PROGRAM

XV International Symposium "Advanced Display Technologies-2006" (ADT'06)

October 03-05, 2006

P.N. Lebedev Physical Institute, Moscow, Russia

ORGANIZED BY:

Russia Chapter of the Society for Information Display

Belarus Chapter of the Society for Information Display

Ukraine Chapter of the Society for Information Display

P.N.Lebedev Physical Institute of Russian Academy of Sciences

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Display Solutions

Electronic Components

Symposium Chair :

Academician, Professor Oleg N. Krokhin

Vice-Director of the P.N.Lebedev Physical Institute

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V.A. Vorobiev	North-Caucasian State Technical University, Stavropol (Russia)
V.Ya. Zyryanov	L.V. Kirensky Institute of Physics, Krasnoyarsk (Russia)

SYMPOSIUM TOPICS

- LC and other non-emissive displays
- Emissive displays (PDP, CRT, FED, LED,OLED, electroluminescent…)
- Microdisplays
- Projection displays
- Flexible displays
- 3D displays
- Display Optics
- Display Electronics
- Display Ergonomics, standards, measuring and testing
- Displays and Systems for civil and military applications

GENERAL INFORMATION

XVth International Symposium "Advanced Display Technologies" will be held from October 3 to October 5, 2006 at the P.N. Lebedev Physical Institute of the Russian Academy of Sciences, 53 Leninsky prospect, Moscow.

P.N. Lebedev Institute +photo of main building and Halls

Registration desk will be open at the main building of the Institute on Monday, October 2 from 14.00 till 20.00. The registration will be also available from 8.00 to 12.00 on Tuesday, October 03 through Thursday, October 5.

Symposium facilities – computer, printer, multimedia projector, and overhead projector will be available for Symposium participants.

Symposiums official language is English.

Symposium fee can be paid at the registration desk (credit cards are not acceptable). Registration fee (2300 rubles for CIS participants and $250 for oversea participants) includes Symposium materials, lunches and excursion. A Get-together party with snacks and drinks will take place on Tuesday, October 03 at 18.00 in the Pillar Hall. **C**omplimentary coffee will be served each day during the Symposium.

Hotel reservation is available through ADT Secretariat and Nicko Travel Co.(contact person Mrs. Irina Kupriyanova, tel. +7-495-7753171, e-mail: kupriyanova@nicko.ru) 15 days before the Symposium start. Hotels “Sputnik” (ph. +7-495-930-2287), “Salut” (ph. +7- 495-234-9292), “Academicheskaya” (ph. +7-495-959-8157) are located on Leninsky prospect not so far from the Institute.

Transportation. The Moscow metro stations “Leninskii Prospect” and “Oktyabr’skaya” are in the vicinity of the Institute as well as well-developed network of buses (n. 111), trolleybuses (n. 4, 33, 62, 84) and taxi transportation can serve to deliver the ADT attendees to the Institute. A map of the Institute vicinity is shown on the next page.

Information is on sites: www.sidchapters.org/russia/ and www.ADT-06.narod.ru .

For additional information please contact SID Russia Chapter: Treasurer Irina P. Revokatova, ipr@sci.lebedev.ru , ph. +7(495)132-6487; Secretary Sofiya I. Torgova, sofia.torgova@mail.ru , ph. +7(495)132-6459, and Igor N. Kompanets, kompan@sci.lebedev.ru , ph./fax +7(495)132-5484.

A message center will be available at the registration desk during the Symposium open hours.

ADT'06 TECHNICAL PROGRAM

P.N. Lebedev Physical Institute

Tuesday, October 03, 2006

10.00-18.00 **Conference Hall** (Third Floor)

10.00-10.30 **Opening Ceremony:**

Oleg N. Krokhin (Symposium Chair) – Welcoming Remarks
Alexander G. Smirnov (SID European Committee Chair) – Greetings
Jong Sam Woo (General Director of Samsung Research Center, Moscow) – Greetings
Igor N. Kompanets (Program Committee Chair) – Organizing Remarks

10.30-11.40 **Plenary Session 1**
Chairman: I.N. Kompanets

10.30-11.05 1 V. Belyaev *(Samsung Research Center, Moscow, Russia).*
Display Technologies and Market in Russia.

11.05-11.40 2 V.Labunov *(Belarusian State University of Informatics and Radioelectronics, Minsk).*
Present state and prospects of nanomaterials and nanotechnologies for new generation of information and communication systems.

11.40-12.00 ***Coffee break***

12.00-14.00 **Plenary Session 2**
Chairmen: V.M. Sorokin and M.G. Tomilin

12.00-12.30 3 A.Smirnov, S.Lazarouk, V.Labunov, P. Poznyak, A.Berezovik (*Belarusian State University of Informatics and Radioelectronics,Minsk*).
Silicon-based microdisplays: the experience of design and manufacturing.

12.30-13.00 4 N.P. Abanshin, N.D. Zhukov, I.A. Zimin, A.V. Kuznetchikhin, R.V. Mhitarjan (*R&DI "Volga", Saratov, Russia*).
OLED: improvement of technology process and increasing the service life.

13.00-13.30 5 Ph. Surman, I. Sexton, W.K. Lee, R. Bates *(De Montfort University, UK)*, K. Hopf (*Heinrich Hertz Institute, UK*), E. Buckley (*Light Blue Optics, UK*).
Multi-user 3D Display using a Head Tracker and RGB Laser Illumination Source.

13.30-14.00 6 E.V. Vorobiev, V.V. Belyaev (*Samsung Research Center, Moscow, Russia*).
Modern trends of video processing for digital TV.

14.00-15.30 ***Lunch***

15.30-16.00 **Special Session: Liquid Crystal Society Awards**
Chairman: V.V. Belyaev

15.30-15.40 S.A. Pikin and S.I. Torgova. 2006 Fredericks Medal Awards: **Rudolf Eidenschink** (in Chemistry) from Germany and **Guram S. Chilaya** (in Physics) from Georgia.

15.40-16.00 Rudolf Eidenschink. Brief speach about research activity.
Guram S.Chilaya. Brief speach about research activity.

Session: Systems and Application
Chairmen: Chairmen: A.N. Putilin and Ph. Surman

16.00-16.20 1 V.V. Petrov, K.A. Grebenyuk (*Saratov State University, Russia*).
Enhancement of stereoscopic images quality: optical correction of depth plane curvature.

16.20-16.40 2 A. Andreev, Yu. Bobylev, I. Kompanets, E. Pozhidaev, V. Shoshin, Yu. Shumkina, S.Torgova (*Lebedev Physical Institute of RAS, Moscow, Russia*), A. Alyushin, M. Alyushin, S. Gonchukov (*Moscow State Engineering Physics Institute, Russia*), A.Strigazzi (*Politecnico di Torino, Italy*).
Experimental model of 3D volumetric display based on 2D laser beam deflector and a stack of FLC light-scattering shutters.

16.40-17.00 3 A.V. Sadchikhin, E.N. Rytov, V.I. Nekljudov, E.E. Akimov (*«AR Technology», Moscow, Russia*).
Development of technologies of multicomponent screens of collective using.

17.00-17.20 4 Yu. Trofimov, V. Posedko, V. Sivenkov, S. Lishik (*Institute of Electronics NAN of Belarus, Minsk*).
LED information boards: the experience of design, manufacturing and application.

17.20-17.40 5 V.B. Lukashenko, M.V. Dyatlov (*JSC "KB Technotronic", Fryazino, Russia*).
Multifunctional Display for Transport Application.

17.40-18.00 6 A.Martinovich, A. Maximov, O.Kursevich, V.Lebedev (*PHOTEK plant of SPC "Integral", Minsk, Belarus*).
Mass production of high reliable LCDs.

18.00 ***Get Together Party***
Pillar Hall (Third Floor)

Wednesday, October 04, 2006

9.40-14.00 **Seminar Hall of the Theoretical Physics Department** (First Floor)

9.40-14.00 **Session: Emissive Displays**

9.40-11.40 **Seminar 1. Electroluminescent Display Technologies**
Chairmen: N. Abanshin and N. Soschin

9.40-10.00 1.1. M.M. Sychov *(Saint-Petersburg State Institute of Technology, Russia*).
Surface Properties and Luminescence of Powder Phosphors.

10.00-10.20 1.2 E.V. Komarov, M.M. Sychov, Y. Nakanishi, H. Kominami, V.V. Bakhmetiev, V.G. Korsakov *(Saint-Petersburg State Institute of Technology, Russia*).
The influence of ZnS phosphors composition on their luminescent properties.

10.20-10.40 1.3 N. Maslak-Gudima (*Institute of Sorption & Ecology, NAS, Ukraine*), M. Minyaylo (*Institute of Semiconductor Physics, NAS Ukraine, Kiev*).
Triplet emitters for optimization of organic light emitting diode.

10.40-11.00 1.4 L. Lepnev, A. Vaschenko, A. Vitukhnovsky, S.Torgova (*Lebedev Physical Institute of RAS, Russia*), S. Eliseeva, O. Kotova, N. Kuzmina (*Lomonosov Moscow State University, Russia*).
Tandem Organic Light Converters and Peculiarities of Photocurrent Multiplication.

11.00-11.20 1.5 D. Zajarskiy, O. Ruzanov, D. Fedorkov, V. Petrov, B. Klimov (*Saratov State University, Russia*).
The organic luminescent display with an interior electric field.

11.20-11.40 1.6 N.V. Gaponenko (*Belarusian State University of Informatics and Radioelectronics,Minsk*).
Xerogels, doped with lanthanide ions, in mesoporous matrices: from peculiarities of optical excitation to multicolor luminescent images.

11.40-12.00 ***Coffee break***

12.00-14.00 **Seminar 2. Cathodeluminescent Display Technologies**
Chairmen: M. Sychov and I. Shein

12.00-12.20 2.1 N.P. Soschin, V.N. Lichmanova, V.A. Bolshukhin, E.A. Kirillov (*R&D I «Platan», Fryazino, Russia*).
The new phosphors for screens of high-speed CRT.

12.20-12.40 2.2 A.O.Dmitrienko, V.P.Dmitrienko, A.V.Strel'tsov, S.V.Kudryavtsev, S.L.Shmakov (*Saratov State University, Russia*), D-S. Zang, Y.-C. You (*Samsung, Korea*).
Efficient RGB-phosphors: synthesis and peculiarity of cathodoluminescence.

