FlexTech Alliance
for Displays & Flexible, Printed Electronics

FlexTech Trends

News from the world of displays and flexible, printed electronics

Q4 2011

FlexTech Trends

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Note from the President

by *Michael Ciesinski*

FlexTech Trends returns will some new elements that will continue over the next several issues. First, Henkel Corporation was selected as our initial "featured member company" as a consequence of their completion of a project for debondable laminating adhesives to enable active matrix backplane fabrication on flexible substrates. The fabrication process involves temporarily bonding a flexible PEN substrate on a rigid carrier and fabricating amorphous silicon thin film transistors (a-Si TFT) backplane devices. The rigid carrier is used to obtain proper planarity, dimension stability, and lithographic registration. After device fabrication, the flexible substrate can be peeled off the carrier free of adhesive residue and without damaging the active components.

If your company has a good product or demonstrator story to tell, please contact Denise Rael at email (denise.rael@flextech.org) for consideration in an upcoming issue of *FlexTech Trends.*

Second, this and future newsletters will contain summaries of FlexTech Alliance-sponsored workshops, webinars or conferences. We recognize that, while not all member companies can attend each event, there is a benefit in providing event summaries. We hope these summaries will increase the value of your FlexTech Alliance membership.

In this issue, look for the IDTech Ex summary of FlexTech Alliance's Transparent Conductor Workshop and +Plastic Electronics' summary of our SEMICON West TechXPOT, which included NanoMarkets, NovaCentrix, Nth Degree, Solarmer Energy, Thin Film Electronics, Western Michigan University and Xenon. Also, Denise Rael reviews outcomes from the "Hybrid Nanocomposites & Interfaces for Printed Electronics" workshop, held in September 2011 at Georgia Tech.

The Flex Conference returns to the Arizona Grand Hotel on Feb 6-9, 2012 and has an outstanding slate of speakers and presentations. Day 1 keynote and plenary speakers are from the Air Force Research Laboratory, Universal Display Corp., E Ink, dpiX, Konarka Technologies, Lockheed Martin, Applied Materials, Corning, Solvay, and the Welsh Centre for Printing and Coating. As in past events, short courses, R&D, manufacturing, and product segments, as well as panel sessions will comprise the full agenda. More information can be found at www.flexconference.org

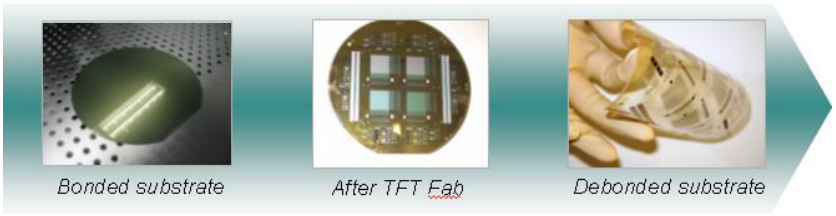
We hope to see you in Phoenix in February 2012. In the meantime, best wishes for the holiday season and a prosperous New Year.

Member Profile: Henkel Corporation

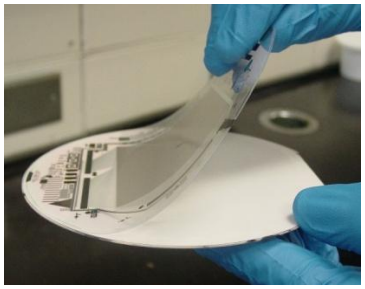
Bonding Companies and Technologies Together

Product solutions from Henkel Corporation can be found in many items that touch our lives every day: cars, books, computers, aircraft, refrigerators, cell phones, furniture, textiles and more. Founded in 1876 and headquartered in Düsseldorf, Germany, Henkel is a materials manufacturer with leading brands and technologies in three business areas: laundry and home care, cosmetics and toiletries and the largest segment, adhesive technologies. The adhesives, sealants and surface treatments product groups from Henkel are key ingredients to making flexible electronics viable in everyday use and everyday products.

