

Display Week 2009 Symposium Preview

Plan your visit to Display Week 2009 with an advance look at the key trends and issues that will be highlighted in the symposium's far-ranging collection of display-technology sessions.

by Jenny Donelan

THIRTEEN SUBCOMMITTEES have chosen the papers to be presented at the Society for Information Display's International Symposium at Display Week 2009 in San Antonio this June. From exciting new discoveries to cutting-edge research to ingenious manufacturing solutions, these papers will disclose results and ideas from top researchers from the international electronic-display industry.

The following is a list of session highlights by subcommittee, which includes active-matrix devices, applications, applied vision, display electronics, display manufacturing, display measurement, display systems, emissive displays, field-emission displays, liquid-crystal technology, OLEDs, and projectors. The thirteenth subcommittee, new this year, is flexible displays. For flexible-display highlights, see the article "Flexible Displays Come Into Their Own at Display Week 2009" that appeared in the March issue of *Information Display* magazine.

Active-Matrix Devices: Can Oxide Thin Films Substitute for Silicon?

The biggest news by far in the Display Week 2009 active-matrix sessions, according to subcommittee chair Hyun Jae Kim, Associate Professor with the School of Electrical and Electronic Engineering at Yonsei University in Seoul, Korea, will be the use of oxide-semiconductor technology as a replacement for silicon-semiconductor technology. "This

is very new and promising," says Kim. "This technology affects not only thin-film-transistor liquid-crystal displays (TFT-LCDs), but also active-matrix organic light-emitting-diode (AMOLED) displays – future flat-panel displays." One of the papers focusing on that topic will be "Development of a Driver-Integrated Panel Using Amorphous In-Ga-Zn-Oxide TFTs" by Takeshi Osada from the Semiconductor Energy Laboratory Co. Osada's design team created a 4-in. quarter-video graphics array (qVGA) liquid-crystal panel integrated with a gate driver and a source driver by using bottom-gate bottom-contact (BGBC) TFTs made from an oxide semiconductor. They then prototyped the liquid-crystal panel and integrated the gate driver and source driver on the panel.

Kim notes that although this is not the first time that the above technology has been presented – there have been papers at IMID (International Meeting on Information Display) and ITC (International Thin-Film Transistor Conference) – SID '09 will represent the largest and most exciting confluence of such papers.

Other papers of interest include:

- "A Novel Driving Method for Cost-Competitive a-Si TFT-LCDs" by Su-Hwan Moon from LG Display discusses the application of six-times-rate driving (SRD) to a TFT-LCD.
- "A Novel Low-Power-Consumption All-Digital System-on-Glass Display with Serial Interface" by Kenji Harada from Toshiba explains how designers achieved a power consumption of 15 μ W in a 2.26-in. format.

Applications: Color Comes Closer to e-Paper

Display applications are where the rubber meets the road – where the technology goes into real products and customer problems are solved. This year, the hot session topics include 3-D displays, LED backlights, and low-power solutions such as e-paper. "The 3-D application session will include unique implementations that relate to the evolving 3-D stereo field," says committee member Adi Abileah, Chief Scientist at Planar Systems. Among those papers are "An Autostereoscopic 3-D Display Using Tunable Liquid-Crystal Lens Array that Mimics Effects of a GRIN Lenticular-Lens Array" by Paul C.-P. Chao from National Chiao Tung University, and "VCMaster3D: A New Fourier Optics Viewing-Angle Instrument for Characterization of Autostereoscopic 3-D Displays" by Pierre Boher from ELDIM. The first paper discusses tunable liquid-crystal lenticular lenses that are unique in structure, says Abileah. The second is about a conoscopic camera specific to autostereo displays. "The angular resolution is very high, and it includes features that allow the characterization of viewing freedom range, stereo contrast, stereo luminance, and more."

In terms of low-power solution topics, the recent releases of new e-paper products has led to a related and growing question: how soon can electrophoretic technology be adapted to full color? Come to the session and see for yourself.

The paper that attempts to answer that question is: "Development of e-Paper Color Display Technologies" by Alex Henzen of

Jenny Donelan is the Managing Editor of Information Display Magazine. She can be reached at jdonelan@pcm411.com.

iRex Technologies, an invited paper that addresses the possibility of going beyond the gray-scale reproduction to which electrophoretic layers are now limited. “The final goal,” according to the paper’s abstract, “must be a color image that challenges the performance of a color photograph.”

