFT-LCD panel.

P 23: A Novel Structure And Process For Improving Image Sticking

Jung Woo Lee, Hyun Seok Hong, Ki Suck Cha, Jung Young Lee, Bae Won Lee
Development Center, LCD Business, Samsung Electronics Co., Asan, Korea
Junsin Yi
Sungkyunkwan University, Suweon, Kyenggi, Korea

Image Sticking caused by the spatial difference of photo leakage current in a-Si:H TFT LCDs has been investigated and improved. When a mosaic pattern which is a image sticking pattern in TFT LCDs is displayed repeatedly over a long time, Image Sticking is shown in case a-Si:H TFT's leakage currents of white pattern and black pattern are different. After being displayed long time, the photo leakage currents of black pattern region are lower than white pattern region. This phenomenon has been investigated physically and electrically. There is no Image Sticking at proposed TFT pixel and process architecture.

P 24: Effect of Domain Size in Pattering Technology on Anchoring Properties of Liquid Crystal Alignment Materials

Anatoli Murauski, Vladimir Chigrinov, Hoi Sing Kwok
Hong Kong University of Science and Technology, Hong Kong

Micro- and nano- patterned alignment for realization of LC configuration with high pretilt angle was investigated. The patterning is performed in such way that the patches, which induce different alignment directions at the surface, cooperate to induce a single resultant alignment direction in the bulk of the LC layer. In order to achieve uniform LC alignment in the bulk from non-uniform alignment patches on surface, the size of the alignment patches has at least one dimension that is much smaller than the thickness of the liquid crystal layer. Numerical calculation was used for investigation of the orientation effect on patterned alignment layers.

P 25: The Effect of Nanopatterning using Rigiflex Mold on Liquid Crystal Alignment

Jong Bok Kim, Jong Tae Kim, Kyung Chan Kim, Han Jin Ahn, Byoung Har Hwang, Hong Koo Baik
Department of Materials Science and Engineering, Yonsei University, Seoul, Korea
Ju Ri Lim, Chu Ji Choi, Youn Sang Kim
Center for Intelligent Nano-Bio Materials and Division of Nano Science, Ewha Womans University, Korea

The nanopatterning using rigiflex mold is introduced to solve the several problems, such as difficulty to generate the pretilt angle and to control the liquid crystal (LC) rising-up direction and low optical property, in general patterning techniques for LC alignment. The rigiflex mold allows the mold to peel off with directionality, followed by orientation of the free end chain of alignment layer with physical groove. The oriented free end chain induces the preferential direction of LC molecules in LC driving, solving the problems such as pretilt generation and control of LC rising-up direction. In addition, nanometer-scale pattern improves the optical property, such as brightness. This is attributed to the increase of LC order parameter and suppression of diffraction in nanometer-scale pattern. As a result, these results show the potential of nanopatterning technique as an alternative alignment method.

P 26: Carbon – Containing Covering for Anchoring Breaking Nematic Microdevices

S.I. Kucheev
Belgorod State University, Belgorod, Russia
P.M. Litvin
Institute of Semiconductors Physics, Kiev, Ukraine
V.N. Tkach
Institute of Superhard Materials, Kiev, Ukraine
V.G. Chigrinov
ECE Dept, Hong Kong University of Science and Technology, Hong Kong

We demonstrate experimentally, that in residual atmosphere of scanning electron microscope the nano-scale carbon-containing (hydrocarbon) films by snuff effect can be produced. The micropattern of carbon film including axial-symmetric ones is defined by the e-beam raster. The areas of alignment of liquid crystal molecules precisely repeat the micropattern of carbon containing films with micron resolution. Liquid crystal 5CB on CH film demonstrates a breaking anchoring under simultaneous action of the ac voltage and liquid crystal material flow. AFM analysis of CH films obtained by electron beam enables to conclude that there exists the direction which defines the azimutal alignment of liquid crystal molecules on CH surface.

P 27: Alignment of Nematic Liquid Crystal Molecules by the ITO Films Modified in Glow Discharge Plasma

Yu.Kolomzarov, P.Oleksenko, V.Sorokin, P.Tytarenko, R.Zelinskyy
Lashkarev Institute of Semiconductor Physics, NAS of Ukraine, Kyiv, Ukraine

Influence of ionic and plasma treatment on orienting properties of the ITO films was investigated. The stable tilt angle generation of nematic liquid crystal (NLC) molecules was attended. Dependences of NLC molecules tilt angles from different technological regimes of the ITO films deposition were shown. Results of orienting films surfaces investigation by the atomic-force microscopy (AFM) showed the viscous-elastic mechanism of nematic liquid crystal molecules alignment by the modified ITO films.

Emissive Display Technologies

P 28: Field Emission Characteristics of CNT Paste Emitters Modified by Ar Ions Irradiation

Sang Jik Kwon, Hyung Seok Han, Eou Sik Cho, Dal Ho Lee, Min Hyung Ahn, Zhao Hui Li, Kwang Ho Kim, and Sung Jae Hong
Electronics Eng., Kyungwon University, Seongnam, Korea
Jong Sung Kim
Chemical Eng., Kyungwon University, Seongnam, Korea

Ar ion bombardment was applied as an effective surface treatment method for obtaining the carbon nanotube field emission array (CNT FEA). The photo sensitive CNT paste was screen-printed. Then, the back-side was exposed to UV light. After that, the exposed CNT paste was selectively remained by development. After post-baking, the remaining CNT paste was bombarded by accelerated Ar ions for removing some binders and exposing only the CNTs. As a result, the field emission characteristics were strongly dependent on the accelerating energy. At 100 eV, the emission was highest and as the acceleration energy increased to more then 100 eV, the emission decreased. This was a result of the removal of the CNT itself as well as the binders.

P 29: CNT Emitter Coated with Titanium Oxide Nanoparticles for FED Application

Youngmin Choi, Jong-Ung Kim, Byong-Hwan Ryu
Advanced Materials Division, KRICT, Yuseong, Daejeon, Korea
Heesung Moon, Jaemyeong Kim
SAMSUNG SDI Co., Kiheong, Yongin, Korea

Carbon nanotubes (CNTs) have used as an electron emitter of the field emission display (FED) due to their characteristics of high-electron emission, rapid response and low power consumption. However, to commercialize the FED with CNT emitter, some fundamental problems regarding life time and emission efficiency have to be solved. In this study, we investigated the TiO_2 coated CNT as a field emitter. TiO_2 nanoparticles can coated on CNT surface by chemical solution method. The size of TiO_2 nanoparticles were uniform with the average size of about 2.4 nm to 3.1 nm. The crystallinity of nanoparticles on CNT surface improved by heat treatment in hydrogen atmosphere. Field emission performance of TiO_2 nanoparticle coated CNT was characterized and tested.

P 30: Application of Carbon Nanofiber Coated with Pt Nanoparticles to FED

Youngmin Choi, Won-Woo Lee, Beyong-Hwan Ryu
Device nano materials center, KRICT, Daejeon, Korea

We prepared CNF (carbon nanofiber) by the solvothermal method for FED applications. We controlled several conditions to synthesize effective CNF for field emission applications. Nano-sizesd Pt nanoparticles were coated on the CNF. In this study, we have applied Pt nanoparticles- coated CNF which can be produced in mass, to field emission application.