In a recently completed project funded by the FlexTech Alliance, Henkel helped develop a new laminating adhesive vital to next generation flexible substrates. Working with the Flexible Display Center (FDC) at Arizona State University, the objective of the project was to develop debondable laminating adhesives to enable active matrix backplane fabrication on flexible substrates. The result is a process that can utilize the manufacturing infrastructure already in place for LCD displays to fabricate flexible large area or novel form factor applications with minimum process modification or capital investment. It's a great story of industry collaboration.



The fabrication process involves temporarily bonding a flexible substrate on a rigid carrier and fabricating amorphous silicon thin film transistors backplane devices. The rigid carrier is used to obtain proper planarity, dimension stability, and lithographic registration. After the device is fabricated, the flexible substrate can be simply peeled off the carrier, in the absence of external activation and without any damage to the active components. The adhesive preferentially adheres to the carrier, leaving the flexible substrate free of adhesive residue. After debonding, the adhesive film on the carrier can be removed by heating, enabling the carrier to be re-used.



Remember the story of the engineer at 3M who developed the non-sticking adhesive that wasn't specifically suited for the original application but ended up launching the Post-it Note era? One major outcome for Henkel as a result of the debondable laminate project: they not only solved the original application problem, they found other uses for the adhesive beyond the original intent. Through connections made in the FlexTech Alliance, Henkel discovered that their laminating adhesive, with fine-tuning for different performance requirements, could be commercialized for other applications, specifically flexible photovoltaics and flexible displays.

Henkel has a long history working with the FlexTech Alliance. A previous project produced barrier display sealants for OLEDs. OLED displays are susceptible to degradation from atmospheric water and oxygen. With partial funding from FlexTech, Henkel developed the ECCOSEAL line of moisture barrier sealants for the OLED assembly that have proved effective in prolonging the lifetime of the device.

As in the case of the debondable laminating adhesive, the key ingredients that Henkel provides the flexible display industry can be long gone before the final display product reaches the market. But without these integral, almost "invisible" parts of the manufacturing process, flexible displays would be more hype than reality.

Hitting the Spot

On July 14 during SEMICON West 2011, the FlexTech Alliance held its Extreme Electronics TechXPOT session, 'Printed Flexible Electronics: Beyond R&D to Real Deal Technologies.'

Event Summary by Sara Ver-Bruggen
+Plastic Electronics Magazine www.plusplasticelectronics.com

At SEMICON West 2011 visitors got an insight into of the breadth of flexible and printed electronics technologies and applications and their commercial progress. SEMICON West is the flagship annual event for the global microelectronics industry, which is organized by industry association Semiconductor Equipment and Manufacturing International (SEMI).

SEMI has played a critical role in setting standards and pulling together different elements of the microelectronics industry; while FlexTech Alliance, through funding and support programs, events, and other activities plays a proactive role in fostering the growth, profitability and success of the electronic display and the flexible, printed electronics supply chain. The Extreme Electronics TechXPOT session, which lasted just under three and a half hours, took place during the morning, in the middle of the main exhibition hall.

Stacy Oresman, FlexTech Alliance's director of technology, explains: "In the myriad of activity going on during SEMICON West, SEMI carves out a theater right in the center, so it wasn't a workshop or seminar in a traditional sense, as there are lots of companies coming and going. Over the course of the session we had about 195 people come and listen to presentations." Companies in the audience included Applied Materials, Bosch, Carl Zeiss, DuPont and Samsung.

Practical applications

The session, which included several companies that are beneficiaries of FlexTech Alliance's R&D programs, like organic solar cell developer Solarmer Energy, had been put together to demonstrate how the printed and flexible electronics industry is moving from R&D into volume manufacturing for practical applications. The session program was designed to cater for different levels of understanding of flexible and printed electronics, as well as different parts of the value chain.

"Many had some knowledge, while for those with less, the first presentation by NanoMarkets provided the necessary background," explains Oresman.