12.40-13.00 2.3 V.A. Vorobyev, N.V. Siglovaja, N.I. Kargin (*North-Caucasus State Technical University, Stavropol, Russia*).
Perfection of a red-emitting phosphor Y_2O_3:Eu for displays with high current density.

13.00-13.20 2.4 N.P. Abanshin, E.G. Mukhina, B.I. Gorfinkel (*R&DI "Volga", Saratov, Russia*).
Development of displays with autoemissive cathodes on the basis of carbon nanotube.

13.20-13.40 2.5 B.G. Shulitski, V.A. Labunov, A.L. Prudnikova (*Belarusian State University of Informatics and Radioelectronics, Minsk*).
Investigation of the Multi-Wall Carbon Nanotube Synthesis Process with the regulated parameters.

13.40-14.00 2.6 V.I. Kozlovsky, A.B. Krysa, D.A. Sannikov, Ya.K. Skasyrsky, Yu.M. Popov (*Lebedev Physical Institute of RAS, Moscow*), P.I. Kuznetsov (*Institute of Radiotechnics and Electronics of RAS, Moscow*), M.D. Tiberi (*Principia LightWorks Inc., CA, USA*).
Laser CRT as light source for display technology.

14.00-15.00 ***Lunch***
15.00-20.00 ***Cultural Program***

Thursday, October 05, 2006

9.40-14.00 **Conference Hall** (Third Floor)

9.40-14.00 **Session: Non-Emissive Displays**

9.40-11.40 **Seminar 1. LCD Technologies – Alignment and Electrooptics**
Chairmen: S. Palto and E. Pozhidaev

9.40-10.00 1.1 Yu. Kolomzarov, P. Oleksenko, V. Sorokin, P. Tytarenko, R. Zelinskyy (*V.Lashkarev Institute of Semiconductor Physics, Kiev, Ukraine*).
SiO_x doped orienting films: technology, properties and nematic LC oriented structures.

10.00-10.20 1.2 Yu. Kolomzarov, P. Oleksenko, V. Sorokin, P. Tytarenko, R. Zelinskyy (*V.Lashkarev Institute of Semiconductor Physics, Kiev, Ukraine*).
Influence of external factors on the molecular orientation of NLC aligned by silicon oxide films.

10.20-10.40 1.3 S. Lazarouk , A. Smirnov, V. Labunov, A. Astafjev (*Belarusian State University of Informatics and Radioelectronics, Minsk*), A.Maximov, A.Martinovich (*PHOTEK plant, SPC "Integral" , Minsk, Belarus*).
LC alignment using nanostructured alumina layers.

10.40-11.00 1.4 *S.V. Pasechnik, D.V. Shmeliova, V.A. Tsvetkov, A.V. Dubtsov, B.A. Shustrov (*Moscow State University of Instrument Engineering & Computer Science, Russia*).*
New geometry for a study of weak anchoring in liquid crystals.

11.00-11.20 1.5 S. Hirota, S. Oka, O. Itou (*Hitachi, Ltd., Japan*), S. Komura (*Hitachi Displays, Ltd., Japan*).
Advantage of Transflective IPS-LCD Technology for Mobile Applications.

11.20-11.40 1.6 S.A. Studentsov, V.A. Brezhnev, N.D. Zhukov (*R&D Institute "Volga", Saratov, Russia*), V.G.Chigrinov, Al. Murauski (*Hong Kong University of Science and Technology*).
Super twist liquid crystal display with 3-d electrodes.

11.40-12.00 ***Coffee break***

12.00-14.00 **Seminar 2. LCD Technologies - Electrooptics and Optics**
Chairmen: S.V. Pasechnik and N.D. Zhukov

12.00-12.20 2.1 E.P.Pozhidaev, A.A.Zhukov, I.N.Kompanets, E.E.Buslova, P.S.Komarov, Yu.P.Bobilev, V.M.Shoshin (*Lebedev Physical Institute of RAS, Moscow, Russia*).
Surface nanostructures of aligning layers as a tool of ferroelectric liquid crystal display cells operation steadiness increasing.

12.20-12.40 2.2 V.A. Loiko, A.A. Konkolovich, P.G. Maximenko (*Institute of Physics of NAS, Minsk, Belarus*).
Optical characteristics of polymer dispersed liquid crystal films with fine droplets.

12.40-13.00 2.3 N.A. Ivanova, S.Sh. Shahab, V.E. Agabekov (*Institute of Chemistry of New Materials, NASB, Belarus*), O.V. Tsaruk, V.A. Dlugunovich (*Stepanov Institute of Physics, NASB, Belarus)*.
Optimization of formation method of L-type polarizers on the data of polarimetry and heat conductivity.

13.00-13.20 2.4 I. Kasianova, A. Krivoschepov, D. Yurchenko, A. Lazarev, P. Lazarev (Crysoptix Ltd, Moscow, Russia), S. Palto (*Institute of Crystallography, RAS, Moscow, Russia*).
New transparent birefringent material for interference polarizer fabrication.

13.20-13.40 2.5 A.Lazarev, P.Lazarev, A.Manko, S.Remizov (*Crysoptix Ltd, Moscow, Russia*), S.Palto (*Institute of Crystallography, RAS, Moscow, Russia*).
Cryscade Optical Films: Retarders for LCD.

13.40-14.00 2.6 A. Putilin, I. Gustomiasov (*Lebedev Physical Institute of RAS, Moscow, Russia*).
Application of Holographic Elements in Displays and Planar Illuminators.

14.00-15.30 ***Lunch***

Thursday, October 05, 2006

15.30-17.30 **Pillar Hall** (Second Floor)

Poster Session
Chairman: A.G. Vitukhnovsky

Emissive Display Technologies

P.1 Tarasova-Tarosjan, E.V. Sergeev, E.V. Komarov, M.M. Sychov, E.V. Kolobkova, V.V. Bakhmetiev *(Saint-Petersburg State Institute of Technology, Russia*).
Influence of the type and concentration of coactivator on the ZnS:Cu phosphors properties.

P.2 E.V. Sergeev, L.I. Tarasova-Tarosjan, E.V. Komarov, A.A. Eruzin, M.M. Sychov, E.V. Kolobkova, I.B. Gavrilenko *(Saint-Petersburg State Institute of Technology, Russia*).
Plasma modification of EL phosphor.

P.3 N.A. Vlasenko, P.F. Oleksenko, L.I. Veligura, M.O. Mukhlyo, Z.L. Denisova (*Institute of Semiconductor Physics, NAS of Ukraine, Kiev*).

Comparison of some characteristics of planar and edge TFEL ZnS:Er,F emitters.

P.4 N. Lachinov, V. M. Kornilov, Yu.M.Yumaguzin (*Institute of the Physics of Molecules and Crystals, Ufa Research Center RAS*, *Russia*).
Electron emission from polimer films under electric-field influence.

P.5 I.V. Shein (*ZAO "Almaz-Fazotron, Saratov, Russia*), S.L. Shmakov (*Saratov State University, Russia*).
Electrophoretic Technique with a Thin Electrochemical Cell Driving by Light like a Photoprinting Process: for LED and OLED Screening Application.

P.6 N.P. Soschin, V.N. Lichmanova, V.A. Bolshukhin, E.A. Kirillov (*R&D I «Platan», Fryazino, Russia*).
Use of radiative cathodoluminescence screens for creation of devices of illumination.

P.7 V.A. Vorobyev, Y.V. Kuznetsov, N.I. Kargin (*North-Caucasus State Technical University, Stavropol, Russia*).
Studying the temperature characteristics of luminescence $SrTiO_3:Pr^{3+}$.

Non- Emissive Display Technologies

P.8 S.I. Kucheev (*Chernigov University, Ukraine*).
Ion-controlled liquid crystal grating in silicon/nematic/ITO structure.

P.9 A.V. Barannik, O.O. Prishchepa, A.M. Parshin, A.V. Shabanov, V.G. Nazarov, V.Ya. Zyryanov (*Kirensky Institute of Physics of SB RAS, Krasnoyarsk, Russia*).
Magneto-optical method to study the threshold characteristics of PDNLC films.

P.10 V.G. Nazarov, A.M. Parshin, V.Ya. Zyryanov, V.F. Shabanov (*Kirensky Institute of Physics of SB RAS, Krasnoyarsk, Russia*), V.I. Lapanik, V.S. Bezborodov (*Institute of Applied Physics Problems, Minsk, Belarus*).
PDLC Films Uniaxially Arranged by Magnetic Field in SIPS Technology.

P.11 A. Rybalochka, M. Chumachkova, M. Minyailo, V. Sorokin (*V.Lashkarev Institute of Semiconductor Physics, Kiev, Ukraine*).
A simulation method for electro-optical characteristics of ChLCs.

P.12 T.G. Drushlyak, I.M. Gella, N.I. Shkolnikova, N.B. Novikova, L.A. Kutulya (*STC «Institute for Single Crystals», NAS, Khar'kov, Ukraine*).
New 1-aryl-spirooctan-4-ones as chiral components of induced short-pitch cholesterics.

P.13 N. Shkolnikova, L. Kutulya, T. Drushlyak, N. Pivnenko, E. Popova, E. Kopeychenko (*STC «Institute for Single Crystals», NAS, Khar'kov, Ukraine*).
Ferroelectric properties of LC systems including chiral dopants with different molecular structure.

P.14 A. Andreev, E. Pozhidaev, T. Fedosenkova, J. Shumkina, I. Kompanets (*Lebedev Physical Institute of RAS, Moscow, Russia*).
Dynamics of the domain borders motion in ferroelectric liquid crystals.

P.15 S.Sh. Shahab, N.G. Ariko, V.E. Agabekov, L.N. Filippovich (*Institute of Chemistry of New Materials, NASB, Minsk, Belarus*).
Anisotropy of polarized polyvinyl alcohol films.

P.16 V.P. Gerasimov, V.A. Gunyakov, S.A. Myslivets, V.G. Arkhipkin, V.Ya. Zyryanov, V.F. Shabanov (*L.V. Kirensky Institute of Physics of SB RAS, Krasnoyarsk, Russia*), S.Ya. Vetrov (*Krasnoyarsk State Technical University, Russia*), G.N. Kamaev (*Institute of Semiconductor Physics of SB RAS, Novosibirsk, Russia*).
Influence of Incidence and Temperature on Defect Modes in Photonic Crystal Cell with Nematic Layer.