P 31: The Electron Beam Microdisplay of the High Resolution Based on Field Emission Cathode Unit

N.A.Djuzhev, M.A.Makhiboroda, S.A.Gudkova
Lukin State Research Institute for Physical Problems, Zelenograd, Moscow, Russia
V.E. Skvortsov
Videoelectronica Co., Zaprudnya, Moscow region, Russia

In the given work creation of new type vacuum cathode-luminescence indicator on field emission is described. Feature of the considered device is use of the field emission cathode unit, made on technology MEMS. This structure includes single field emission cathode with high aspect ratio and components of formation and focusing of an electronic beam. As a result, in the given type of devices advantages of all known types of FED-indicators and conventional CRT's are combined. Experimental characteristics of emission of 2-electrode cathode unit and micro CRT with single field emitter were obtained. The special attention was given to increase of stability of emission current and durability of the cathode.

P 32: Simulation of Electrophysical Processes in Planar Field Emission Structures based on Carbon Nanotubes

N. P. Abanshin, B. I. Gorfinkel,
Federal State Unitary Enterprise "R&D Institute "Volga", Saratov, Russia
A. N. Yakunin
Institute of Problems of Precise Mechanics and Control, Saratov, Russia

The paper presents a mathematical model of computation and investigation of electro-physical processes in planar field emission structures on the basis of carbon nanotubes. For reduction of dimensionality of the numerical model an assumption of existence of the translation symmetry was used. Effect of height of nanotubes and deposition density of them to the cathode surface on the level of electric field intensityon the micro tip surface was studied.

P 33: The Electron Gun for Field Emission Light Sources with Carbon Fibers Cathode Design Improvement

A.S.Leychenko, M.Yu.Leshukov, N.V.Luparev, P.A.Starikov, E.P.Sheshin
Moscow Institute of Physics and Technology, Dolgoprudny, Moscow Region, Russia

The problem of efficient light source production is considered. Field emission is proposed as the free electrons producing method for the cathodoluminescent light source. An improved electron projector is designed and vacuum cathodoluminescent lamp is created. The lamps produced show high and stable photoelectric characteristics and can be used in various fields of light sources application.

P 34: Selective CNTs Growth on Si/SiO_2 Surfaces for Micro Field-Emission Display Technology

Boris G. Shulitski, Alena L. Prudnikava, Vladimir A. Labunov
Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus

Growth selectivity of carbon nanotube (CNT) arrays on the top of Si/SiO_2 topology with the use of atmospheric CVD method has been investigated. The successfully achieved conditions of reversible CNTs growth both on Si and SiO_2 surfaces were found to be sensitive to gas-carrier flow rate and catalyst/hydrocarbon solution injection rate. The prevalence of different active sites on Si and SiO_2 surfaces at different flow rates of gas mixture can explain the different ways of catalyst precipitation followed by subsequent CNTs growth. The principal opportunity of such a growth will allow to decorate substrate with field-emitters of precise-geometry and to avoid the catalyst localization step in the FED technology.

P 35: Polymer-Semiconductor Nanocomposites Thin Films for Field Emission Displays

A.V. Kukhta, E.E. Kolesnik,
Stepanov Institute of Physics, NAS of Belarus, Minsk, Belarus
S.A. Vorobyova, A.I. Lesnikovich, A. Kudlash
Belarusian State University, Minsk, Belarus
P.K. Khanna
Centre for Materials for Electronics, Pune, India

Highly luminescent nanocomposite thin film consisting of polyfluorene with imbedded CdS nanoparticles are developed. Strong cathodoluminescence has been observed under irradiation by a pulsed high energy electron beam giving a new conception to create a printable screen for field emission display. The spectrum of cathodoluminescence contains emission of both polyfluorene and CdS nanoparticles, forming white light. The addition of CdS nanoparticles was found to increase the radiation stability of polyfluorene film in ambient conditions.

P 36: Studying Luminescence (ZnMg)O

Vorobiev V. A.
Laboratoy of nanochemistry and nanotechnology, SSC RAS, Stavropol, Russia

Studying the radiation spectrum dependence (ZnMg)O on the maintenance magnesium oxide has shown, that shift of a radiation maximum from 515 nm for zinc oxide up to 480 nm for samples containing up to 12 mol.% MgO is observed. A low-voltage cathodoluminescence spectrum as well as chromaticity coordinates coincide with those at high-voltage excitation. Cathodoluminescence low-voltage brightness is 8 times decreased at the phosphors structure content at 12 % a pier of magnesium MgO. One of the reasons of luminescence intensity fall of (ZnMg)O at increase of the contents magnesium oxide in the field of solid solutions existence, is the general reduction of luminescence centres concentration. The second reason of brightness reduction in a number of solid solutions (ZnMg)O is the reduction of coherent dispersion of X-rays area sizes.

P 37: Studying of $Y_3Al_{5-x}Sc_xO_{12}$:Ce Photoluminescence

V. Vorobiev
Laboratoy of nanochemistry and nanotechnology, SSC RAS, Stavropol, Russia,
N. Karrgin, B. Sinelnikov
North Caucasus State Technical University, Stavropol, Russia

The study of physicochemical characteristics and light-technical data interdependence with $Y3Al5_{-x}Sc_xO_{12}$:Ce phosphors synthesis conditions has been carried out. The samples of $Y3Al5_{-x}Sc_xO_{12}$:Ce composite were obtained by method of burning. The observed changes in garnet spectral characteristics with scandium content indicate the following: when the scandium content in YAG:Ce is increased, the crystalline field effect on Ce^{3+} ion external shell is reduced. Garnets with scandium are not single-phase by composition and obtained phosphors have low light-technical data.

P 38: UV-Emitting Y_2O_3:Gd Film

M.M. Sychov
St. Petersburg State Institute of Technology, St.Petersburg, Russia
Y. Nakanishi, H. Kominami
Shizuoka University, Hamamatsu, Shizuoka, Japan

UV-emitting Y_2O_3:Gd thin films for cathodoluminescent applications were fabricated by electron-beam evaporation. Films are suggested for FED screen design using UV-emitting CL phosphor, emission of which is further converted into visible blue, green and red light by efficient organic phosphors. Organic layers are easy to pattern using ink-jet printing technique.

P 39: Co-Dopant Effects of Mn^{2+}-Activated $MgGa_2O_4$ Phosphor Under VUV Excitation

Young-Min Moon, Sungho Choi, , and Ha-Kyun Jung
Advanced Materials Division, Korea Research Institute of Chemical Technology, Daejeon, Korea
Sang Ho Lim
Department of Materials and Engineering, Korea University, Seoul, Korea

Luminescent properties and co-dopant effects of manganese-activated $MgGa_2O_4$ phosphor were investigated under VUV excitation. $MgGa_2O_4$:Mn exhibited an intense green emission with the spectrum centered at 503 nm and the sensitizer Eu and Ce improved the radiant efficiency and decay time characteristics. In addition, the excitation efficiency strongly depends on the bonding energy and degree of inversion of host materials. In case of optimum compositions, manganese-activated $MgGa_2O_4$ phosphor could be one of the potential green-emitting PDP phosphors.

P 40: Influence of Bi Dopation of Polycrystalline Y_2O_3 Matrixes on Their Eu^{3+} Luminescence

V.P.Dmitrienko, A.O.Dmitrienko, S.L.Shmakov, S.V.Kudryavtsev
Saratov State University, Saratov, Russia
A.V.Strel'tsov
Institute of Radioengineering and Radioelectronics, Saratov Division of RAS, Saratov, Russia

The phenomenon of Eu^{3+} luminescence sensibilization in yttrium oxide on Bi dopation has been established. The presence of Bi^{3+} ions leads to the appearance of recombination luminescence with Bi ions involved at low (not higher than 6-8 at %) concentrations of the major activator and to raising the threshold of own concentration quenching of its luminescence. Besides recombination Bi luminescence, intracentric luminescence due to Bi^{3+} at the crystal site position with no overlap of their electronic shells with the conductivity band of the crystal has been found.