Applied Vision: Optimizing Wide-Color Gamut

According to Applied Vision Chair Helge Seetzen, Director for HDR Technology at BrightSide Technologies, the Applied Vision subcommittee addresses a unique segment of the display industry, both in terms of technology and timing. The committee tends to review papers on physical devices that are already in the marketplace – with topics that include common applications as well as new trends. “We also have studies from R&D labs that are working extremely far forward,” says Seetzen. It is uncommon, he notes, to receive a paper representing untried applications.

The Applied Vision focus this year, he notes, seems to be white color gamut. Last year’s conference featured numerous papers across multiple sub-committees that were devoted to building wide-color-gamut displays. What the APV committee is seeing now, he says, are papers on how to optimize those displays. One such paper in particular is “Evaluation of Gamut-Expansion Algorithms for Wide-Gamut Displays” by Dr. Masato Sakurai of Sony Corp.

A forward-looking topic that is showing up this year is interactivity. “It’s not just about making a display that works well,” says Seetzen, “it’s what can we do with it in terms of interaction with a touch screen or using it in more varied environments.”

Other interesting papers include:

- “Human Vision in Complex Environments” by Mary Hayhoe from the University of Texas at Austin, an invited paper in the session on Image-Quality Evaluation.

Display Electronics: A Display is More Than a Panel

A trend with regard to established display technologies, according to Display Electronics Chair Michiel A. Klompenhouwer, Senior Research Scientist with the Video Processing Group at Philips Research Laboratories, “is that innovations are shifting to electronics (driving and signal processing) rather than device physics, and also that the ongoing inte-

gration of components in the display module (to improve form factor and reduce cost and power) is driving the development of efficient electronics systems.” A related trend, he notes, is the idea that a display is no longer just a panel. “To reach the high image quality, low power, and attractive form factor of today’s displays,” says Klompenhouwer, “it is just as important to develop innovative signal processing, interfaces, and driving technologies.”

Other papers of interest include:

- “Low Overhead Clock-Shared Differential Signaling (CSDS): An Efficient Interface for Large-Sized TFT-LCDs” by Nyuntae Kim from Samsung Electronics Co., Ltd., and “A Reduced Voltage Differential Signaling (RVDS) Interface for Chip-on-Glass TFT-LCD Applications” by Jung Pil Lim also from Samsung Electronics Co., Ltd. Says Klompenhouwer: “These two papers mark the ongoing development of efficient interfaces (high bandwidth, low power, minimal wires) to cope with the high demands in current display modules, such as high resolution, thin form factor, and low power.”
- “Advanced Local Dimming and Scanning LED-Backlight Driving System Using a Novel Driver IC” by Kyoung-Uk Cho from Samsung Electronics Co., Ltd., and “Color Optimization Model for High-Dynamic-Range LCDs with RGB Color Backlights” by Yi-Ling Chen from National Chiao Tung University are examples of the idea that a display is more than a panel, requiring advanced signal processing that is also fully integrated with the display.
- Two invited papers, “Key Requirements for High-Quality Frame-Rate Conversion” by Claus Nico Cordes from NXP Semiconductors and “A Consideration on Motion-Image-Quality Improvement of LCD-TVs” by Taiichiro Kurita from NHK Science & Technical Research Laboratories, provide an overview of the current status of motion artifacts in LCD TVs.

Display Manufacturing: Cost-Effectiveness Is Key

As SID President Paul Drzaic explains in this month’s President’s Corner, new approaches to reducing costs are a hot topic for papers in

Display Manufacturing this year. This issue is especially relevant to LCDs: smarter manufacturing techniques will only bolster this technology’s dominance, according to Drzaic.

Other papers of interest include:

- “Fabrication of a 26-in. PVA LCD Panel by Using a Laser Ablation Process” by Yonghwan Shin from Samsung Electronics Co., Ltd., (in collaboration with Nakan Corp.) describes how the team replaced a six-step process with a single laser-ablation step to pattern ITO in a TFT panel.
- “FPD Repair System Using Electrostatic Droplet Technology” by Hyungjin Lee from LG Electronics explores the use of electrohydrodynamic jet technology as a reliable means of repairing the black matrix in a TFT panel.