P.17 G.M.Zharkova, A.P.Petrov, I.V.Samsonova, S.A.Strel'tsov (*Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk, Russia*).
Holographic polymer-LC arrays.

P.18 V.Kourmachev, Yu. Timoshkov, T. Orechovskaya, V.Timoshkov (*Minsk Instutute of Management, Belarus*).
Novel way of fabrication of microreliefs for MEMS.

Display Systems and Applications

P.19 K. Karapetyan, A. Morozov, M. Potapova (*Samsung Research Center, Moscow*).
Beam reshaping for rectangular area illumination.

P.20 K. Karapetyan, A. Morozov, M. Potapova (*Samsung Research Center, Moscow*).
Multiple PC-based simulation of complex illumination system using TracePro and MATLAB.

Complimentary coffee, snacks and drinks will be served during the Poster Session in the Pillar Hall.

17.30 **Closing Ceremony**

ADSTRACTS OF PRESENTED PAPERS

10.30-11.05 *Tuesday, October 03, 2006* Plenary Session 1

1. Display Technologies and Market in Russia

V. Belyaev

Samsung Research Center, Moscow, Russia

11.05-11.40 *Tuesday, October 03, 2006* Plenary Session 1

2. Present state and prospects of nanomaterials and nanotechnologies for new generation of information and communication systems

V.Labunov

Belarusian State University of Informatics and Radioelectronics, Minsk

The main goals and content of two national programs "NANOTEX" and "ELECTRONIKA"
for years 2006-2010 will be discussed. All projects of these programs are dealing with investigation of the components (transistors; displays; solar cells; gazo-, chemo-, bio-, sensors; micro-fuel cells; electronic-optical and electro-mechanical elements) for new generation of the information and communication systems by the scaling to the nanosizes the components of the Si technology as a basic one and expending the functional possibilities of these components by the utilization of the specially elaborated nanostructured inorganic and functional organic materials such as porous Si and AI2O3, nanoparticles , nanotubes, nanowires, self assembling nanolayers and bio-structures.

12.00-12.30 *Tuesday, October 03, 2006* Plenary Session 2

3. Silicon-based microdisplays: the experience of design and manufacturing

A.Smirnov, S.Lazarouk, V.Labunov, P. Poznyak, A.Berezovik

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In this paper we will describe main steps of designing and manufacturing of microdisplays for NTE applications. Two types of devices will be discussed e.g. reflective LCOS- microdisplays and light emitting LED-microdisplays based on nanoporous silicon. The comparison between these two technologies will be done.

4. OLED: improvement of technology process and increase in service life

Abanshin N.P., Zhukov N.D., Zimin I.A., Kuznetchikhin A.V., Mhitarjan R.V.

FZUE "R&DI "Volga", Russia, Saratov

Modern OLED technology (organic light-emitting displays) is leading technology of the following generation of flat-panel displays.

OLED devices provide high brightness small power consumption, a wide corner of the review, good contrast. Besides they compact and easy, maintain significant mechanical loadings, possess a wide range of working temperatures and have sufficient service life.

Now the basic efforts of developer are directed on increasing of device service life. Because organic molecular and polymeric light-emitting materials quickly collapse under action of oxygen and water vapour, contained in environmental air the perfect hermetization of OLED is required. Therefore full sealing of "stuffing" display panel in necessary for maintenance comprehensible (from the point of view of commercial use) for durability. The basic directions of our developments are directed on the decision of this problem. In this article the various ways of OLED hermetization, that developed in R&DI "Volga" are considered. We describe the newest vacuum sealing technology without stem, allowed us to brake process of degradation of organic layers of OLED structure. Additionally, the comparative analysis of the influence of OLED sealing on devices durability is submitted.

From the technology point of view, OLED has significant advantage at cost in comparison with the "know-how" of liquid crystal matrixes. OLEDs are much less sated with materials, they demand essentially smaller amount of technological operations. Therefore the cost price of this devices at transition to their mass production will be lower, than for LCD. However, the manufacture of displays with organic materials requires to pay exclusive attention to improvement of technology processes. The basic results of researches are resulted at the choice of modes to preliminary preparation of a surface of electrode metal layers, in particular ITO, before deposition of organic layers of OLED- structure. The influence of deposition methods for organic layers and their thickness on electrooptical characteristics OLED is analysed. The measured values of brightness, current and voltage for various thickness transport layers and the designed values of point efficiency are submitted.

13.00-13.30 *Tuesday, October 03, 2006* Plenary Session 2

5. Multi-user 3D Display using a Head Tracker and RGB Laser Illumination Source.

Authors:

Phil Surman – De Montfort University
Ian Sexton - De Montfort University
Klaus Hopf – Heinrich Hertz Institute
Edward Buckley – Light Blue Optics
Wing Kai Lee – De Montfort University
Richard Bates – De Montfort University

Abstract

A 3D display that incorporates an RGB laser as the backlight for an LCD and a head position tracker is described. The display provides 3D to several viewers, each of whom does not need to wear special glasses and is able to move freely over a large area. It operates on the principle of forming exit pupil regions where either a left image or a right image is seen on the screen. These follow the positions of the viewers' eyes by using the output of the head tracker to control the backlight optics.

The stereo image pair is displayed on a direct-view LCD, and steering optics behind this form the pupils. Currently the two images are spatially multiplexed with left and right images presented on alternate pixel rows. An RGB laser source illuminates a series of binary phase holograms displayed on an LCOS panel, which acts to direct light to the appropriate positions on a series of optical arrays according to information supplied by the head tracker. The arrays enable exit pupils to be formed over a large viewing region by employing novel coaxial optical elements.

A high-precision 3D video head tracker has been developed that employs an appearance-based method for initial head detection and a modified adaptive block-matching technique for head and eye location measurements in the tracking phase. The adaptive block-matching approach compares the current image with eye patterns of various sizes, which are stored during initialization.

13.30-14.00 *Tuesday, October 03, 2006* Plenary Session 2

6. Modern trends of video processing for digital TV

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A review of modern methods of video processing to enhance digital TV picture quality (color spaces, format transformation, video scaling etc.).

16.00-16.20 *Tuesday, October 03, 2006* Session: Systems and Applications

1. Enhancement of stereoscopic images quality: optical correction of depth plane curvature

Vladimir V. Petrov, Konstantin A. Grebenyuk

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Saratov State University

Present study is aimed to development of the method for correction of stereoscopic image distortion termed depth plane curvature. Depth plane curvature is such a distortion that makes objects at the centre of the screen look closer to observer then objects at the corners of the screen, whereas in the real world they don't.

This distortion occurs when viewing stereoscopic images obtained with converged camera configuration and could lead to wrong perception of relative objects distances. The reason for depth plane curvature is that in converged camera configuration imaging sensors of two cameras are located in unparallel planes while both captured images are displayed at the same plane which is the plane of stereoscopic display screen.

In present study we propose possible method for correction of depth plane curvature using especial optical configuration for the stereoscopic display. The main idea of the method is to display left and right perspective views at different planes (screens) intersecting at definite angle. The rules for this angle definition are shown. Possible realization of proposed intersecting screens configuration with current display technologies is described.

16.20-16.40 *Tuesday, October 03, 2006* Session: Systems and Applications

2. Experimental model of 3D volumetric display based on 2D laser beam deflector and a stack of FLC light-scattering shutters

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The joint research team of the LPI and MEPHI studies and uses the new optical bistability effect in fastest monomeric ferroelectric LC, which is much cleaner in a transparent state and can switch on/off the light scattering for total time of only 400 μs at ±50 V pulse. It means that a volumetric screen can consist of 30-100 shutters, and the depth spatial resolution can reach 30-100 sections.

A prototype of 3D display with a multilayer volumetric screen of 10 LC shutters was designed, and its work was demonstrated. The light scattering was switched on and off in shutters in turn along Z direction. Section images on scattering shutters were visualized due to the laser diode beam which was scanned in XY directions by the fast and compact TeO_2 acousto-optical deflector (any point can be addressed for 2 μs). Laser diodes of R and G colors were used. Possible parameters of real 3D volumetric display were estimated.

16.40-17.00 *Tuesday, October 03, 2006* Session: Systems and Applications

3. Multicomponent screens of collective usage for extremes condition of application

Sadchikhin A.V., Dr.Sci.Tech., Rytov E.N., Nekljudov V.I., Akimov E.E.

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In this paper the analysis of the most widespread technologies of joint of screens in videowalls. It is shown, that they have a series of essential lacks: the big optical gap (1,5 - 2,0 mm) at the declared mechanical gap of 0,5 mm, the limited range of operation temperatures from 5^0C up to 30^0C (optimum temperature from the point of view of operation of the screen 20^0C +/-3^0C) and humidity up to 80 % (without a condensate).
The new patented technology of fastening of screens is discussed. The technology (it is named by us «the image without borders») provides an optical gap between screens about 0,1 mm in a range of temperatures from 0^0C up to 50^0C (and more) and humidity from 0 % up to 99 %. Thus there is no curvature of screens.
Results of development earthquake-proof the multicomponent screen for block control panels of nuclear stations which maintains seismic influences in size of 7 points under the Richter scale on a mark of 10 meters are shown.

17.00-17.20 *Tuesday, October 03, 2006* Session: Systems and Applications

4. LED information boards: the experience of design, manufacturing and application

Yu.Trofimov, V.Posedko, V.Sivenkov, S.Lishik

Institute of lectronics NAN of Belarus, Minsk

Main steps of design, manufacturing and control of LED information boards will be discussed. Main attention will be paid to the interactive boards with a non-contact input of information and, in articular, to photo touch systems.