P 41: A Comparison Study of the Effect of He-Xe and Ne-Xe Mixtures on the Excitation Efficiency of the Plasma Display Panel

A. Khorami, F. Bahmani
IRIB College, Tehran, Iran
M. Fathipour,
University of Tehran, Tehran, Iran

Each cell in a plasma display panel (PDP) is activated by discharge of a mixture of a rare gas such as He or Ne and the excitation of a main gas such as Xe. Due to the limitation in increasing Xe partial pressure, the luminous efficiency of PDP is usually lower than that of Cathode Ray Tube (CRT). In this paper we have investigated the effect of mixture composition on the microdischarge cell efficiency. We show that the excitation efficiency in He-Xe mixtures is lower than that of Ne-Xe mixtures. Adding a small amount of Ar in a Ne-Xe mixture increases cell efficiency, while for He-Xe mixtures cell efficiency is reduced.

P 42: Characterization of MgO Protective Layer Using Nanopowders Prepared by RF Plasma

Seung Dueg Choi, Eon Byeong Park, Young Joo Lee, Jong-Il Park, Choong Jin Yang
Research Institute of Industrial Science and Technology, Pohang, Korea

MgO thin films are widely used as dielectric layers of plasma display panel (PDP). Secondary electron emission coefficient γ of the thin films is a key factor for reduction of electric consumption of PDP. In this study, nanopowders of MgO are synthesized by radio frequency (RF) plasma technique. Their structure, morphology and particle size distributions are determined. Their secondary electron emission coefficient and the electrical properties of thin film from single and poly crystal MgO powders were investigated. The films were made using electron beam deposition. The crystallinity and microstructure of thin film were determined by XRD and SEM. By using nanopowders of MgO, the deposited films showed good secondary electron emission coefficient values than conventional MgO films.

P 43: Nano-sized Y_2O_3:Eu Phosphor Particles Prepared by RF Plasma Combustion

Jong-Il Park, Eon Byeong Park, Young Joo Lee, Choong Jin Yang, Seung Dueg Choi
New Materials & Components Research Center, Research Institute of Industrial Science and Technology, Korea

Nano-sized Y_2O_3:Eu phosphor particles were synthesized by radiation-frequency(RF) plasma combustion technique using spraying suspension containing micron Y_2O_3 powder and europium nitrate precursors. The experiments carried out to study the influence of parameters (generator plate power, reactor pressure and solution concentration) on the synthesized particle size. The results indicated that suspension concentration is the most important factor for the particles size. Changing the plasma plate power also had the effects on the synthesized particles size. As-prepared Y_2O_3:Eu nanoparticles for red phosphor had diameters from 60 to 150 nm and showed the main emission peak of particles at 610 nm, which corresponds to the red emission. The Y_2O_3:Eu phosphor particles post-heat treated at 1000 ◦C and showed higher photoluminescence intensity than as prepared-particles and the micron-sized Y_2O_3:Eu product prepared by solid-state reaction method.

P 44: On Mechanism of Anomalous Superlinear Intensification of Cr^{2+} Ion Emission in ZnS:Cr TFEL Devices

M.A. Mukhlyo, N.A. Vlasenko, P.F. Oleksenko, Z.L. Denisova, L.I. Veligura
Institute of Semiconductor Physics, NAS of Ukraine, Kyiv,Ukraine

For the first time, an anomalous enhancement of the Cr^{2+} ion emission intensity (I) with increasing voltage (V) is discovered in ZnS:Cr TFEL devices instead of the typical saturation in the $I(V)$ dependence. In addition, I depends very superlinearly on the transferred charge in this case. The I enhancement is accompanied by the rise of the sample temperature up to 40 - 50°C. However, there is no change in the EL spectrum. The above effects is explained by the thermofield $Cr^{+} \rightarrow Cr^{2+}$ recharging.

P 45: Customer Tailored EL Display

O. Berezin, B. Gorelik, M. Voskoboinik
MOBIChem Scientific Engineering Ltd, Zur Hadassa, Israel

O. Saksagansky
MIDIPrint Co., Moscow, Russia

The original technology of Customer Tailored EL Displays has been developed. Such displays can find a wide application as personal signs, invitation tickets, greetings, etc. The samples of above EL Displays were manufactured with usage of EL pastes for screen print by MOBIChem Scientific Engineering Ltd. The EL displays have satisfactory brightness (about 100 cd/m2) and durability (customer life time more than 5000 hours).

P 46: High Dielectric Constant Polymer for Display Applications

S.V. Mjakin, A.L. Zagranichek, M.M. Sychov, V.G. Korsakov
St-Petersburg State Institute of Technology, 26, St-Petersburg, Russia
I.V. Vasiljeva
Technology Center RADIANT, Ltd., St-Petersburg, Russia
A.G. Rodionov, L.L. Ejenkova
Joint Stock Company Plastpolymer, St-Petersburg, Russia

The modification of cyan esters of poly(vinyl alcohol) (CEPA) useful as a binder in composites for electroluminescent displays by electron beam irradiation at the optimum absorbed dose about 150 kGy is found to provide up to 2.5 times growth of its dielectric constant in combination with a considerable increase of its optical transparency in the visible region. The origin of this effect promising for the enhancement of CEPA application efficiency is discussed on the basis of the data of UV-vis and IR-spectroscopy.

P 47: A Sacrificial Layer Process for the Fabrication of Top Emission OLEDs

Sung Mook Chung, Chi-Sun Hwang, Jeong-Ik Lee, Sang Hee Ko Park, Lee-Mi Do, and Hye Yong Chu
IT Convergence & Component Lab., Electronics and Telecommunications Research Institute, Deajeon, Korea

We report on enhancement of luminance characteristics in top emitting organic light emitting diode with a sacrificial layer. Cr/Al/Cr multilayer was used as an anode of TEOLED and Cr etched Cr/Al layer was also prepared. The sacrificial layer was removed before deposition process of organic layer to avoid oxidation problem of Al layer. Using this process, we have successfully fabricated TEOLED with Cr/Al anode and improved device performance was obtained, which might be explained by high reflectance of the anode.

P 48: Low Voltage Organic Light-Emitting Devices with New Electron Transport Layer

Mi-Young Ha, So-Youn Kim, Dae-gyu Moon
Department of Materials Engineering, Soonchunhyang university, Asan, Korea

Low voltage operation of organic light-emitting devices (OLEDs) is one of the critical issues on realizing low power consumption display. We have developed the new electron transport layer for the low voltage operation of OLEDs. The device having a structure of ITO/2T-NATA/DPVBi : rubrene (1%)/DPVBi/new ETL/LiF/Al have been used. The thickness of new ETL was varied to 20, 60, 80, and 100 nm. The brightness rapidly increases as the driving voltage. The voltage for achieving 1,000 cd/m^2 was 3.0 V, whereas the turn on voltage for the brightness of 1 cd/m^2 was 2.1 V with 60 nm thick new ETL.

P 49: Tuning the Emission Characteristics of Transparent Organic Light-Emitting Devices with CsCl Passivation Layer

So-Youn Kim, Mi-Young Ha, Dae-gyu Moon,
Department of Materials Engineering, Soonchunhyang University, Korea
Chan-jae Lee , Jeong-In Han
Information Display Research Center, Korea Electronics Technology Institute, Korea

We have developed the transparent passivation layer for transparent organic light-emitting devices (TOLEDs) using CsCl layer. The CsCl passivation layer improves the optical transmittance of Ca/Ag double layer which have used as a semitransparent cathode, resulting in substantial increase of the luminance by the enhanced light extraction out of the TOLEDs.