Display Measurement: A New Standard for Metrology

In terms of quantity and quality, this was one of the best years ever for submissions to Display Measurement, according to subcommittee chair Stephen Atwood, Principle Engineer, Azonix Corp. The biggest news in this area is the creation of the Display Metrology Standard (DMS) by SID’s International Committee for Display Metrology (ICDM). Members of that committee have spent countless hours over the past few years, working on the altruistic and far-sighted goal of creating a common language for display measurements that can be used by anyone involved with displays. “It’s like Linux for metrology,” says Atwood. For more about the DMS and the ICDM’s dedicated session at Display Week, see “ICDM Special Session: A Visionary Standard” in the March 2009 issue of *Information Display* magazine.

Another type of vision is the subject of a paper by Toni Järvenpää from Nokia Research Center, “Advances in Near-to-Eye Display Optical Characterization,” takes an advance look at measuring displays that are not widely in use yet. Special glasses or head-up displays will help users more comfortably view movies and other content on the tiny screens of portable media. “It’s hard to watch a movie on your iPod,” says Atwood, “but you can put on these ‘projector’ glasses and plug them into your iPod and now you have a bigger, virtual image.” What Järvenpää has done, Atwood explains, is to find methods to characterize these near-to-eye virtual displays – to apply as much practical metrology as

symposium preview

possible to an area in which human factors and ergonomics will figure greatly.

Other papers of interest include:

- “Comparison of Motion-Blur Measurement Methods” by Andrew Watson from the NASA Ames Research Center and “Advanced Display Motion-Induced Color-Distortion Analysis Methods” by Jongseo Lee from Samsung Electronics Co., Ltd., both address the measurement of motion blur. Atwood describes the removal of motion blur as “one of the fundamental challenges to the LCD-panel industry. Having solid methods to characterize the phenomena and quantify the improvements will be critical.”

Display Systems: 3-D TVs Get Closer to Home

Now that 3-D has come to movie theaters in a big way – approximately 30 “A-list” pictures

have been scheduled for release in 3-D throughout 2009 – is it only a matter of time before 3-D shows up in home televisions as well? Researchers and designers are betting on it. In fact, 3-D is one of the most exciting developments in Display Systems, according to Subcommittee Chair Brian Schowengerdt of the University of Washington’s College of Engineering. Key to the development of 3-D televisions is high-speed LCDs that are optimized for 3-D use.

“One of the ways to create 3-D images is to flash the right and left images of a stereoscopic pair back and forth sequentially over time,” says Schowengerdt. “Historically, it’s been difficult to do this well with flat-screen displays because the 3-D mode effectively halves the refresh rate.” LCDs have just not been fast enough. But both Samsung and Toshiba have developed new ways to increase the speed of LCDs, notes Schowengerdt, and

representatives from both companies will be presenting papers in the display systems sessions. Samsung’s Sang Soo Kim will be describing a full-HD 240-Hz TFT-LCD in a paper titled “World’s First 240-Hz TFT-LCD for Full-HD LCD TV and Its Application to 3-D Displays.” That LCD demonstrates twice the speed of a unit the company presented last year, Schowengerdt notes. Daiichi Suzuki from Toshiba will present an earlier-stage technology based on time-sequential optically compensated bend (OCB) LCDs that are “even faster but not as close to commercialization,” he says. That paper is “Crosstalk-Free 3-D Displays with Time-Sequential OCB-LCDs.”

Other papers of interest include:

- “Eco-Display High-Optical-Throughput Color-Filterless Field-Sequential LCDs” by Han-Ping D. Shieh and “Two-Color Field-Sequential Method for Color-