17.20-17.40 *Tuesday, October 03, 2006* Session: Systems and Applications

5. Multifunctional Display for Transport Application.

Lukashenko V.B., Dyatlov M.V.
JSC “KB Technotronic”, Fryazino of Moscow region, Russia

1) MFD-26 - (multifunctional display) - smart unit, vehicle computer able to receive sensors signals, process it and to display the analyzing results in the image form on the screen 10' size.
2) MFD-26 has very high EMI durability that allowed by using:
- CAN interface for data buses
- custom developed filtration for the power, ground buses and the case of the unit.
3) MFD-26 can be upgraded:
- custom sensors (temperature, light sensors and so on).
- CPU rate
- memory.
The unit processing capabilities are defined by standard PC-104 board that can be easily upgraded so as the customer needs.
4) The unit has excellent vibration durability that ensured by custom developed vibration and shock absorption system.
5) The unit is extremely durable in the harsh climatic environment that ensured by the using custom developed software and hardware that controls heating the LCD and backlight.
6) The units indication unit can display image with excellent optical performance ensuring readability in any illumination conditions from full darkness to direct sunlight. The optical performance is ensured by using custom developed antireflection glasses, optical films, backlight unit and LCD screen.

17.40-18.00 *Tuesday, October 03, 2006* Session: Systems and Applications

6. Mass production of high reliable LCDs

A. Martinovich, A. Maximov, O.Kursevich, V.Lebedev
PHOTEK plant of SPC "Integral", Minsk

Technological features of high reliable LCDs mass production will be analyzed. Special attention will be paid to high reliable control of LCD parameters during and after manufacturing process and operability assurnce of a LCD at low temperatures.

9.40-10.00 *Wednesday, October 04, 2006* Session: Emissive Displays

Seminar 1. Electroluminescent Display Technologies

1.1. Surface Properties and Luminescence of Powder Phosphors

M.M. Sychov

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It is very well known that surface properties of phosphor particles have great impact on their luminescence. That is because surface participates charge transfer processes as well as radiative and non-radiative recombination of charge carriers. In this work it is shown that chemical measurement of content of surface acid-base absorption centers allows one to obtain important information about chemical composition and defects on the surface. Using as an example ZnS powder phosphors it is shown that it is possible to establish correlation between surface, crystal and luminescent properties of phosphors of certain compositions. Such correlations further allows one to use chemical diagnostics of surface for the control of phosphor quality and for the prognosis of its performance.

10.00-10.20 *Wednesday, October 04, 2006* Session: Emissive Displays

Seminar 1. Electroluminescent Display Technologies

1.2. The influence of zns phosphors composition on their luminescent properties

Komarov E.V., Sychov M.M., Nakanishi Y.*, Kominami H.*, Bakhmetiev V.V., Korsakov V.G.

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Influence of activator (copper) concentration and coactivator type (chlorine, bromine and iodine) upon the structure and properties of ZnS phosphors was investigated. Dependence of EL brightness on the copper content has extreme character and position of maximum shifts to the higher Cu concentration in the series I<Br<Cl. With a growth of Cu content the quantity of luminescence centers of various nature increases and additional heterojunctions $ZnS-Cu_2S$ which are the sources of electrons are formed. Decrease of brightness can be explained by concentration suppression and formation of opaque Cu_2S phase. Influence of phosphor chemical composition on its spectral characteristics, size and the form of particles was investigated. The increase of the particles size in the series Cl<Br<I at the constant copper concentration positively affects EL brightness because larger particles are more efficient at the given exciting voltage. At the same time the quantity of copper in phosphor decreases as change of chlorine to a halogen with bigger atom radius makes diffusion of ions into a crystal more difficult. Cathodoluminescent properties of the synthesized samples were investigated and the comparison of cathodo- and electroluminescent characteristics was performed.

1.3. Triplet emitters for optimization of organic light emitting diode

N. Maslak-Gudima, M. Minyaylo*

Institute of Sorption & Ecology, NAS Ukraine
*Institute of Semiconductor Physics, NAS Ukraine

The scientific analysis of researches aimed to increase the efficiency of OLED electroluminescent devices has been carried out. In case of doped emitter molecules (organic-transition-metal compounds), it is possible to obtain four times higher efficiency than with typical singlet emitters. This takes place by specific singlet and triplet paths (electron-hole interactions) which involve dopant-to-matrix charge transfer states. Organo-transition-metal triplet emitters have a great potential to be applied in OLEDs. Thus, several types Ir (III) organic complexes to create OLEDs with various spectral characteristics were offered.

1.4. Tandem Organic Light Converters and Peculiarities of Photocurrent Multiplication

Leonid Lepnev[1*], Andrei Vaschenko[1], Alexei Vitukhnovsky[1], Svetlana Eliseeva[2], Oksana Kotova[2], Sofia Torgova[1], Natalia Kuzmina[2]

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The novel tandem two-diode organic amplifier/converter of light based on successively connected photosensitive and light emission cells with spatial disjunction of processes of photocurrent multiplication (PM) and electroluminescence has been proposed and realized. The terbium complex $Tb(Sal)_3(TPPO)_2$ (HSal – salicylic acid, TPPO – triphenylphosphine oxide) or Alq_3 (aluminum tris-(8-hydroxyquinoline)) have been used as active layers in light emission cell of device as well as the perylene pigment Me-PTC (N,N′′-dimethylperylene-3,4,9,10-bis(decarboximide)) in the photosensitive one. A modernized model of field-activated structural traps has been suggested. Kinetics of PM during light- and voltage switching with time pauses is explained using this model. The PM gain up to 10^5–fold has been achieved. The conversion of long-wave (λ=600 nm) light into narrow emission bands of $Tb(Sal)_3(TPPO)_2$ (λ_{max}~545 nm) and wide-band (from 490 nm) emission of Alq_3 has been obtained. A computer simulation of the tandem-diode amplifier/converter has been performed and operation conditions providing transition from the up-conversion mode to the enhancement of light mode have been studied.

This work has been fulfilled under support of grants of Russian Foundation for Basic Research (RFBR) №№ 04-02-17040, 05-03-33090, 05-03-34821-MF-a, 06-02-16399a and of Development Program for System of Leading Scientific Schools in Russia, code NSh-4541.2006.2; 2006-RI-112.0/001/221.

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1.5. The organic luminescent display with an interior electric field

D.A. Zajarskiy, O.M. Ruzanov, D.A. Fedorkov, V.V.Petrov, B.N. Klimov

Saratov State University, Saratov, Russia

In the present paper the problem which is important for the modern microelectronics - a raise of effectiveness of carrier charge transfer by means of making of an internal field is considered. For this purpose we create structures which besides standard layers, such as HTL, ETL contain layers consisting of polymers with the Internal charge, such as PSS, PAH. Theoretical calculations show, that the addition this layers in polilayers OLED structures can lower potential energy barrier between organic layers and electrodes that will allow to raise{increase} effectiveness of an emission of charge transfer and consequently also number of excitons in working area of the display.

1.6. Xerogels, doped with lanthanide ions, in mesoporous matrices: from peculiarities of optical excitation to multicolor luminescent images

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The report summarizes the peculiarities of synthesis and luminescence properties of the structures comprising xerogels, doped with optically active erbium, terbium and europium, in porous anodic alumina and artificial opals. Effect of light scattering is matrices with anisotropic density of states is discussed from viewpoint of enhanced luminescence from the structures for blue, green, red and infrared spectral ranges.

2.1. The new phosphors for screens of high-speed CRT

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The optical-electronic methods of processing of the large massif information (meteo- and geographical cards, geology and geoengineering, manufacture and rewriting of films on haloid carriers etc.), despite of wide use of alternative digital technologies, have not reduced of its use in engineering. Optical scheme of similar devices includes high-speed electron beam CRT with one or two-coordinate development; the optical carrier of the corrected or analyzed information; the optical system of carryover and record of signals.

In this scheme the basic stop of processing speed of the information is luminescent screen CRT, for which the following basic parameters are characteristic:

- Decay time up to 10 % from initial value is no more than 100 ns;
- Spectral range of a light signal no more than 110 nm with the basic spectral maximum intensity at about 540 nm;
- The spatial optical resolution of the luminescent screen is not less than 50 microns;
- High radiating stability of the screens CRT is up to 10 thousand hours.

In "Platan" a series of works on creation of the new high-speed effective phosphors was undertaken on the basis of two various kinds of inorganic materials:

- Oxiorthosilicates of rare earths,
- Aluminagarnet of the elements П,Ш and 1У of groups with f-d activator Ce+3.

We showed a possibility of adjustment by spectral composition of the phosphor emission in the specified series of the compounds by a method of two or three - ions replacement of basic cation, for example Y on the ions Gd, Ln, having wide a power split, or on the ions Tb+3, Eu+3, Sm+3, that have numerous emission levels and in depending on concentration are extinguished at replacement by them in plenties of basic cation (La or Y). The similar operate by an emission spectrum has allowed to achieve shift of a spectral maximum from 390 нм up to 450 нм on (Y2Me)SiO5:Ce systems, whereas for systems (Y, Gd, Ln) 3 (Al, Ga) 5O12:Ce the shift can make up from 520nm up to 605 нм.

The problem essential decrease of decay time basic d-f-emitter Ce+3 was decided by additional introduction into the composition of a basis phosphor the elements such as Yb+3, the power levels set of which allow smoothly to change the emission time from 55ns.

The creation of high spatial resolution was decided by development of new methods solid phase synthesis of an inorganic phosphors out of nanodimension initial raw material. It was allowed to synthesis final products at the lowered temperatures (reduction of geometrical size of phosphor grains) with the minimal infringement of composition and making of micromonocrystals grains having the clear morphological structure. Monocrystalization of each separate grain was accompanied by essential increase of their power- and light output and also radiating stability.

The parameters of high-speed phosphors are submitted in the table

Phosphor	Spectral inclusion, nm	Power output, %	Particles size, mkm	Decay time, ns
(Y, Gd, Me) $_2SiO_5$:CeYb	390-510	12-14	d_{50} = 1,0	40-50
(Y,Gd,Me)$_3$(Al,Ga)$_5$CeYb	500-605	12-16	d_{50}= 2,0	40-60

The emitting screens were created with high-speed CRT, working with speeds of the information processing in 2-3 times above, than achieved before the values on frequency f=10-20 MHz.

Ref.: Patent № 2252240. "Blueemitting phosphor on a basis yttrium-gadolinium oxiorthosilicate, activated by Ce 3+ ".