P 50: Effects of Al Doping to ZnO Nanorods in Inorganic EL Device Including ZnO Nanorods

Tomomasa Satoh, Kazumoto Takizawa, Takunori Shinao and Takashi Hirate
Kanagawa University, Yokohama, Japan

In inorganic AC electroluminescence(ACEL) device including ZnO nanorods layer as an intermediate layer for lowering of operation voltage, the effects of Al doping into ZnO nanorods on EL characteristics were studied. The Al doping was significantly effective in lowering operation voltage of the EL device.

P 51: Large Area ZnO Coating for the Display Devices

A.A. Erusin, I.B. Gavrilenko, N.M. Sergeeva, V.V. Bakhmetiev, I.V. Fomin, K.A. Ogurtsov, M.M. Sychov
St. Petersburg State Institute of Technology, St.Petersburg, Russia

We report fabrication of large area ZnO film coatings for the display applications. Films have good light transmittance and conductivity stable over time and at temperature increase. Details of film properties studied by electrical, optical and morphology measurements will be reported.

P 52: ZnO-based TCO Material for Displays: Ceramic Targets, Deposition Methods, and TCO Thin Films Development

Aslan Abduev, Akhmed Akhmedov, and Abil Asvarov
Institute of Physics, Dagestan Scientific Center of RAS, Makhachkala, Russia

ZnO-based transparent conducting oxide films were grown by dc magnetron sputtering of ceramic target and the formation process and the properties were studied and the sintering technique of ceramic targets for the deposition of uniform TCO films without columnar structure by dc magnetron sputtering was developed. This work demonstrates a potential in improving the chemical stability of ZnO-based TCO.

P 53: Comparative Characteristics of Rare-Earth Metals as Cathodes for Organic Light-Emitting Diodes

V.A. Ilichev, M.A. Katkova, A.N. Konev, I.I. Pestova, M.N. Bochkarev
Razuvaev Institute of Organometallic Chemistry, Nizhny Novgorod, Russia

The lanthanides Sm, Tm, Yb were used for preparing by vacuum sublimation (10^{-6} mbar) stable simple cathode for organic light-emitting diodes of composition ITO/TPD/Alq_3/Ln. The freshly prepared device was tested in air without encapsulation. The active area of devices was 3×5 mm. Compared to a baseline device ITO/TPD/Alq_3/Al all of prepared devices with lanthanides Tm, Sm and Yb as a simple cathode exhibit significantly enhancing electron injection and improving device performance. Furthermore, all these devices also show a higher operational stability to compare with Al. The better results have been obtained for device with Tm cathode. These results are of practical importance with respect to the choice of stable pure cathode metals with low work-function for organic electroluminescent display applications.

P 54: Chalcogens as Modifiers of Anode Surface in OLEDs

M.A. Katkova, V.A. Ilichev, A.N. Konev, M.A. Batenkin, I.I. Pestova, M.N. Bochkarev
Razuvaev Institute of Organometallic Chemistry, Nizhny Novgorod, Russia
A.G.Vitukhnovsky
Lebedev Physical Institute, Moscow, Russia

Influence of thin chalcogen X (S, Se, Te) interlayer between ITO and HTL on the operating characteristics of OLEDs of ITO/X/TPD/Alq_3/Yb composition has been investigated. It was found that the sulphur layer decreases operating voltage and enhances operating stability of a device while the selenium or tellurium interlayers impair these characteristics.

P 55: Cathode Contact Structure Employing Top-Emitting OLED

Jae-Yoon Lee, Sung-Joon Bae, Chang-Wook Han, and In Byeong Kang
LG.Philips LCD R&D center, Korea

An active matrix organic light emitting diode (OLED) display employing hydrogenated amorphous silicon thin film transistor (a-Si:H TFT) prefers a cathode contact structure rather than an anode contact structure. In this paper, a new normal top emitting OLED (TOLED) employing cathode contact structure has been proposed.

P 56: Effect of Impurities on Optical Property of ZnS Phosphor for EL Application

Sang-Do Han, Tai-Yeon Cho, Hak-Soo Lee, Jihye Gwak, Chi-Hwan Han, Sang-Hyun Park
Korea Institute of Energy Research, Daejeon, Korea
Dong-Hyuk Shin
ELK Co., Daejeon, Korea; Department of Physics, Dongguk University, Seoul, Korea
K.C. Singh
Department of Chemistry, Maharshi Dayanand University, Rohtak, India

High-performance ZnS phosphors comparable to those commercially available for EL application were synthesized by solid-liquid state reaction with two firing steps, which exhibit high luminescence intensity and good chromaticity. Luminescence properties of ZnS phosphors prepared with different concentration of impurities were studied.

P 57: Si-based Avalanche LEDs for Passive Addressed NTE Microdisplays

P.Jaguiro, S.Lazarouk, A. Berezovik, V.Astaf'ev, P.Poznyak and A.Smirnov
Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus

At present time the most suitable kinds of Si-LEDs are monocrystal and porous silicon avalanche LEDs. They have such advantages as long operation lifetime (> 10000 hours), continuous spectrum, which allows to filter RGB colors, operation voltages less than 12 volts and extremely sharp VA-curve, fast response time (~ 1 ns), high operation current densities (up to 8000 A/cm^2 in pulse mode). Rather low energy efficiency (<1%) is not so significant for NTE microdisplays. These advantages open a way to design a high performance and cost effective passive addressed microdisplays.

Flexible Display Technologies

P 58: Application of Thermal-Cured Polymers as Gate Dielectrics to Plastic-Based Organic Thin-Film Transistors

Gi Heon Kim, Sung-Min Yoon, Chul Am Kim and Kyung-Soo Suh
IT Convergence & Components Laboratory, ETRI, Daejeon, Korea

We have synthesized thermal-curable polymers by mixing poly(vinyl phenol) and a thermal-crosslinking agent (MMF). These polymeric insulating films exhibit good chemical, physical and electrical properties as dielectrics. Their insulating and dielectric properties are dependent on MMF concentration. We have fabricated plastic-based organic thin-film transistors (OTFTs) with these dielectric layers to investigate the relationship between the performance of the OTFT and the electrical/chemical properties of these insulating films. The OTFT showed good electrical performance; the field-effect mobility was 1.1 $cm^2V^{-1}s^{-1}$. It has been found that a relatively low dielectric constant of a dielectric layer gave higher field-effect mobility.

P 59: Temperature-Dependent Electrical Characteristics of Low Temperature a-Si: H TFTs Fabricated on Plastic Substrate

K. Y. Ho, P. C. Chen, C. H. Cheng, C. C. Cheng, and Y. H. Yeh
Display Technology Center, Industrial Technology Research Institute (DTC/ITRI), Hsinchu, Taiwan

Low temperature deposited a-Si:H TFTs have been successfully fabricated on colorless polyimide (CPI) substrate for flexible display applications. A serious degradation of threshold voltage was observed after applying external thermal stress. The Si-based TFTs become more stable after applying several thermal stress cycles. The a-Si:H TFT backplane fabricated at 160°C on PI substrate has been successfully fabricated and demonstrated for 4.1" QVGA AMLCD.

P 60: Realization of Flexible Lateral Pixels on PET Substrates for DC-PDP Structures

Z. Sanaee, K. Zand, S. Mohajerzadeh, S. Darbari, and A. Akhavan
Department of Electrical and Computer Engineering, University of Tehran, Tehran, Iran
N. Zehforoush
Department of physics, University of Tehran, Tehran, Iran

A lateral pixel structure on a PET substrate is reported to realize flexible plasma display panels. Shellac acts as the insulating coating and the operation of pixels is demonstrated. A second micromachined PET is used to encapsulate each cell. Oxygen plasma ashing is used to significantly improve the air penetration through PET by a factor of 20.