2009 Display Week Schedule at a Glance — Henry B. Gonzalez Convention Center

TIMETABLE	Sunday	Monday		Tuesday				Wednesday		Thursday		Friday					
	Course	Sem	Bus	Symp	Exh	Inv	App	Symp	Exh	Symp	Exh	Symp					
7:30 AM - 8:00 AM																	
8:00 AM - 8:30 AM				SID Bus Mtg													
8:30 AM - 9:00 AM		Seminar 1 - 3	Business Conference	Welcome & Keynote Addresses													
9:00 AM - 9:30 AM	Short Course S1 & S2			Oral Papers 21-27	Exhibits Open	Investors Conf.	App Tutorials A1-A2	Oral Papers 28-32	SID Luncheon & DYA Awards	Exhibits Open	Oral Papers 38-43	Exhibits Open	Oral Papers 58-64				
9:30 AM - 10:00 AM																	
10:00 AM - 10:30 AM																	
10:30 AM - 11:00 AM		Seminar 4 - 6	Bus. Conf. Lunch	Oral Papers 3-8	Exhibits Open	Investors Lunch	App Tutorials A3-A4	Oral Papers 33-37	Exhibits Open	Oral Papers 44-50	Exhibits Open	Oral Papers 65-69					
11:00 AM - 11:30 AM																	
11:30 AM - 12:00 PM																	
12:00 PM - 12:30 PM					Exhibits Open	Investors Conference	App Tutorials A5-A6	Oral Papers 33-37	Exhibits Open		Exhibits Open	Auth. Int.					
12:30 PM - 1:00 PM																	
1:00 PM - 1:30 PM																	
1:30 PM - 2:00 PM		Seminar 7 - 9	Business Conference	Oral Papers 9-14	Exhibits Open	Investors Conference	App Tutorials A5-A6	Oral Papers 33-37	Exhibits Open	Oral Papers 51-57	Exhibits Open						
2:00 PM - 2:30 PM																	
2:30 PM - 3:00 PM																	
3:00 PM - 3:30 PM				Oral Papers 15-20	Exhibits Open	Investors Conference	App Tutorials A5-A6	Oral Papers 33-37	Exhibits Open	Auth. Int.	Exhibits Open						
3:30 PM - 4:00 PM	Short Course S3 & S4	Seminar 10 - 12	Oral Papers 15-20														
4:00 PM - 4:30 PM																	
4:30 PM - 5:00 PM																	
5:00 PM - 5:30 PM			Bus. Recept	Auth. Int.	Exhibits Open	Inv. Recept	App Tutorials A5-A6	Oral Papers 33-37	Exhibits Open	Auth. Int.	Exhibits Open	Poster Papers					
5:30 PM - 6:00 PM																	
6:00 PM - 6:30 PM																	
6:30 PM - 7:00 PM					Exhibits Open	Inv. Recept	App Tutorials A5-A6	Oral Papers 33-37	Exhibits Open		Exhibits Open						
7:00 PM - 7:30 PM																	
7:30 PM - 8:00 PM																	
8:00 PM - 8:30 PM					Exhibits Open	Inv. Recept	App Tutorials A5-A6	Oral Papers 33-37	Exhibits Open		Exhibits Open						
8:30 PM - 9:00 PM																	
9:00 PM - 9:30 PM																	
9:30 PM - 10:00 PM		Awards Banquet															

Filter-Free MVA-LCDs” by Yi Ru Cheng, a professor and student, respectively, from National Chiao Tung University in Taiwan, address color-filterless LCDs with lower power consumption and diminished color break-up.

- “1-mm-Diameter Full-color Scanning Fiber Pico Projector” by Brian Schowengerdt from the University of Washington discusses a miniature projector that is 1 mm in diameter and 9 mm in length and can project full-color images at 500 × 500 pixels.

Emissive Displays: Creating More-Efficient Plasma

Improving plasma-display panel (PDP) efficiency – partly by increasing xenon-gas content – is one of the trends that Subcommittee Chair Gerrit Oversluizen from Philips Research Laboratories says he is noticing in the area of emissive displays. There has also been “much attention given to the protective layer in PDPs,” he says. In general, research efforts seem to be directed at lowering the cost of production while increasing performance. Oversluizen notes that there were no large-size commercial panel-improvement contributions from the industry this year.

Other papers of interest include:

- “Address Discharge Characteristics of High-Luminous-Efficacy PDP with SrO Protecting Layer” by Hae Yoon Jung from Seoul National University describes how researchers, in their words, “achieved low voltage driving and high luminous efficacy by applying SrO protecting layer in PDPs.”
- “Control of Temperature Dependency of Exo-Electron Emission Behavior for MgO Film of ACPDPs” by Yong Seog Kim from Hongik University is an invited paper recommended by the chair.