2.2. Efficient RGB-phosphors: synthesis and peculiarity of cathodoluminescence

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*Samsung SDI Co Ltd., Korea

Synthesis techniques for RGB phosphors based on zinc-cadmium sulfides and yttrium-gadolinium oxosulfides effectively excited in CRT screens, middle-voltage and high-voltage (300-2000 V) FED and low-voltage VFD have been developed. The influence of synthesis conditions (blend composition, activator and coactivator concentrations, nature and content of fluxes, annealing temperature and atmosphere etc.) on their brightness, efficiency and chromaticity coordinates has been established.

An effective zinc-cadmium-sulfide R phosphor for low-voltage flat VFD (excitation 40 V), zinc-sulfide GB phosphors for CRT of special purposes
(5-18 kV), and an R phosphor based on yttrium-gadolinium oxosulfide for FED and low-voltage VFD as well as for CRT have been synthesized.

The relation between the synthesis conditions, chemical composition and grain size of phosphors, and the influence of these conditions on the formation and cathodoluminescent characteristics of CRT, FED and VFD screens are discussed.

2.3. Perfection of a red-emitting phosphor Y_2O_3:Eu for displays with high current density

Vorobyev V.A., Siglovaja N.V., Kargin N.I.

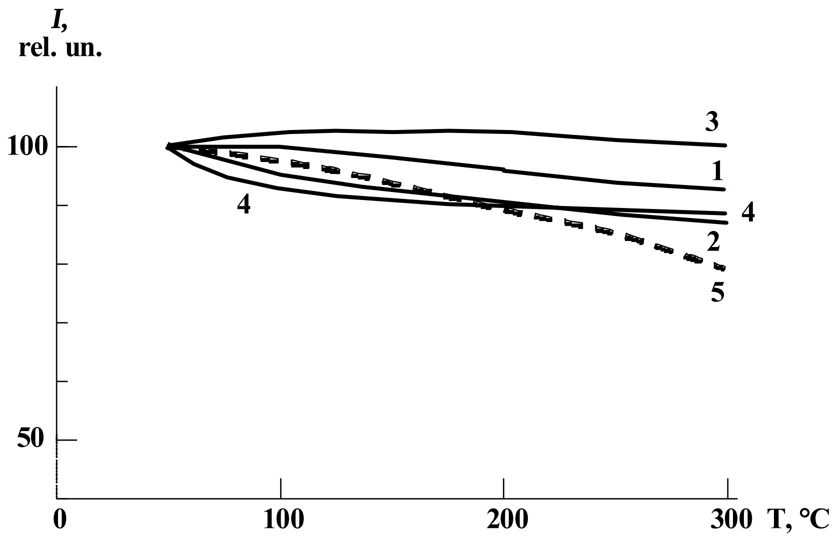
North-Caucasus State Technical University, Russia, Stavropol

At a choice substantiation of phosphors for devices with high current density, it is necessary to take into account a brightness reduction effect at the high working temperatures, connected with transformation of a significant energy part of electron beam into warmth. It causes undesirable heating of a phosphors covering. The analysis of information sources about the most perspective and useful red-emitting electron-excited phosphors has shown, that in projective electron beam tubes are applied a phosphors on the yttrium oxide basis only. For application in a low-voltage field-emission displays the $Y_2O_3:Eu$ is considered as perspective, however at present is applied basically $Y_2O_2S:Eu$.

The reasons limiting integration of yttrium oxide in electron-beam and flat-panel displays are: nonlinear dependence of brightness from a current density at the increased excitation density. Therefore search of the elements increasing low-voltage cathode-luminescence brightness at working current density is topical at present.

It was earlier established, that ions of trivalent metals (*B, Ga, Sc, Gd*) at accelerating voltage 1 kV and low current density give a significant gain of brightness. It testifies to increase of a phosphor basis conductivity that is one of requirements to low-voltage phosphors.

Dependence of cathode-luminescence brightness from temperature was measured on pilot unit "PRSEL" at cooling of preliminary-heated up sample. Speed of cooling 10 K/min was provided with speed of nitrogen vapors submission. The temperatures interval is 77- 600 K.



2.4. Development of displays with autoemissive cathodes on the basis of carbon nanotube.

Abanshin N.P., Muhina E.G., Gorfinkel B.I.,

FSUE "RDI" Volga ", Russia

Last time the development of information display systems with autoemissive cathodes on the base of carbon nanotube (CNT) is included into number of the perspective works concerning to nanoelectronic region.

The main methods of reception CNT are electroarc dispersion of graphite and catalitic vapour deposition of hydrocarbons (CVD).

R&DI "Volga " are carried out the development of information display systems on the base of CNT received by these two methods.

Digital indicators with a planar arrangement of electrodes and with the hinged cathodes covered CNT, and also matrix diode systems are made.

At device manufacturing thin-film and thick-film technologies for layer deposition were used. The nanotubes received by electroarc dispersion, were rendered on electrodes by a electrophoretic method. The electrode figure for displays with CNT, received by CVD method, was formed by a photolithography on a catalist film of a silicon substrate.

The developed displays on base CNT, received by an electroarc dispersion method, are characterized by managing fields 1,5-2 B/microns. Thus brightness of radiation ≈1000 kd/m^2.

Displays with CNT, received by CVD method, had managing fields 3–4 B/microns at brightness of radiation ≈1000 kd/m2.

Tests for the minimal operating time of the developed displays are lead. The analysis of manufacturing techniques and parameters of displays has shown, that CNT display technology, received by an electroarc method it is essentially easier, however durability of CNT displays, received by method CVD is higher.

Development of CNT displays was carried out, submitted GPI RAS (Moscow) and IRE RAS (Saratov).

2.5. Investigation of the multi-wall carbon nanotube synthesis process with the regulated parameters

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The atmospheric pressure CVD technology of multi-wall carbon nanotube arrays synthesis on the top of different MDS structures by the method of dosed aerosol injection of fluid hydrocarbons with volatile catalyst performs the possibility to vary over a wide range the type, structure and percentage ratio of the catalyst in a hydrocarbon solution what assure the high level of CNTs growth selectivity and density of CNTs packing management. It assures nontoxicity of both carbon source gases and auxiliary components, high efficiency due to high CNTs growth rate and low cost owing to simplicity of technological equipment. It allows to consider this technology as a basis for the future manufacturing of aligned CNT arrays for FEDs.

2.6. Laser CRT as light source for display technology

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[1)]Institute of Radiotechnics and Electronics of RAS, Russia
[2)]Principia LightWorks Inc., USA

Last results obtained recently with GaInP/AlGaInP multi quantum well (MQW) structures emitting in red range (640 nm) show that mini laser cathode ray tubes (CRT) may have efficiency as high as 10 %. So they are perspective monochromatic light sources for display technology. At present we concentrate on the problem to extend the high results achieved in red to green and blue ranges.

In the paper we shall discuss some technological problems, which prevent to grow high quality MQW II-VI compound structures. The main of them is the high internal stresses in the structures. By an optimization of growth conditions the problem was solved mainly and the ZnCdSe/ZnSSe structures with different Cd and S contents for blue and green ranges were obtained for laser CRT. The maximum output power of 3.2 and 1 W was achieved at wavelength of 535 and 463 nm respectively under longitudinal pumping by electron beam with the electron energy of 40 keV and room temperature.

9.40-10.00 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 1. LCD Technologies – Alignment and Electrooptics

1.1. SiO_x doped orienting films: technology, properties and nematic LC oriented structures

Yu. Kolomzarov, P. Oleksenko, V. Sorokin, P. Tytarenko, R. Zelinskyy

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Abstract

Technology of SiO_x:In, Sn orienting films by reactive cathode sputtering (RCS) method is presented. The influence of In, Sn surface concentration in cathode target on orienting film properties are investigated by the AFM and optical profilometry methods. The properties of orienting microrelief obtained by RCS method for different In, Sn concentration and by poliimid rubbing method are compared.

It was shown that such orienting microrelief create defectless and perfect on the microscopic level nematic LC oriented structures.

10.00-10.20 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 1. LCD Technologies – Alignment and Electrooptics

1.2. Influence of external factors on the molecular orientation of NLC aligned by silicon oxide films

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Thermal and degradation stability of orienting SiO_x films deposited by reactive cathode sputtering (RCS) in glow discharge plasma has been investigated. It is shown that heat treatment and other external factors initiate transformations on the surface of orienting film and formed new conditions on the interface. It is lead to change of easy orientation axis direction of LC molecules and appearance of various defects in the LC aligned structures.

The technological ways for increasing of orienting layers durability under influence of external factors has been proposed.

10.20-10.40 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 1. LCD Technologies – Alignment and Electrooptics

1.3. LC alignment using nanostructured alumina layers

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We have developed the novel low temperature technological method to form nanostructured alumina layers with regulated tilt of porous which can be used for the precise alignment of liquid crystal molecules in LCDs.

11.00-11.20 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 1. LCD Technologies – Alignment and Electrooptics

1.5. Advantage of Transflective IPS-LCD Technology for Mobile Applications

S. Hirota, S. Oka, O. Itou (Hitachi, Ltd.)
S. Komura (Hitachi Displays, LTd.)

In this paper, we discuss the transflective display performance and the viewing-angle characteristics required for FPDs used in mobile devices. The reflective property of the transflective technology is necessary for desirable visibility under various lighting conditions. The transmissive property is also important for representing photographic-quality images. It is often thought that the viewing-angle characteristics of FPDs are not important because the usage of these mobile devices is usually personal. However, the viewing-angle property is still important for FPDs used in mobile devices to display photographic-quality images. The position of the user and the display is not fixed, and the devices aren't always viewed from the normal direction. The influence of the binocular parallax should be also considered. The display of photographs requires not only excellent contrast viewing angle, but also no change in the gamma and the chromaticity characteristics. As for the chromaticity characteristic, that of unsaturated color is important, because most actual colors of natural objects are unsaturated. Our transflective IPS-LCD shows good performance in these characteristics.

1.4. New geometry for a study of weak anchoring in liquid crystals

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It is known that weak anchoring plays a key role in some new type of liquid crystal displays, bistable for example [1]. In this report we propose the new geometry for a study of both static and dynamic properties of liquid crystal layers, confined by weakly anchoring surfaces. The main advantage of the geometry is the possibility to register extremely slight local azimuth variations of a director induced by electric field and surfaces due to strong changes of the intensity of the light propagating in the plane of the surface under consideration (see fig.).