P 61: Technology of Manufacturing and a Physical Properties of a Dispersed Microencapsulated Liquid Crystals.

Alexander Invalev
Stereopixel Ltd., Korolev, Moscow region, Russia
George Pozdniakov
Khristianovich Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia
Sergey Trashkeev
Institute of Laser Physics, SB RAS, Novosibirsk, Russia
Victor Seregin
Mendeleyev University of Chemical Technology, Moscow, Russia

The paper describes the technology of ultra-fine powder production; the powder consists of plastic spherical microcapsules containing a liquid crystal. The average size of the capsules is about ~ 10 micrometers, wall thickness ~ 0.1 micrometer. Some electrooptical properties of the produced microcapsules have been studied. It is proposed to use these microcapsules to manufacture flexible film liquid-crystal indicators.

Electronics and Applied Vision

P 62: A Completely Integrated Power-Efficient High-Voltage Driver for Bistable Displays.

Ann Monté, Jan Doutreloigne, and Pieter Bauwens
ELINTEC / TFCG-microsystems, Ghent University, Technologiepark 914, Gent, Belgium

This article describes a completely integrated new driver for bistable displays. The extra logic that is added combined with special dynamically controlled High-Voltage (HV) switches that connect the rows and columns of the display to the appropriate HV sources results in a power saving of about 50% compared with traditional drivers.

P 63: Elimination of Row-Dependent Image Defects in Cholesteric LCDs for 2+2 Dynamic Drive Schemes

A. Rybalochka, P. Tytarenko, M. Minyaylo, V. Sorokin
Lashkaryov Institute of Semiconductor Physics, Kyiv, Ukraine

A modified 2+2 dynamic drive schemes are proposed to eliminate row-dependent image defects in cholesteric displays by equalization of the pre- and the post-selection stages for all display's pixels. We demonstrate the way for composition of row and column waveforms that provide equal duration of all addressing stages for each pixel irrespective of its row number. Proposed modification is desirable for gray scale implementation especially.

P 64: An Analog Interpolator for LCD Source Drivers

Seraphin Itoua
HMT Microelectronic AG, Biel/Bienne, Switzerland

In conventional LCD source driver circuits, the central building block is the Digital to Analog Converter (DAC) providing gamma correction. Each pixel is connected to the same DAC through a selection matrix and an output amplifier. Higher is driver resolution, bigger is the chip. An analog interpolation circuit is proposed to reduce chip area.

P 65: New Optical Feedback Pixel Driver Circuit and Its Simulation in SPICE

N.P.Papadopoulos, A.A. Hatzopoulos
Dept. of Electrical and Computer Eng., Aristotle University of Thessaloniki, Greece
D.K. Papakostas
Dept. of Electronics, Alexander Technological & Educational Institute of Thessaloniki, Greece

A new optical feedback circuit is proposed with fewer components and wider range of V_{data} voltage. Its operation was verified by simulation using the HSPICE simulator and the previous published light-impact model of polycrystalline TFTs.

Systems and Applications

P 66: Interactive Optical Channel in Man–Machine Systems

Yurii Trofimov, Valerii Posedko, Aleksandr Pautino, Sergey Lishik, Vitalii Tsvirko, and Aleksey Smirnov
Stepanov Institute of Physics, NAS of Belarus, Minsk, Belarus

Modern state of photosensory display systems, its functional capabilities and application perspectives are analyzed. Main requirements and principles of creating effective optical channel for interaction between operator and display system also as problems of its realization and ways of its solving are considered. Results of own researches in field of practical design of LED display and indicator elements with photosensitive function are given.

P 67: A New Approach to Stereoscopic Display Developed by Solving the General Equation of Light Polarization

Vasily A. Ezhov

Prokhorov Institute of General Physics, Moscow, Russia

It is described a new approach to stereoscopic displays using amplitude modulation and elliptical polarization. The theory is developed by deriving and solving the general equation for elliptical polarization. Several transfer functions for novel stereoscopic displays are shown.

P 68: Glasses-Free Stereoscopic Displays Based on Shutters, and Dynamic Polarizers with Moving Boundaries Between Areas with Complementary Optical Properties

Vasily A. Ezhov
Prokhorov Institute of General Physics, Moscow, Russia
Vladimir A. Brezhnev, Sergey A. Studentsov
Volga R&D Institute, Saratov, Russia

It is possible to make *glasses-free* direct-view and projection 3D displays (including multiview ones) based on existing stereoscopic displays using decoding elements with moving boundaries at a certain distance from the observer. The necessity of maintaining this distance is the main limitation but this can be overcome by tracking the observer.

P 69: The Application of Pentacene-Based Organic Thin Film Transistor on Gas Sensing

Hsiao-Wen Zan, Kuo-Hsi Yen, Wen-Xin Wu, Yen-Ren Lo, and Yuh-Shyong Yang
National Chiao Tung University, Taiwan

We utilize the pentacene-based organic thin film transistor (OTFT) to act as a NH_3 gas sensor. When the NH_3 gas interacts with the OTFT, the drain current is reduced and the threshold voltage is negatively shifted toward a larger value. On the other hand, the subthreshold swing does not seem to be significantly influenced by the NH_3 gas. From the analysis of gated-4-probes OTFT, the extracted contact resistance is increased and the estimated contact-less field-effect mobility is reduced, with the increase of the NH_3 concentration. The reduction of the mobility and the increase of the threshold voltage are also discussed in this study.

P 70: The research of the acceptability of MFD-26 for application in track and vehicular transport

Victor B. Lukashenko, M.V. Dyatlov. and A.A. Semash
Technotronic Design Laboratory, Ltd., Moscow, Russia
Y.V. Kryag, A.A. Lucenko and E.V.Savina
JSC Ramenskoye Design Co., Ramenskoye, Moscow Region, Russia

Multifunctional display MFD-26 with unique optical performance parameters was developed for rail road transport and today it is successfully exploited in joint manufacturing of Russia and Germany diesel electro locomotives. This paper summarize the researches about acceptability of MFD-26 for application in the environment of track and vehicular transport. It was experimentally proven: MFD-26 can work withstanding shocks up to 200g and vibrations up to 10 g.

P 71: Analysis of parameters of the solid body head up display for indication on the frontal glass in transport indication

V.M. Dyatlov, M.V. Dyatlov and A.A. Semash
Technotronic Design Laboratory, Ltd., Moscow, Russia
O.N. Galinach, E.V. Savina, V.I. Seliverstov
JSC Ramenskoye Design Co., Ramenskoye, Moscow Region, Russia

Application of the head up displays in transport vehicles sufficiently increase the safety and comfort of vehicle driving. This is so mostly due the lack of needing to change the look direction from ambient road situation to instrument panel. It leads to increasing the reaction speed, and increases the error free information reading especially in difficult weather conditions. Up to recent times the main image generation technology in HUD, were high brightness cathode ray tubes (CRT) and it was the obstacle to wide application of the HUDs in commercial transport. This paper summarize the analysis of optimal optical performance parameters of HUD's for different kinds of transport and parameters of prototypes of LCoS based HUD for transport.

P 72: Nanostructured materials for movable optical systems

V.I. Kurmashev, Yu.V. Timoshkov, V.Yu. Timoshkov
Belarus State University of Informatics and Radioelectronics, Minsk, Belarus

MEMS-based displays are widely used in display industry. We report about using composite materials instead homogeneous metals. Wear resistance increased in 2-2.5 times, microhardness increased in 2 times, coefficient of friction and corrosion current were reduced by factor 1.5 and 1.6 respectively.