Field-Emission Displays: Advances in Non-TV Areas

“Four or five years ago, every major display company had a large R&D program pursuing a field-emission-display (FED) color-TV project,” says SID Fellow Jim Chen. Several major manufacturers demonstrated large, beautiful displays based on this technology. But the majority of these programs have gone quiet. Although no one nor any company has officially claimed a reason, Chen says, “the

usual explanations are (1) the FED panels have a reliability problem or (2) the FED panels have a brightness-uniformity problem.”

“So far not all of the players have officially withdrawn from pursuing the FED effort; they are hoping and waiting for a breakthrough invention to happen,” Chen continues. In the meantime, researchers are trying to find new applications for FEDs, including backlight units for LCD panels and consumer lighting because in these applications the requirements for brightness uniformity and longevity are not so critical as for TVs.

This situation puts FEDs in a tough spot with regard to cutting-edge papers but nevertheless there are some good ones this year, notes Chen. One is “Improvements of Color CNT-FED Character Displays” by Hiroyuki Kurachi from Noritake Co., which presents a CNT-FED used in a character-display device. “This paper discusses the improvements of the higher pixel density and lower power usage of the new design,” says Chen. “This is one of the very few successful FED products on the market.”

Other papers of interest include:

- A 7-in. Field-Emission Backlight-Unit Assembly Using TiO₂-Coated Spacer for LCD Panels” by Jian-Min Jeng from Tatung University describes “a charge leakage coating on a CNT backlight unit’s spacers to eliminate the discharge arcing problem in CNT backlight units,” says Chen.
- “Enhanced Electron Emission of Carbon-Nanotube Emitters with Post-Growth Treatment” by Kyu Chang Park from Kyung Hee University discusses a new resist-assisted patterning (RAP) process to improve a CNT emitter’s emission controllability and uniformity.

Liquid-Crystal Technology: Incremental Rather than Evolutionary Improvements

“LCDs have achieved maturity in performance and price and established themselves as the benchmark for all other displays,” says Chair Birendra Bahadur of Rockwell Collins. “Most of the current LCD improvements are incremental and not evolutionary. Fast switching, cholesteric, flexible and mobile displays, optical films, and 3-D seem to be the hottest topics in LCDs.” Further improvements, he continues, are also happening in viewing angle, response time, color gamut,

resolution, power consumption, cost, LED backlights, and touch applications. “We have also noticed the emergence of other passive display technologies,” says Bahadur. “There are many papers on electrowetting, electro-phoretic, and other passive displays. A recommended paper in this area is ‘Transmissive Electrowetting-Based Displays for Portable Multi-Media Devices’ by Andrea Giraldo from Liquavista BV.” Another overall trend to note, according to Bahadur, is the continuing “greening” of LCDs. “Newer displays consume less power and their manufacturing uses less materials and processes, which indirectly reduce the emission of green-house gases. LCDs can reduce paper and, hence, tree consumption significantly and can be used again and again. They are also effective in educating people in poor countries or remote places.”

Other notable papers include:

- “An Over-500-Hz Frame-Rate-Drivable PSS-LCD: Its Basic Performance” by Norio Koshida from Nano Loa, Inc.
- “Fast-Switching Flexoelectric Display Device with High Contrast” by Flynn Castles, a student at the University of Cambridge, describes how a flexo-electro-optic effect provides a fast-switching mechanism suitable for use in field-sequential-color full-motion-video displays.

OLEDs: Advances in Manufacturing, Improvements in Performance

If from a research curve standpoint, OLED discoveries are flattening out somewhat – “This year we feel that OLED is a maturing technology,” says Subcommittee Chair Denis Kondakov from Eastman Kodak Co. – key advances continue to be made. “We are seeing steady improvement in the important performance characteristics rather than sporadic breakthroughs,” he says. And, in manufacturing, there is still much to be done before OLED-based products – especially larger ones – hit the market in a big way and fulfill their potential as a contender to LCD (see this month’s “President’s Corner”). Both “Multi-nozzle Printing: A Cost-Effective Process for OLED-Display Fabrication” by Reid Chesterfield from Dupont Displays and “Large-Area Color-Patterning Technology for AMOLEDs” by Min Chul Suh from Samsung SDI Co., Ltd., discuss manufacturing techniques for OLED displays.

symposium preview

Other papers of interest include:

- “AMOLED Displays Using Transfer-Printed ICs” by John Hamer from Eastman Kodak Co. describes how active-matrix OLED (AMOLED) displays were fabricated using backplanes with transfer-printed microscale-silicon integrated circuits in place of conventional thin-film transistors (TFTs).