In this case a pure twist- like deformation of a director results in a variation of the angle between the optical axis and the direction of the light propagation. It leads to a strong optical response at an essential value of optical length. The proposed geometry can be useful for a study of such phenomena as breaking off surface anchoring and slow gliding of the easy axes.

References : Chigrinov, V.G. *Liquid Crystal Devices: Physics and Applications*, Artech-House, BostonLondon (1999).

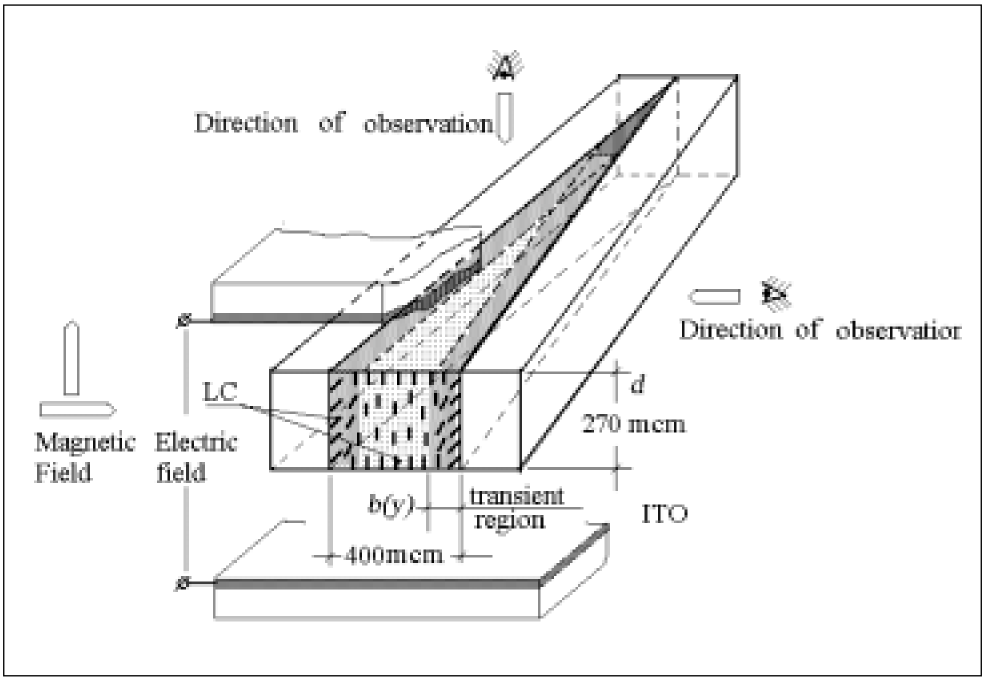

FIGURE: General scheme of the LC cell.

1.6. SUPER TWIST LIQUID CRYSTAL DISPLAY with 3-D ELECTRODES

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The main lacks of passive matrix STN LCDs are frame response and "off-state" pixel charge accumulation. As result, the multiplex level is limited, electro-optical parameters are worsened and the power consumption is increased.

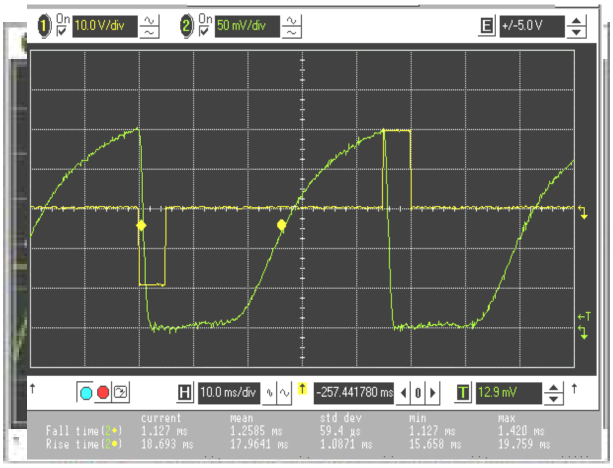
Construction without those imperfections is suggested in this article. Multi-layer 3D electrodes, consisted of conventional electrode on the substrate surface and conducting film on isolating pedestal tops is discussed. Those pedestals are placed between the surface electrode rows or columns like a black mask. The pedestal value is equal to 1/4 - 1/2 of the LC-layer thickness.

3-D electrode on one substrate without any electrodes on another plate is considered. For 180º cell with MLC-6096 (Merck) +1.0% ZLI-811, LC thickness d=4.0-4.5 mkm, pitch P_0=10 mkm contrast ratio CR is equal to 160:1, total response time is about 20 ms.

In another construction variant with 3-D electrode on the first substrate and standard thin electrode on the second one, "off-state" root-mean-square voltage can be reduced by the electrical signal control on additional electrodes. So, the contrast ratio, multiplex level, and response time for passive matrix addressing STN LCD are equal to 228:1, 1/64 and 90 ms, respectively.

The standard alignment methods (rubbing or oblique evaporation) are useless for the special 3D electrode structures described. The new LC alignment non-defect technology for 3D electrodes is suggested and discussed in this paper.

Various variants of 3D electrode construction and technologies are proposed.



a) b)

Figure. Passive matrix addressing of LC cell with 3D electrodes:
a). static driving;
b). 1/64 multiplex form voltage form driving.

12.00-12.20 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 2. LCD Technologies – Electrooptics and Optics

2.1. Surface nanostructures of aligning layers as a tool of ferroelectric liquid crystal display cells operation steadiness increasing

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It was shown experimentally that aligning layers on ITO surfaces of liquid crystalline cells at ordinaty spin-coating can be arranged statistically as island nanostructures with typical thickness of islands 3÷15 nm, in plane averaged dimension of islands about 500 nm÷5μm and an averaged distance between islands about 500 nm÷5μm also. Variations of mentioned above parameters of surface nanostructures results in schanging of aligning surface polarity and manifests in controlled bistable and multiplex operation steadiness of ferroelectric liquid crystal (FLC) display cells.

12.20-12.40 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 2. LCD Technologies – Electrooptics and Optics

2.2. Optical characteristics of polymer dispersed liquid crystal films with fine droplets

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The method to describe scattering cross sections, phase shift, and ellipsometrical parameters of light transmitted through the polymer dispersed liquid crystal films with fine droplets is considered. The listed parameters are connected with the film morpholagy. The simple equations are derived. They can be used for many display applications, for example phase correction.

12.40-13.00 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 2. LCD Technologies – Electrooptics and Optics

2.3. Optimization of formation method of L-type polarizers on the data of polarimetry and heat conductivity

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It is known that linearly polarizing structure of L types polarizers is formed at orientation by stretching of a film from polyvinyl alcohol (PVA) into which is entered dichroic dye. Earlier [1] by laser Stoks-polarimetry method were investigated by us two ways of coloring of film:

- in «mass» - introduction of diazodye of group azobenzenazonaphtalene in initial composition from PVA,
- in «bath» - by absorption of dichromofor from a solution by the not painted film.

Is established that irrespective of formation method of polarizing structure, they have both amplitude anisotropy (dichroism) and phase anisotropy (birefringence) and last decreases with growth of absorption of a film, that is with increase of concentration of dye.

In the given report results of research of two above-stated of formation method of polarizing structure of L types polarizers have been carried out by Stoks-polarimetry and thermo indicator methods in the first time. Is shown that the first method is preferable as film not only are painted on thickness, but also become more oriented as factor of anisotropy of heat conductivity at them is higher.

13.00-13.20 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 2. LCD Technologies – Electrooptics and Optics

2.4. New transparent birefringent material for interference polarizer fabrication

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We have developed new non-absorbing birefringent material for Interference Polarizer (I-Polar) fabrication. I-Polar can be used in light recycling systems aimed to improve backlight efficiency and reduce power consumption of the LCD displays. By wet coating the new material onto a substrate we produce anisotropic films with thickness in the range of 60-90 nm. Such thickness range satisfies the condition that optical thickness of layers in the interference polarizer is equal to the quarter wavelength. One birefringent layer of the material coated on glass reflects 14% of polarization orthogonal to the anisotropic film coating direction which corresponds to refractive index in the said direction equal to 1.8, whereas a stack of 5 layers (3 birefringent layers alternated with 2 isotropic ones, refractive index of the latter being equal to the minimum in-plane index of the birefringent layer) on the glass produces 38% reflectance at 550 nm. The designs based on this material for a typical LCD backlight spectrum will be presented.

13.20-13.40 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 2. LCD Technologies – Electrooptics and Optics

2.5. Cryscade Optical Films: Retarders for LCD

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We have developed a new class of materials and a Cryscade™ method of manufacturing of the retardation film. Advanced materials comprise the amphiphilic compounds and include salts of carboxylic and sulfonic acids with conjugated aromatic cores, which do not absorb light in visible range of light spectra. The Cryscade™ method of manufacturing of the crystalline thin films is based on printing from aqueous solution of lyotropic liquid crystal phase. We have produced a set of retardation films that exhibit properties of C-, A-plates and biaxial films. As compared to conventional retardation materials, new retardation films produced with the Cryscade™ method are strikingly thinner (thickness range is 100 - 1000 nm), whereas birefringence is typically much higher (delta n varies from 0.05 to 0.40). Such a broad range of available thickness and retardation values makes feasible tailoring of LCD designs for customer needs. Viewing angle performance of the crossed polarizers is significantly improved in the presence of the Cryscade™ retardation films, so that the light leakage at oblique incidence decreases several times. Formation of the new coatable stretchless retardation coatings by a roll-to-roll process can be easily incorporated into the techniques widely used in the LCD industry. The Cryscade™ retarders are aimed for LCD HTV application and open up opportunities for the manufacturing cost reduction.

13.40-14.00 *Thursday, October 05, 2006* Session: Non-Emissive Displays

Seminar 2. LCD Technologies – Electrooptics and Optics

2.6. Application of Holographic Elements in Displays and Planar Illuminators

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Holographic Optical Elements (HOE's) on planar waveguides can be used to design the planar optics for backlit units, color selectors or filters, lenses for virtual reality displays. The several schemes for HOE recording was proposed to obtain planar stereo backlit unit and private eye displays light source. In this paper it is shown that the specific light transformation grating permits to construct efficient stereo backlit units that can be switched to 2D viewing. It is also shown several schemes of reflection/transmition backlit units and scattering films based on holographic optical elements. The performance of the waveguide HOE can be optimized using the parameters of recording scheme and etching parameters. The schemes of HOE application are

discussed and some experimental results are shown.