P 73: Head-Tracked 3D Displays

Phil Surman, Ian Sexton, Wing Kai Lee, Richard Bates
De Montfort University, Leicester, UK
Klaus Hopf
Heinrich Hertz Institute, Berlin, Germany
Edward Buckley
Light Blue Optics, Cambridge, UK

This paper describes the authors' development of single user and multi-user 3D displays that do not require the wearing of special eyewear (autostereoscopic) and employ head position tracking to give a large degree of freedom of viewer movement. This makes them particularly suited to TV applications. The single and multi-user versions of the display that incorporate an LCD and future development based on a laser-based 3D display that does not require an LCD are described.

17.00–18.00 Transfer

Special Event / 18.00–22.00 / Moskva-River, the Boat-Restaurant

Thursday, September 20

Session 7: 3D Vision / 9.15 – 10.40 / Red Hall

Chair: **Jyrki Kimmel**, *Nokia Research Center, Finland*
Co-Chair: **Andrew Putilin,** *Lebedev Physics Institute, Russia*

9.15–9.35 ***Invited Paper:*** **3D Displays - Fundamental Physical Classification for Clearing Inherent Technical Features**
S7-1 Vasily A. Ezhov
Prokhorov Institute of General Physics, Moscow, Russia

Four fundamental physical classes (covering all possible technical approaches for 3D displays) can be described using two fundamental physical criteria. Parameters of the displays are briefly analyzed with respect to the psychophysical properties of human 3D vision.

9.35–9.55 ***Invited Paper:*** **Switchable 2D-3D displays**
S7-2 Marcel P.C.M. Krijn, Dick K.G. de Boer, Siebe T. de Zwart, Oscar H. Willemsen
Philips Research Europe, Eindhoven, The Netherlands

Switchable 2D/3D were developed, using liquid-crystal (LC) filled switchable lenticulars. In this way it is possible to have a high-brightness 3D display capable to fully exploit the native 2D resolution of the underlying LCD. A 42" locally switchable prototype was made having a matrix electrode structure. These displays were realised using cylindrical lenticulars. An alternative for these are lenticulars based on gradient-index (GRIN) lenses. Preliminary results for such switchable GRIN lenses will be shown as well.

9.55–10.10 **Optical Characterization Methods for Autostereoscopic 3D Displays**
S7-3 Toni Järvenpää, Marja Salmimaa
Nokia Research Center, Tampere, Finland

We have investigated how the optical properties of autostereoscopic (3D) displays can be objectively measured and what are the main characteristics defining the perceived image quality. These basic characteristics and the different measurement methods for optical verification of transmissive 2-view and multi-view 3D displays are presented.

10.10–10.25 **Near to Eye Display with Diffractive Exit Pupil Expander having Chevron Design**
S7-4 Viljakaisa Aaltonen and Tapani Levola
Nokia Research Center, Tampere, Finland

Exit Pupil Expanders (EPEs) enable a light and thin design for see-through Near-to-Eye Display (NED). So called Chevron EPE was designed for further improve the design and usability aspects for NEDs. The diffractive EPE has typically one uncoupling grating area that delivers light into the light guide symmetrically towards left and right eyes. The chevron geometry partially prevents the ambient light from the sides to enter the diffractive structures and thus the unwanted reflections are reduced. Furthermore, the half size of the chevron EPE parts from the undivided EPE comes up in a better yield in the production.

10.25-10.40 **Stereoscopic Image Without Keystone Distortion**
S7-5 K. A. Grebenyuk, V. V. Petrov
Saratov State University, Saratov, Russia

Stereoscopic display configuration for presenting stereoscopic image without keystone and depth plane curvature distortions is proposed. Proposed configuration uses two intersecting screens for presenting left and right perspective images. Possibility of distortions elimination is analytically proved. Expression for screens intersection angle required for distortions elimination is derived.

Author Interviews of the Session 7 will be this day, 16.00–17.00 at the Red Hall

10.40–11.00 Coffee-break

Session 8: Emissive Display Technologies – 2 / 9.20 – 10.40 / Blue Hall

Chair: **Norbert Fruehauf**, *University Stuttgart, Stuttgart, Germany*
Co-Chair: **Evgeniy Sheshin**, *Moscow Institute of Physics and Technologies, Russia*

9.20–9.40 ***Invited Paper:*** **Techno-Business Strategy of PDPs**
S8-1 Shigeo Mikoshiba
The University of Electro-Communications, Tokyo, Japan

There is a big chance for PDP-TVs to win a large marketplace in the 32in. - 70in. diagonal ranges. Technology advancements of PDPs and LCDs in the next two years are compared, and winning strategy for PDPs is discussed.

9.40–10.00 ***Invited Paper:*** **Radiation Modification of Powder Phosphors**

S8-2 Maxim M. Sychov
St. Petersburg State Institute of Technology, St.Petersburg, Russia

Gamma and electron beam treatment of ZnS improves copper solubility in the phosphor and increase EL brightness. Radiation treatment of ready ZnS:Cu, Cl,Br, ZnS:Cu,Al,Br and ZnS:Cu,Cl also improve brightness. It is shown that two-step radiation modification (before and after synthesis) allows one to improve EL brightness up to 90%.

10.00–10.20 **Luminescence from Eu-doped garnets in porous anodic alumina**
S8-3 G. K. Maliarevich, E. A. Stepanova, T. I. Orekhovskaya, N. V. Gaponenko
Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus
A. Podhorodecki , J. Misiewicz
Institute of Physics, Wroclaw University of Technology, Wroclaw, Poland

Sol-gel synthesis of Eu-doped yttrium-alumina garnet in porous anodic alumina is used . Strong red emission due to intense photoluminescence band at 617 nm associated with $^5D_0 \rightarrow {}^7F_2$ transition of Eu^{3+} is observed from the fabricated structure. Heat treatment of the samples from 200 to 900 °C results in drastic increase in photoluminescence (PL) intensity, that is associated with annealing the defects of the structure.

10.20–10.40 **Blinking as a Tool of Quantum Dot OLEDs Studies**
S8-4 Panos Argyrakis
Aristotle University of Thessaloniki, Thessaloniki, Greece
Vladimir Lidsky, Vasily Zalunin, Alexei Vitukhnovsky
Lebedev Physical Institute, Moscow, Russia
Roman Vasiliev, Dmitry Dirin
Lomonosov Moscow State University, Moscow, Russia

Synthesis conditions for different QDs types were suggested and original experimental set-up for luminescence studies of prepared QDs was used. The luminescence time dependence for two types of core/shell QDs (CdSe/CdS and CdTe/CdSe) were investigated and were compared with behavior of naked ones (CdSe). QDs application for effective OLEDS is discussed.

Author Interviews of the Session 8 will be this day, 16.00–17.00 at the Blue Hall

10.40–11.00 Coffee-break

Session 9: Systems and Applications / 11.00 – 12.40 / Red Hall

Chair: **Karlheinz Blankenbach,** *Pforzheim University, Germany*
Co-Chair: **Vyacheslav Ivanov,** *Samsung Research Center, Moscow, Russia*

11.00–11.20 ***Invited Paper:*** **Application of 2D Focon Arrays in Displays and Planar Illuminators**
S9-1 Andrew Putilin
Lebedev Physics Institute, Moscow, Russia
Arthur Geivandov
Samsung Research Center, Moscow, Russia

Focusing concentrators (FOCON) was designed for fiber optic communication systems, as coupling devices. The main aim of those couplers was to match the spatial distribution of the light source or photo-detector with the aperture configuration of light guiding modes of the optical fibers. In this paper we propose to apply the 2D array of the focons for collimating large size optical beams in display devices. The design of the light efficient illumination unit for LCD display that can operate in reflection and in backlit manner was demonstrated. This approach is based on the spatial separation of the light propagation in focon array for reflected beams and light comes from backlit, so it can be named "OPTICAL DIODE".