Over the past few years the plastic electronics industry has been forced to change its expectations considerably. The first start-ups, which quickly became synonymous with an idea of revolutionary technology promising completely new products and applications for electronics, have paved the way for a more sober and practical approach. Flexible electronics are seeing practical exploitation where they enable existing microelectronics supply chains to deliver enhanced products.

Lawrence Gasman, NanoMarkets

Trends

The presentation by Lawrence Gasman, principal analyst and cofounder of NanoMarkets, summed up the trends that are pointing to a new printed and flexible electronics revolution. He identified cost reduction as the most significant driving force for printed and flexible electronics. Gasman's presentation also observed that components and materials produce earlier revenues than systems offerings, with nanomaterials offering particularly good prospects. Examples include clear conductive films based on nanomaterials that are being used as transparent conductors in new touchscreen display designs, in place of indium tin oxide (ITO).

At the systems level, the short-to-medium opportunities seem to be solution-processed OLED lighting, flexible mobile displays and powered smart cards. At the manufacturing level improved inks and faster printing equipment were identified by NanoMarkets as the main opportunities for plastic electronics. The rest of the presenters included mainly start-ups developing plastic electronic devices and systems to the established microelectronics industry.

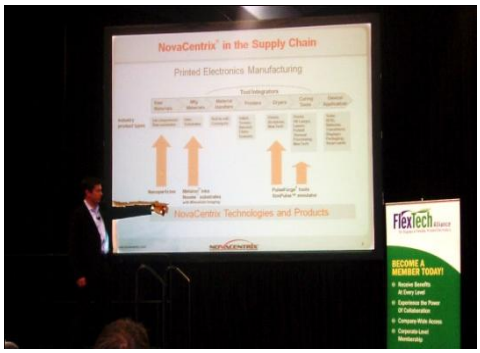
Xenon and NovaCentrix are commercializing processes for curing copper inks, based on nanomaterials. Compared with silver, copper is cheaper and can achieve high levels of conductivity. Xenon supplies high-intensity flash lamps for industrial applications like photovoltaics (PVs), as well as medical and research markets. The company discussed its photonics-based sintering process using low-temperature pulsed light.

Deposition

Presenter Saad Ahmed, engineering manager at Xenon, pointed out that nanomaterials and other high-performance functional materials, processed as inks, require higher or elevated process temperatures, not tolerated by flexible and alternative substrates such as plastics and paper. The challenge is to be able to sinter or cure these advanced inks to create high-performance devices without destroying the substrate beneath.

According to Ahmed: "Using a pulsed light process, where a very narrow pulse of light that has a huge amount of energy is generated, we can impart a lot of energy onto the substrate for a short amount of time – enough time to melt the metal ink, but not enough to increase the temperature of the material."

Xenon is targeting its pulsed flash lamp technology at applications for low-temperature sintering of nanoparticle inks in high-speed roll-to-roll processes, as opposed to low-temperature bake ovens. NovaCentrix, which started up as a supplier of nanoparticle powders and dispersions, has expanded into designing and developing a whole processing system, including nanoinks for specific printed electronics components and applications, and a tool for sintering and curing its nanomaterials. The PulseForge® system uses high-intensity flash lamps to heat the functional inks or films, but not the substrate itself. The company's latest copper nanoink makes oxidization part of the solution.



Stan Farnsworth, NovaCentrix

“Instead of fighting oxidation, we begin with particles in their terminal state: fully oxidized,” explained NovaCentrix marketing vice president Stan Farnsworth’s presentation.”There is no conductivity when printed, but this functionality occurs during PulseForge processing.”

NovaCentrix’s Metalon® ICI-020 copper screen is based on a formulation of copper oxide particles and a reduction agent. After printing, the ink is converted to highly conductive thin-film copper, when NovaCentrix’s PulseForge tool is used to modulate a high temperature reduction reaction between the copper oxide and the reducing agent. The Metalon ICI-020 screen ink, designed for use on paper-based substrates for the smart packaging and RFID markets, costs $75 (e52) a kilogram in volume quantities.