P1. Influence of the type and concentration of coactivator on the ZnS:Cu phosphors properties

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Sychov M.M., Kolobkova E.V., Bakhmetiev V.V.

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In connection with development of the information display, it is interesting to explore influence of the type and concentration of coactivator on the ZnS:Cu phosphors properties, because the chemical content is one of the most important factor influencing their performance. The change of the type of coactivator provides increase of EL brightness in row Al^{3+}> Cl^{-}> Ga^{3+}. In the same time, spectrum of electroluminescence shifts to longer wavelengths in the row chlorine-aluminium–gallium due to increase of relative intensity of green band. The copper content of ZnS:Cu phosphor changes with the change of the type of coactivator. Introduction of aluminium promotes the greater dissolution of copper in the crystal lattice of the zinc sulfide in comparison with others coactivators. The change of the type of coactivator does not promote the change of particle size and does not influence on the crystalline structure of ZnS:Cu phosphor. Change of concentration of aluminium, from 0.02 to 0.06 %wt. results in occurrence of a maximum on dependence of EL brightness on a voltage at 0.03 %wt of Al. Change of concentration of aluminium promote the increase of the copper content, but it does not result in the considerable change of color of ZnS:Cu phosphor.

15.30-17.30 *Thursday, October 05, 2006* Poster Session
Emissive Display Technologies

P2. Plasma modification of EL phosphor

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We report new method of electroluminescence improvement for ZnS phosphor by plasma treatment. Nitrogen plasma modification resulted in 100% improvement of ZnS:Cu,Br EL brightness at 220V drive. Such result was obtained after treatment in nitrogen at 0.05 torr and 0.250 l/min gas flow. When treated at 0.025 l/min gas flow maximum of EL brightness is observed at 0.1 torr pressure. In the same time emission peak shifted from 486-500 to 504-518 nm due to increase of relative intensity of green band in EL spectrum. The observed change is due to removal of thin copper-rich surface layer by bombardment with ions accelerated by electric potential in vacuum chamber. Treatment at pressures lower then abovementioned resulted in brightness degradation due to much higher energy of ions (longer free paths) and thus formation of large amount of surface defects. Usage of both reducing and oxidizing plasma in all cases degraded brightness supposedly due to surface chemicals reactions with formation of zinc and sulfur vacancies. It should be noted that treatment of phosphor in vacuum without plasma effect did not result in significant EL improvement. Thus plasma treatment is a perspective method for the control of EL brightness and spectra of ZnS phosphors.

15.30-17.30 *Thursday, October 05, 2006* Poster Session
Emissive Display Technologies

P3. Comparison of Some Characteristics of Planar and Edge TFEL ZnS:Er,F Emitters

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Institute of Semiconductor Physics, NAS of Ukraine, Kiev

The following differences have been revealed in characteristics of an edge TFEL ZnS:Er,F emitter against those of the same planar emitter: (1) the intensity of the 1.535-mcm emission band is significantly higher than that of other bands and its voltage (V) dependence is the sharpest; (2) this band narrows with increasing V. The differences are explained by, firstly, lesser optical losses in the near-infrared region than in the visible one in the edge emitter and, secondly, the optical amplification of the 1.535-mcm emission in this emitter.

15.30-17.30 *Thursday, October 05, 2006* Poster Session
Emissive Display Technologies

P4. Electron emission from polimer films under electric-field influence

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The development of effective electron-beam emitters is still one of tasks of physical electronics.

The report investigated thin polymer-coated tungsten spikes. The polymer was deposited on the tungsten spike from a polymer solution by using a deep-coating method. The polymer film thickness was estimated to be of 25–50 nm. The known experimental results for the field emission of the cathodes with polymer coatings mainly consist of the current–voltage characteristics with respective estimations of the work function. The emitted electron energy distribution measured in high vacuum with the use of high-resolution analyzers has virtually not been reported till now, although such data contain important information about the emission process and must be analyzed together with the current–voltage characteristics and emission images of the cathodes.

The relative work function of the cathode with the polymer coating was estimated to be 0.45 eV, which is one order of magnitude less than that for the pure-tungsten cathode.

The interpretation of the results obtained must be performed taking into account different mechanisms for the electron scattering in the polymer film and their emissions.

P5. Electrophoretic Technique with a Thin Electrochemical Cell Driving by Light like a Photoprinting Process: for LED and OLED Screening Application.

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First decision:

A microvolume of the planar cell must completely releases its disperse phase – to form a coating.

If the electrode gap is rather narrow — ~100 - 300 μm, the suspension (even IPA-based ones) is easily held inside it by capillary forces and no bath is needed as a container.

Second and third decisions:

Dispersions must be very stable and easily poured, it must be liquid when hot and resolidify when cooled.

In order to stabilize the dispersion, it is gotten sluggish by adding:

I) glycerol,
II) polymers for gelation.

However, electrophoresis requires its medium to be low-viscous at deposition. The particles, organic molecules and big ions should possess high mobilities. To this end, the electrochemical cell is heated. Melting of the gel medium allows EPD of phosphor or organics. Then gel is removed by melting or washing the deposited films remains.

Selective illumination of electrocemical planar cell with a cappilar gap throught masking electrod or by laser locally heats and melts the gel, the dispersion or organic solution is activated electrically, and EPD begins just at the place affected by the light. In this version the technology procedures is looking like photoprinting, bat the base of phenomenon is EPD.

P6. Use of radiative cathodoluminescence screens for creation of devices of illumination LCD.

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Average and high-voltage cathodeluminescence on the efficiency (light output to 60 lm/W) are comparable to high-frequency luminescent lamps and white light diodes (LED) supplied converters. However both widely used variants of creation of devices of back illumination require at the realization complex optical dispersant. The uniformity of distribution of a light flow thus makes ±15 % at general decrease of local brightness up to L = 200±50 kd/m2.

The opportunity of creation very uniform and bright plane surface of devices of illumination with use of radiating screens from inorganic phosphors is considered, continuously raised distributed field a great point by cathodes made from carbon nanotubes CNT [1]. The similar design was offered by the experts of institute ITRI (R. China). Unique many times striped phosphor on a basis oxysulfide yttrium-terbium- of structure Y_2O_2S: Tb.Tm.Eu was developed in R&D I "Platan". This material provides:

- intensive radiation in dark blue (λ = 470 nm), green (λ = 545 nm) and red (λ = 626 nm) areas of a seen spectrum;
- very high current linearity of brightness at significant density of a continuous current of excitation (j=20-100 mA/sm2);
- average and short time of afterglow, smaller duration of the television staff (t e-10-2s);
- Radiating stability of brightness of a luminescence during 10 000 hours of continuous work;
- High local (10000 cd/m2) and average (2000 cd/m2) brightness of a luminescence.

The demonstration of the LCD-device with cathodoluminescence by back illumination on the international congresses SID-2005 and SID-2006 shows on perspective of application average volt cathodoluminescence in LCD-displays. Constructive and technological problems of industrial release of similar devices now are studied

[1] Reports ITRI at a conference SID-2005, Boston, 2005.

P7. Studying the temperature characteristics of luminescence $SrTiO_3:Pr^{3+}$

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For the studying a thin defective structure and an energy transfer mechanisms related to it, thermo-stimulated luminescence (TSL) and luminescence intensity dependences from temperature (thermal quenching - TQ) were involved, allowing to establish a chemical kind of capture centers and character of their interaction with luminescence centers. Identification of defects by comparative analysis of TSL for samples with varied compound was made taking into account a literature data concerning a defective equilibrium $SrTiO_3$, an electro-neutrality condition and elastic interactions at a phase transition point of $SrTiO_3$ (T_C □ 110 K). Results are reflected as band-models constructed according to calculated activation energies of de-excitation and quenching processes.

According to the offered model it is established two energy transfer channels to luminescence centers.

So-called "down"-channel of energy transfer, is connected with acceptor impurity Al_{Ti}□, function of which consists in capture simplification by Pr^{3+} of hole as a result of association $Pr^{3+}Al_{Ti}$□and of granting free holes. In a result the probability of holes ingress to luminescence centers, initially limited by low mobility, is increased.

"Upper"-channel of energy transfer, due to oxygen vacancies. With downturn of oxygen pressure at synthesis, concentration of oxygen vacancies together with an opportunity of their association into a sub-zone is increased, high electron mobility in which reduces their non-radiative recombination probability. It is reflected on TQ curves by increase of a luminescent output in area 230 - 420 K.

The estimation of applicability $SrTiO_3:Pr^{3+}, Al$ to a class low-voltage flat-panel displays based on field emission effect, which have average value anode voltage $U_a = 300$ V and current density $j = 100$ mA/sm^2 at duty 240, has given positive result. In the same time observably for the most effective sample in similar conditions of excitation high brightness – more than 500 Kd/m^2 and linear brightness dependences from current density and voltage allows to decrease greatly the power which consumed by the device.

P8. Ion-controlled liquid crystal grating in silicon/nematic/ITO structure.

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In the work a possibility of using of silicon/nematic/ITO structure for ion-controlled liquid crystal diffractive grating formation is considered. Monocrystalline silicon sample with lithographically performed periodical surface –n-n+- structure having (H) depth of n+ pockets is used as one wall in the cell. –N-n+-relief difference equal to pair hundreds nanometers does not cause diffraction of laser beam(0,63 mkm). Due to field effect in silicon which is induced by ion charge localized (adsorbed) near silicon surface a depleted layer width (L) in silicon can be changed within some range. The conditions of formation (L<H) and disappearing (L>H) of liquid crystal periodic deformation which repeats a solid-state grating in silicon substrate are discussed. Influence of ion dissociation on liquid crystal grating is also considered.

P9. Magneto-optical method to study the threshold characteristics of PDNLC films

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Polymer dispersed liquid crystal (PDLC) films are very promising material for the display application especially for the flexible panels. The base effect revealing in PDLC films is a light scattering controlled by external fields (electrical, magnetic, etc.) that transform the orientational structure inside LC droplets. Recently we have proposed the numerical method to simulate the director configuration within bipolar nematic droplets with the rigidly fixed poles. This method allows to determine the threshold characteristics of the PDLC films. To test the validity of the model we have earlier compared it with the data of the electro-optical measurements. However this analysis has been complicated by requirement to take account of the complex distribution of electric field inside the droplets. Here we propose the magneto-optical method to verify the model. In this case the magnetic-field strength is homogeneous inside PDLC films and it removes the above-mentioned problem. The measured values of threshold fields agree well with the calculated ones. Moreover we compare the data obtained by magnetooptical method with the electrooptical measurements.