Projection Displays: Picos Generate Plenty of Interest

“There is a great deal of activity and new development in pico projectors,” says Edward English from REE Optical Systems, Chair of the Projection Displays subcommittee. “This is a very active area; there have been several big announcements and a lot of press about these devices. It is a nascent product group, with some uncertainty about whether it will

become a large category vs. a novelty type device.”

Key areas with regard to picos, he continues, include (a) development of an affordable, mass-produceable green laser, (b) small, fast field-sequential microdisplay devices, and (c) effective thermal and power management. “There is also a great deal of commercial activity – new product launches – for small, so-called companion or pocket

2009 Display Week Symposium at a Glance — Henry B. Gonzalez Convention Center

Times	Ballroom C1	Ballroom C2	Ballroom C3	Room 214A/B	Room 214C/D	Room 217A/B	Room 217C/D	Times
Tuesday, June 2								
8:00 – 10:20	SID Business Meeting and Keynote Session (Ballroom C)							8:00 – 10:20
10:50 – 12:10	3 AMOLEDs I	4 Flexible-Display Components		5 Emerging Applications	6 Field-Emission Displays	7 Plasma-Display Efficacy and Cell Design	8 Front-Projection Display Systems	10:50 – 12:10
2:00 – 3:20	9 AMOLEDs II	10 Flexible-Display Manufacturing (Joint with Manufacturing)		11 3-D Applications	12 Field-Emission Applications	13 Plasma-Display Driving	14 Pico Projectors	2:00 – 3:20
3:40 – 5:00	15 Oxide TFTs I	16 Flexible Active-Matrix Backplanes		17 Understanding Visual Display Artifacts	18 Field-Sequential Color	19 Phosphors	20 Solid-State Projection Light Sources	3:40 – 5:00
5:00 – 6:00	Author Interviews (Exhibit Hall D)							5:00 – 6:00
Wednesday, June 3								
9:00 – 10:20	21 Oxide TFTs II	22 Cholesteric LCDs	23 OLED Devices I	24 Display Measurement Methods and Standards	25 Autostereoscopic Displays	26 Plasma-Display Protective Layers	27 Driver-IC Technology	9:00 – 10:20
10:40 – 12:00	28 System-on-Glass AMLCDs	29 Mobile Displays	30 OLED Devices II	Special Session Focus: The ICDM	31 Advance TV and 3-D Displays		32 Touch-Panel Electronics	10:40 – 12:00
2:00 – 3:30	Designated Exhibit Time (Exhibit Hall C)							2:00 – 3:30
3:30 – 4:50	33 Novel Active-Matrix Devices	34 Novel Display Technologies	35 OLED Devices III	36 Characterization of Display Systems and Components	37 Novel Displays			3:30 – 4:50
5:00 – 6:00	Author Interviews (Exhibit Hall D)							5:00 – 6:00
Thursday, June 4								
9:00 – 10:20	38 Touch-Screen Active-Matrix Displays	39 Fast Response I	40 OLED Manufacturing (Joint with Manufacturing)		41 Stereoscopic Projection (Joint with Projection)	42 Display Manufacturing: Processes	43 Backlight Driving: Color Processing	9:00 – 10:20
10:40 – 12:00	44 Organic TFTs	45 Fast Response II	46 OLED Mechanisms	47 Image-Quality Evaluation	48 Slim LCD TVs	49 Display Manufacturing: Patterning	50 Backlight Driving: High-Dynamic-Range Processing	10:40 – 12:00
1:30 – 2:50	51 E-Paper	52 LC Alignment	53 AMOLED Displays	54 3-D	55 LED Backlights (Joint with Applications)	56 Display Manufacturing: Interconnects and Metalizations	57 Video Processing and Motion Fidelity	1:30 – 2:50
3:00 – 4:00	Author Interviews (Exhibit Hall D)							3:00 – 4:00
4:00 – 7:00	Poster Session (Exhibit Hall D)							4:00 – 7:00
Friday, June 5								
9:00 – 10:20	58 Emerging Active-Matrix Technologies (Joint with Active Matrix)	59 Optical Films for LCDs	60 White OLEDs	61 Image-Quality Modelling	62 RGBW Color (Joint with Electronics)	63 Display Manufacturing: OLEDs	64 Interface Technologies	9:00 – 10:20
10:40 – 12:00	65 Flexible AMOLEDs	66 Novel LC Materials and Effects		67 Color	68 Novel Backlights	69 Display Manufacturing: Substrates		10:40 – 12:00
12:00 – 1:00	Author Interviews (Exhibit Hall D)							12:00 – 1:00
TECHNOLOGY TRACKS KEY								
Active Matrix	Applications	Applied Vision	Electronics	Emissive	FEDs	Flexible Displays		
Liquid Crystal	Manufacturing	Measurement	OLEDs	Projection	Systems			