Organic PVs

Another start-up benefiting from FlexTech Alliance funding support is Solarmer Energy. The company has achieved successive breakthroughs in the power conversion efficiencies of its laboratory-made organic (O)PVs. In a project funded by FlexTech Alliance, Solarmer has developed OPVs close to nearly 12% using high-efficiency donor polymer materials. The project builds on previous designs to make a new active layer material in polymer solar cells that delivers improved properties like low band gap, appropriate molecular energy levels, good mobility and excellent processability. Vishal Shrotriya, managing director of Solarmer, presented on his company’s breakthroughs, looking at markets including building-integrated (BI) PV, portable and off-grid power generation.

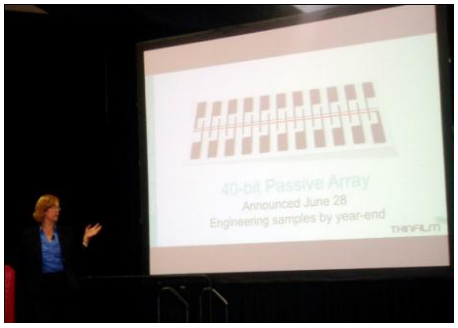
Cost

According to Solarmer’s technology roadmap to 2015, the company will roughly halve the cost per watt of its OPVs year-on-year, calculated on the basis that in 2015 Solarmer has a 278MW production output, at 7% efficiency and a 10- year lifetime, achieving $0.78 cost per watt. Solarmer has installed roll-to-roll production tools to develop a scalable, high-volume and cost-efficient process for making OPVs. The company’s pilot line has a production speed of up to 20ft a minute, an output of up to 3MW annually and has cost $1.5 million to install. While ramping up production to achieve economies of scale will reduce materials costs, the company is looking to bring about further reductions by replacing ITO as the TCO layer, and replacing the silver back contact with either aluminum or copper inks.

Oresman observes: “Solarmer is progressing quickly. It has set new records for efficiencies and has installed new production equipment to make that transition from lab to scale up. The company has partnerships in place to provide routes to market. Come 2012 don’t be surprised if it has something to announce in terms of commercial plans for its technology.”

Jennifer Ernst, vice president for North America at Thin Film Electronics, discussed her company’s progress in high-volume production of all-printed rewritable memory products for consumer application.

Ernst’s presentation showed how printed non-volatile (NV)RAM, when combined with printed transistor elements, serves as the basis of a new generation of cheap and disposable electronic devices. The company is working with toy and games manufacturers, and has indicated that commercial launches exploiting its technology are not far off.



Jennifer Ernst, Thin Film Electronics

In lighting, William Ray, chief scientist at Nth Degree Technologies, discussed his company's approach that uses traditional printing for graphics arts, such as gravure, screen and flexography, to fabricate semiconductors. The company is developing an LED ink to print lighting over a panel that can replace fluorescent lighting.

Materials database

One step toward moving these research technologies into practical production is reliable information on materials properties that clearly specifies just how these properties are measured, so users can compare products. Erika Rebrosova, assistant professor at Western Michigan University's (WMU) Center for the Advancement of Printed Electronics (CAPE) presented a database being developed for the industry. CAPE has received an award from FlexTech Alliance to create the open-access database for accessing technical information on functional materials used in the manufacture of printed and flexible electronics. The aim is to strengthen the printed electronics industry and supply chain, and provide increased access to technical information about available products.

Entries to the database include relevant non-proprietary information about the material itself, information on deposition and post-deposition processes, information on material properties and applications, and vendor information and contact details. Over 25 companies are in the database, with the number of entries growing. The database will be made available free of charge to FlexTech Alliance members and materials suppliers that list their products. Access for those companies that want to use the database as a resource will be subscription-based.

Since launching the session in 2009, attendance has grown 17% annually, with more expected next year as the industry's infrastructure, with FlexTech's support, establishes further and more flexible, printed products, materials, and processes are piloted and commercialized. According to Oresman, the session enables FlexTech Alliance to remain up to speed on the commercial progress of its partners, and the wider printed and flexible electronics industry, which in turn helps the organization create an up-to-date and current program for its multi-track annual international industry event, held in Phoenix, Arizona, every February. The next one is the 11th Annual Flexible Electronics and Displays Conference and Exhibition, February, 6-9, 2012.