P10. PDLC Films Uniaxially Arranged by Magnetic Field in SIPS Technology

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The uniaxially oriented PDLC films prepared by the solvent induced phase separation (SIPS) method have been studied. The samples are obtained by applying the longitudinal magnetic field while the phase separation of the liquid crystal and polymer occurs due to the evaporation of common solvent from the uniform solution. In the presence of magnetic field the nematic liquid crystals 4-n-pentyl-4'-cyanophenylcyclohexane (5PCH), the 4-n-pentyl-4'-cyanobiphenyl (5CB) and nematic mixture LN-394 shape the spheroidal droplets in polyvinylbutyral matrix. At that the 5PCN and LN-394 always form the stable bipolar structures with the droplet axes order depending on the value of the applied field. For 5CB droplets, the bipolar structure is realized only at the weak magnetic field and the radial structure at the strong one. At the intermediate field, the non-equilibrium structures appear which are characterized by the flickering textures.

P11. A simulation method for electro-optical characteristics of ChLCs

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In this paper a simulation method for electro-optical volt-brightness characteristics of cholesteric liquid crystals has been demonstrated. This method allows to essentially decrease a duration of experimental investigation of transition processes in cholesteric materials. For modeling of electro-optical volt-brightness and volt-contrast characteristics we need to measure only a few specific critical and threshold voltage levels. Moreover there is no need to know any other physical and electro-optical properties of cholesteric materials. The example of modeling of electro-optical response of a ChLC from the initial transient planar state has been considered. These characteristics are very important for determination of various parameters for cholesteric displays and drive schemes at the dynamic addressing. Accuracy of proposed method is estimated by the comparison of volt-contrast characteristics of a ChLC obtained both by experimental measuring and proposed simulation method.

P12. New 1-aryl-spirooctan-4-ones as chiral components of induced short-pitch cholesterics

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New 1-(4X-phenyl)-*spiro*-octan-4-ones **1** (X = F, Cl, Br, C_6H_5, $C_6H_4C_6H_4OAlk$) were synthesized to use for inducement of the helical supra-molecular structure with short pitch under addition to a nematic liquid crystal (LC). Design of compounds **1** was accomplished by the replacement of a double bond in known chiral dopants of a series of the isomenthone arylidene derivatives **2** [1] by the cyclopropane ring. This chemical transformation of chiral dopants **2** made them stable to photo-chemical E-Z-isomerization typical of enones **2**. Moreover, new chiral dopants **1** exhibit the helical twisting power that only slightly reduced as compare to compounds **2**. It is of importance that the helical pitch induced by the **1** in 5CB does not almost depend on temperature.

LC mixtures based on the E-63 nematic and containing the most effective **1** possess visible selective light reflection.

1. L.A. Kutulya, In: Functional materials for science and technik Editor V.P. Semynozhenko. Kharkov: «Institute for Single Crystals», 2001. 381.

P13. Ferroelectric properties of LC systems including chiral dopants with different molecular structure

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New ferroelectric LC systems on the base of the eutectic mixture of phenylbenzoate derivatives including chiral dopants with different number and position of carbonyl groups in their molecular core have been investigated. The ferroelectric characteristics such as spontaneous polarization, tilt angle, rotational viscosity and reorientational switching times as well as their temperature and concentration dependences are analysed. On the base of obtained results and investigations reported in [1, 2] data on the influence of peculiarities the molecular structure of chiral dopants on mentioned properties of ferroelectric LCs are generalized.

1. E.V. Popova, L.A. Kutulya, V.V. Vashchenko, M.N. Pivnenko, A.I. Krivoshey, A.P. Fedoryako // Proceedings of SPIE, V.4759, pp. 164-171 (2002).
2. E. V. Popova, T. G. Drushlyak, V.V. Vashchenko, A.P. Fedoryako, and L. A. Kutulya // Journal of Physical Chemistry, V. 76 (11), pp.1779-1783 (2002).

P14. Dynamics of the domain borders motion in ferroelectric liquid crystals.

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FLC helix pitch p_0 and elastic module K_φ are related with the dispersion coefficient of anchoring energy W_Q and with the thickness of the electrooptical cell d by the following expression $K_\varphi \cdot q_0^2 \approx W_Q/d$, where $q_0=2\pi/p_0$, the interaction between molecules and surface results in partial unwinding of helix structure.

The electric field perpendicular to the helix axis gives rise to transition domains (i.e. the regions where a small number of molecular dipole moments are in the opposite direction to the field), representing the coupling states of two 180^0 domain walls of different signs.

The electric field initiates the motion of domain wall and eventually results in the director reorientation in the whole volume of FLC.

In the helix absence the director of FLC changes direction in every smectic layer, the characteristic time being $\tau_c \sim \gamma_\varphi / P_sE$. The change of the director motion character in the volume of FLC, namely the reorientation due to domain wall motion, decreases the electrooptical response time $\tau_{0.1\text{-}0.9}$ about 3-4 times.

Therefore we can get the electrooptical response time about 100 µS when the electric field is about 4V/µm that are most suitable to be used in an active matrix display (or microdisplay) with the high resolution.

P15. Anisotropy of polarized polyvinyl alcohol films

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It is known [1] that the spectral-polarizing characteristics of polarizer films depend on a nature and quantity of entered dichroic organic dye and as from a stretching degree of a film.

Influence of a nature and concentration of various dyes (indigo carmine, chinaldine red, diazodyes of group azobenzenazonaphtalene and threeazodyes derivative of biphenyl) and also stretching degree of a film on formation of anisotropic structure of a polymeric matrix from PVA in establishment of quantitative interrelation between anisotropy of structure of a film and its polarizing ability is studied.

In the article optical anisotropy and anisotropy of heat conductivity are investigated. First parameter is connected to distinction in absorption of two light waves by a film in mutually perpendicular directions, second - with distinction in distribution of heat in a film on these directions. For the first time for uniaxially oriented polyvinyl alcohol films with dichroic organic dyes quantitative correlation between two parameters is carried out.

Is established that orientation parameters – ordered degree of dye molecules (S) and corner between a direction of wavelength oscillator and axis of orientation (θ) - depend on a nature of dye and practically do not depend on its contents in film (in conditions of performance the Ber's law).

P16. Influence of Incidence and Temperature on Defect Modes in Photonic Crystal Cell with Nematic Layer

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Tunable multilayer photonic crystals (PC) can be formed by the insertion of the nematic LC as a defect layer in periodic structure. Transmission spectra of the PC depend on the orientational and phase states of nematic layer. These states can be controlled by external factors (temperature, electric field, etc), and it makes the PC promising material to be applied in displays. In this work the opportunities of the thermo-optical technique as well as the oblique incidence of light have been studied to control the transmission spectra of the one-dimensional PC cell. The PC considered structure forms the photonic band gap in the visible range of the transmission spectrum with a set of the localized modes whose positions depend on the dielectric properties of PC layers and the incident angle. Transformation of the PC transmission spectrum seems to result from the change of the refractive indices of the nematic caused by variation of both temperature and incidence angle. The numerical simulation of the spectral characteristics agrees well with the experimental data.

P17. Holographic polymer-LC arrays

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Last years composites based on photosensitive polymers and liquid crystals attract an interest of researches to use such composites as an optical medium for storage and display of optical information, in particular in microdisplay technologies. One of the most promising way of the storage information in such media is holographic method. This method allows to fabricate composites with nanostuctured units (for example, diffraction grating), what leads to the improvement of the dynamic and contrast parameters. The presence of anisotropic liquid crystalline phase in the composites allows to manage its optical properties. Theoretical and experimental results concerning to the investigations of the diffraction gratings, formed on the base of the original photopolymeric liquid crystalline composite will be presented in this work. The polarization dependence of difraction efficiency, angular selectivity, as well as switching time and volt-contracts characteristics will be presented also.

P18. Novel way of fabrication of microreliefs for MEMS

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The main goal of this work is the fabrication of microreliefs by using of composite materials instead of homogeneous metals, i.e. co-deposited metal matrix with inert ultra-fine particles by electroless or plating processes. Microrelief structures were produced and tested. The obtained results will be presented and analyzed.

P19. Beam reshaping for rectangular area illumination

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In many optical devices a task often arises to illuminate a rectangular-shaped area. With LEDs used as light sources, this task implies reshaping of the beam from a square Lambertian emitting surface to obtain a rectangular uniformly illuminated area of appropriate dimensions and positioned above or decentered relative to the light source. We describe a new type of refractive lens developed for this purpose and the single-pass synthesis algorithm for its shape requiring no optimization step.

P20. Multiple PC-based simulation of complex illumination system using TracePro and MATLAB

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In simulation of illumination systems tracing of millions of rays is usually required to achieve representative results. Such systems also sometimes include thousands of optical elements which cannot be modeled using built-in software features like textures. This makes simulation on desktop PCs a very challenging, sometimes impracticable task. Software like ZEMAX allows employment of multi-CPU hardware environment which significantly improves simulation speed and allows to cope with more complex optical systems. However some popular illumination-oriented software tools like TracePro cannot make use neither of cluster or multi-CPU environment nor of large memory capacity of such computers and just fail on complex tasks.

To solve this problem we have developed a simulation environment based on multiple independent inexpensive desktop PCs, TracePro and MATLAB. The only improvement of hardware consisted in increasing of RAM size on each PC to the possible maximum of 4 Gb to improve the general performance of PCs.

Basically, our method consists in splitting one source file generated by TracePro into many small source files and tracing the whole task with this smaller number of rays. The amount of RAM required to finish the simulation decreases with the number of rays, and it is usually possible to make practically any complex task simple enough in order for TracePro to cope with it. The result of simulation is recorded into a file containing distribution of output rays, and this file is analysed in MATLAB.

The significant advantage of this approach is that it requires no special programming skills and can be easily adopted by optical engineers. At the same time it is quite powerful and allows for complete automatization of the simulation process, which is important because complex systems simulation can take many hours and it is convenient to run it at nights.