projectors in the 100–200-lm ~50-W range.”

Important papers, says English, include “LCOS Devices for Professional Projection Displays” by Andre Van Calster from Ghent University, which reviews the development of LCOS microdisplay devices. In “High Contrast in Bright Ambients with Angle-Shifting Front-Projection Screen,” Baku Katagiri from Tohoku University will describe “a high-contrast screen that works well in bright, ambient environments using an angle-shifting structure,” according to English. And Jan Drumm of OSRAM will present advances in creating a compact RGB laser module that is suitable for pico-projector applications in “Compact RGB Laser Module for Embedded Laser Projection.”

Other papers of interest include:

- “White-Point Calibration of Color-Sequential Mobile Projector” by Yongchan Keh from Samsung Electronics Co., Ltd., presents an analysis of how LED binning and optical tolerances affect the white-point calibration for projectors.
- “Perceived Brightness of LED Projectors,” a paper from Tsung-Hsun Yang, a student from the National Central University in Taiwan, presents “a nice analytical derivation of why we might perceive an LED-illuminated projector as brighter than a UHP-lamp-illuminated projector,” says English.

Some Necessary Inspiration

From new flexible displays to the Display Measurements Standard to 3-D TVs, the Symposium sessions are proof that great discoveries and advances in display technology have not stopped just because we are in a very tough economy. The Symposium is an excellent place to learn about new manufacturing processes and materials that might give your business the edge it needs. Come get inspired at Display Week 2009. ■

For daily display industry news, visit

www.informationdisplay.org

From flat panel displays to x-ray sensors



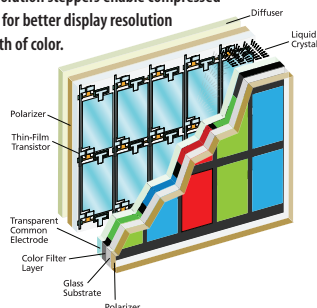
few understand
photolithography
like we do

It's based on a thorough knowledge of applications and how to achieve low cost of ownership for precision lithography, whether on rigid glass, flexible, or roll-to-roll substrates.

For amorphous-silicon AMLCDs, thin-film transistor backplanes are produced on glass substrates, with feature sizes down to 3 to 5 μm and overlay accuracy of $\pm 1 \mu\text{m}$.

LTPS TFT-LCDs, used for PDAs and mobile smartphones, require more mask layers

Amorphous-silicon AMLCD backplane showing transistor and clear aperture locations. Azores' high-resolution steppers enable compressed circuitry for better display resolution and depth of color.



because of additional circuitry. Feature sizes are down to 1.5 μm , overlay accuracy is $<\pm 0.4 \mu\text{m}$.

For FEDs, photolithography generates precise holes in the cathode plate in which emitters are fabricated. Hole diameters range from 0.8 to 1 μm , emitter heights from 3 to 5 μm .

For X-ray sensors, as many as 10 mask layers or more with 2 μm CDs are required to produce highly uniform large area sensors. An accurate photolithographic process with precision stitching and repeatable exposure dosages is critical to generate high yields.

Visit us online today, and see what decades of photolithography development can do for your demanding application.

AZORES
www.azorescorp.com