11.20–11.40 **A New Driving Technology for Passive-Matrix Displays**
S9-2 Pieter Bauwens, Jan Doutreloigne, Ann Monté
Ghent University, ELINTEC/TFCG-Microsystems, Technologiepark 914, Ghent, Belgium

One of the major problems with Passive-Matrix driving is that, depending on the used display-material, only a limited number of lines can be multiplexed. This article provides a new technology for Passive-Matrix driving that eliminates that problem, together with the first positive results.

11.40–12.00 **Optical Performance of Non-Blocking 4x4 Optical Switch: Simulation and Experiment.**
S9-3 V. Alex, A. Dubtsov, Yu. Panarin
School of Electronic & Communication Engineering, Dublin Institute of Technology, Dublin 8, Ireland
T. Wilkinson
University of Cambridge, United Kingdom

A prototype of pure non-blocking 4x4 optical LC switch was designed and built. This switch is based on conventional LCD technology, where the each pixel controlled the polarization state of the light beam. An addressing algorithm was described. The optical performance of the switch, such as cross-talk and insertion loss, was simulated and experimentally studied. The suggested approach offers several advantages over the conventional cross-point architecture such as: cost; complexity; size; adjustment; and optical performance.

12.00–12.20 **New Method for Measuring Moving Picture Resolution Suitable for Various Types of FPD**
S9-4 I. Kawahara
Matsushita Electric Industrial Co., Osaka, Japan

An automated system, as well as subjective test procedures has been developed, both showing stable results and excellent correspondence to each other for the variety of display devices, and wide range of pixel counts, and sizes. Through the measurement, full-HD Plasma TVs showed more than 900 TV lines of resolution, while typical 60Hz LCD TVs of the same pixel count showed only 300 TV lines, while 120Hz LCD TVs showed around 600 TV lines.

12.20–12.40 **Subjective Evaluation of Color Mixing Model for Large Display Units**
S9-5 Takako Nonaka and Tomohiro Hase
Ryukoku University, Otsu, Japan
Morimasa Matsuda
Mitsubishi Electric Microcomputer Application Software Co., Japan

The authors have previously proposed a color mixing model for large display units based on human color vision. This paper reports subjective evaluation experiments to verify the model quantitatively. The evaluation samples were color images and real large display units. As a result, the analytical and experimental viewing distances become longer as the dot pitch becomes larger.

Author Interviews of the Session 9 will be this day, 16.00–17.00 at the Red Hall

12.40–14.00 Lunch Break

Session 10: Backlight / 11.00 – 12.40 / Blue Hall

Chair: **Munisamy Anandan**, *Organic Lighting Technologies, USA*
Co-Chair: **Yurii Trofimov**, *Institute of Electronics, Belarus*

11.00–11.20 **Diffractive Backlight Grating Array for Mobile Displays**
S10-1 Jyrki Kimmel, Tapani Levola
Nokia Research Center, Tampere, Finland
Pasi Lakkonen
NanoComp Ltd, Joensuu, Finland

The display backlight unit (BLU) is the most power-consuming subunit in mobile displays. Previously proposed diffractive backlights do not fully utilize all the possibilities to design gratings effectively for optimal color separation and outcoupling. This paper presents a new pixelated diffractive backlight for overcoming these obstacles in BLU design.

11.20–11.40 **Colour Separating Backlight for Improved LCD Efficiency**
S10-2 M.J.J. Jak, R. Caputo, E.J. Hornix, L. de Sio, D.K.G. de Boer, H.J. Cornelissen
Philips Research Laboratories, Eindhoven,The Netherlands

A large part of the light generated in a backlight is usually absorbed in the colour filters of the Liquid Crystal Display. We present a new backlight that uses a grating to split the white light into different colours. The absorbing filters can be eliminated and efficiency is improved.

11.40–12.00 **Advantages and Disadvantages of Using YAG:Ce Nanophosphors Encapsulated on Blue-Emitting**
S10-3 **LED Chips as Backlights for Displays**
R. Withnall, J. Silver, T.G. Ireland, A.L. Lipman, G.R. Fern,
Wolfson Centre for Materials Processing, Brunel University, Uxbridge, UK
C. McAleese, C. Humphreys
Department of Materials Science and Metallurgy, University of Cambridge, Cambridge, UK
W.A. Phillips
Phconsult Ltd, Cambridge, UK

Samples of YAG:Ce phosphors have been prepared that have various particle sizes ranging from 5 μm to < 1 μm and the effects of both particle size and crystallite size on the luminous efficacies of the phosphor samples have been investigated when they are excited by blue light.

12.00–12.20 **Novel Design of LED Driving System for Local Dimming LED Backlight in LCD**
S10-4 Sang-Yun Lee, Hyung-Suk Kim, Myoung-Soo Choi and Bang-Won Oh
Samsung Electro-Mechanics Co., Suwon, Korea

Novel design of LED driving system for local dimming RGB-LED backlight in LCD TV has been proposed and developed. With new technique, we have accomplished improving the image quality as well as increasing the system efficiency.

12.20–12.40 **Effect of Optical Profile on Perceived Image Quality for Segmented Backlights**
S10-5 S. Swinkels and R. Muijs
Philips Research Europe, Eindhoven, The Netherlands

For segmented dimmable backlights, we evaluated the impact of shape of the optical profile on perceived image quality by means of perceptual experiments. The contrast improvement is not so much affected by the shape but mainly by the number of segments and the profile's width, provided that the profiles do not contain steep edges.

Author Interviews of the Session 10 will be this day, 16.00–17.00 at the Blue Hall

12.40–14.00 Lunch Break

Session 11: Liquid Crystal Display Technologies – 2 / 14.00 – 15.40 / Red Hall

Chair: **Shunsuke Kobayashi,** *Tokyo University of Science, Japan*
Co-Chair: **Sergei Pasechnik,** *MSUIECS, Moscow, Russia*

14.00–14.20 S11-1 ***Invited Paper:*** **Electro-Optical Modes of Ferroelectric Liquid Crystal Display Cells Based on Bi- and Multistability Effects**

E.P. Pozhidaev, A.L. Andreev, I.N.Kompanets, Yu.P. Bobylev, V.M. Shoshin, S.I. Torgova
Lebedev Physical Institute, Moscow, Russia
V.G. Chigrinov, Gurumurthy Hegde, Pazhi Xu
The Hong Kong University of Science and Technology, Hong Kong
A.Strigazzi
Dip. di Fisica and INFM, Politecnico di Torino, Italy

The multistability effect exists under certain conditions in ferroelectric liquid crystal display cells (FLCDC) that means memorization of any light transmission level after the driving voltage switching off. This effect is responsible for three new electrooptical modes with continuous, memorized and reversible gray scale. The modes differ among themselves under the shape of the gray scale curve that can be either S (double or single) or V-shaped dependently on boundary conditions and crystallooptical parameters of the cell. Origin of these modes is under consideration.

14.20–14.40 S11-2 **Antiferroelectric Liquid Crystal Display: Electrically Controlled Birefringence Color Switch as a New Mode**

A.V. Emelyanenko, V.E. Molkin,
Department of Physics, Moscow State University, Moscow, Russia
E.P. Pozhidaev
Lebedev Physical Institute, Moscow, Russia
N.M. Shtykov
Institute of Crystallography, Moscow, Russia

We developed the AFLC mixture with intermediate ferrielectric phases existing in a broad temperature range. At any temperature within this range several birefringent color states were obtained by application of the electric field. The record small time switching between these states can be a basis for the new mode in display technology, because several full-color optical states can be realized in the same material (or in the mixture of materials) without active matrix. These possibilities were investigated both theoretically and experimentally. Theoretical calculations are performed with help of AFLC Phase Diagram Plotter software available at Web-page of the presenting author.

14.40–15.00 S11-3 **Real-Time Volumetric Sensing for the Liquid Crystal Drops by Millimeter Wave Reflectometry**

Chi-Fang Huang, Chien-Wei Fang
Graduate Institute of Communication Engineering, Tatung University, Taipei, Taiwan

The present work is to design a hardware system composed of 20GHz millimeter waveguide components, and functioning to monitor the drop volume of ODF (One-Drop-Filling) machine in a real-time and on-site manner. Rayleigh scattering and deconvolution theory are the base for predicting the drop volume. By using the LabView software environment, an automatic measuring system is achieved.

Author Interviews of the Session 11 will be this day, 16.00–17.00 at the Red Hall

15.40–16.00 Coffee-break

Session 12: OLED-AMOLED Technologies / 14.00 – 15.40 / Blue Hall

Chair: **Eliav Haskal,** *Philips, The Netherlands*
Co-Chair: **Alexei Vitukhnovsky,** *Lebedev Physics Institute, Russia*

14.00–14.20 S12-1 ***Invited Paper:*** **Florescent and Phosphorescent OLED by Sequential Doping**

Xiaowei W. Sun
Nanyang Technological University, Singapore

Highly efficient fluorescent and phosphorescent organic light-emitting diodes (OLEDs) fabricated by sequential doping are discussed. The emission layer consists of a few repeating cells, similar to a multiple quantum well structure, which are made of sequentially evaporated host and dopant. An external quantum efficiency as high as 3.38 % and 8.78 % photons/electron was obtained for fluorescent and phosphorescent OLEDs. By avoiding co-evaporation, sequential doping should render better control on device performance and day-to-day repeatability. As a byproduct, we also discovered a long range quenching mechanism, which can be considered as an extension of Forster energy transfer. Lastly, we also showed some device results of white OLED making use of our sequential doping technique.

14.20 – 14.40 S12-2 **Increasing Peak Luminance Using White Extension in RGBW AMOLED**

Alexander Arkhipov, Kyongtae Park, Baek-woon Lee and Sungtae Shin
LCD Business Unit, Samsung Electronics Corp., Korea

Applying white subpixel in AMOLED panel permits to increase brightness of the panel (compare to the RGB panel). Using special algorithms and RGB subpixels (as additional white) permits to increase brightness of this panel up to 2 times. At the same time it's very important to keep panel current at permissible range. Proposed algorithm permits to increase brightness of the RGBW AMOLED panel and limit its summary current at the same time.

14.40– 15.00 S12-3 **Top-Emitting qVGA AMOLED Display With Integrated Row Driver Fabricated In LTPS Without Ion Doping**

Rene Hlawatsch, Holger Baur, Steffen Hergert, Sven Jelting, Efstathios Persidis, Fabio Pieralisi, Patrick Schalberger, Norbert Fruehauf
Universitaet Stuttgart, Stuttgart, Germany

We previously reported an NMOS LTPS active matrix process that creates the doped regions using PECVD deposition instead of ion doping. In this paper we present the first 4.4 inch quarter-VGA AMOLED display fabricated using this cost-effective process, thus demonstrating sufficient TFT yield and uniformity for this more demanding application. As an additional means of cost reduction we integrated the row driver onto the display substrate.

15.00–15.20 S12-4 **Fabrication of 3.5 inch QCIF AMOLED Panel with Ultra Low Temperature Polycrystalline Silicon Thin Film Transistor on Plastic Substrate**

Yong-Hae Kim, Choong-Heui Chung, Jaehyun Moon, Dong-Jin Park, Su-Jae Lee, Gi Heon Kim, and Yoon-Ho Song
IT Convergence & Components Lab., ETRI, Daejeon, Korea

We fabricated the 3.5 inch QCIF AMOLED panel with ultra low temperature polycrystalline silicon TFT on the plastic substrate. To reduce the leakage current, we used the triple layered gate metal structure. To reduce the stress from inorganic dielectric layer, we applied the organic interlayer dielectric and the photoactive insulating layer.

15.20 – 15.40 S12-5 **Reliability of the Extrapolated OLED Lifetime from Stretched Exponential Decay Fit**

H. Cloarec,
Thomson R&D France, Cesson Sévigné
D. Vaufrey, T. Maindron, C. Prat
Commissariat à l'Energie Atomique (CEA), Grenoble Cedex 9, France
T. Mohammed-Brahim
Institut d'Electronique et des Télécommunications, Université de Rennes, Rennes, France

Stretch Exponential Decay (SED) fit of the luminance degradation is usually performed to determine the lifetime of Organic Light-Emitting Diodes (OLED). The conditions to obtain meaningful SED parameters and significance of fitting parameters (reflected degradation) are discussed from aging measurements on highly stable efficient doped OLED.

Author Interviews of the Session 12 will be this day, 16.00–17.00 at the Blue Hall

15.40–16.00 Coffee-break

Author Interviews of Sessions 7,9,11 / 16.00 – 17.00 / Red Hall

Author Interviews of Sessions 8,10,12 / 16.00 – 17.00 / Blue Hall

ED'07 COMMITTEES

Eurodisplay-2007 General Chair: Oleg KROKHIN, *Lebedev Physical Institute, Russia*

ORGANIZATION COMMITTEE:

Chair: Oleg KROKHIN, *Russia*
Co-Chair and Program Chair: Igor KOMPANETS, *Russia*
Co-Chair and Executive Chair: Victor BELYAEV, *Russia*
Ukraine Co-Chair: Victor SOROKIN
Belarus Co-Chair: Sergei YAKOVENKO
Treasurer: Irina REVOKATOVA, *Russia*
Secretary: Sofia TORGOVA, *Russia*
General Manager: Irina VINNIKOVA, *Russia*
Exhibition: Alexander BILENKO, *Russia*
Konstantin BOGACHEV, *Russia*
Evgeny DEGTYAREV, *Russia*
Vyacheslav IVANOV, *Russia*
Natalia POLUKHINA, *Russia*
Vladimir SAMSONOV, *Russia*
Marlen SEREDNITSKY, *Russia*
Leonid SOMS, *Russia*
Alexei UDOYNIKOVSKY, *Russia*

INTERNATIONAL ADVISORY COMMITTEE

Larry WEBER, SID President
Munisamy ANANDAN, SID Treasurer,
Philip HEYMAN, SID Convention Committee Chair
Jyrki KIMMEL, Past SID Regional Vice President, Europe
Alexander SMIRNOV, SID Regional Vice President, Europe
Jenny NEEDHAM, SID Data & Office Manager

PROGRAM COMMITEE

General Program Chair: Igor KOMPANETS, *Russia*
Americas Program Chair: John RUPP, *USA*
Asia Program Chair: Xiaowei SUN, *Singapore*
Europe Program Chair: Alexander SMIRNOV, *Belarus*
Seminar Chair: Vladimir CHIGRINOV, *Hong Kong*
Victor BELYAEV, *Russia*
Karlheinz BLANKENBACH, *Germany*
Sergey BUKESOV, *Russia*
Norbert FRUEHAUF, *Germany*
Darrel HOPPER, *USA*
Jyrki KIMMEL, *Finland*
Antony LOWE, *UK*
Shigeo MIKOSHIBA, *Japan*
Gerrit OVERSLUIZEN, *The Netherlands*
Victor SOROKIN, *Ukraine*
Sergej STUDENTSOV, *Russia*
Maxim SYCHOV, *Russia*
Zvi YANIV, *USA*