Breakdown of attendees by role and job type	
Corporate level	14
Exec president and vice president level	22
Senior research/scientists and directors	22
Analysts	6
Engineers and engineering managers, managers other and consultants	90
Business development and sale	16
Professors	2
Editors	1
Unknown	22

FlexTech Alliance Transparent Conductors Workshop August 17-18, 2011

Tour Sponsor

An Analyst's View by Harry Zervos IDTechEx

The workshop was attended by about 60 people active in the printed electronics industry and keen on finding out developments on transparent conductor solutions beyond ITO.

The workshop's keynote was delivered by Debasis Majumdar with Eastman Kodak, focusing on the development and applications of PEDOT films (earliest work as far back as 1947!), which find an opportunity in applications that require increased flexibility or stability in conductivity under strain, with an aim of a 25-40% reduction in price when compared to similar grade ITO.

Taking into account the variability in performance of commercial grade ITO, an observation emerged that there are cases where PEDOT performance, in terms of transmission and resistivity, is equal to ITO.

Today's state of the art PEDOT (Clevios PH 1000) has reached 300 ohms/sq. at 95.9% bulk transmission or 91.2% transmission on 4mm thick PET which allows it to be comparable with ITO in the range of conductivity between 100 and 300 Ohms/sq. (For lower resistivities, ITO outperforms PEDOT).

Display applications identified by Eastman Kodak include resistive touchscreens, polymer dispersed liquid crystal displays (PDLC) or semiconductive coatings on electrodes for PDLCs. It's interesting to note that in the resistive touchscreen applications, a wash of SWCNTs deposited on top of PEDOT gave a great improvement in the number of cycles the touchscreen could withstand, with no change in the achieved conductivity levels.

Lawrence Gasman of NanoMarkets focused on the markets for transparent conductors, with the display market taking up the largest share by far, and ITO being the main material (difficult to displace, old ways die hard and ITO tends to have optimal combination of conductivity and transmission).

It's interesting to note though that the PV market has moved away from ITO: a-Si manufacturers for example use ITO, FTO and AZO, First Solar is using FTO and most CIGS PV manufacturers use AZO. 2010 and 2011 has seen a rapidly growing interest in ITO alternatives, with touch displays being the most targeted (the Boogie Board™ by Kent Displays being an interesting example of a device using PEDOT:PSS). But according to NanoMarkets, transparent conductors based on carbon nanotubes and nanosilver are also expected to see strong growth while graphene seems to be a bit further behind in terms of taking up market share as it's still difficult to get hold of substantial quantities of the material.

Maikel van Hest with the National Renewable Energy Laboratory (NREL) listed the main issues of conventional TCOs for photovoltaics:

- ITO: Expensive
- FTO: High temperature deposition
- AZO: Poor Acid Resistance

Lunch Sponsor

Amorphous TCOs might be an alternative, amorphous Indium Oxide or Indium Zinc Oxide (which is also water and water vapor resistant) for instance. But the main question remains: is indium necessary for high conductivity and what are the alternatives to indium? a-CdSnO is highly conductive and indium free but unfortunately contains cadmium (which is not a big issue when used in CdTe solar cells that already contain it, although, sequestered or not, some markets do not allow Cd-containing products, e.g. Japan).

Rahul Gupta, director of business development with Cambrios Technologies focused on the nano-silver based approach that the company's working on. The main market focus for Cambrios is the strong growth area of projected capacitive touchscreen technologies (typically 100-250 Ohms/sq.), with a secondary focus on the displays and PV market (<10-100 Ohms/sq.). Companies like Hitachi and Toray have already announced film products using Cambrios' materials

An important advantage is the ability to process Cambrios' ClearOhm™ at low temperature without losing performance, which allows for the use of plastic substrates such as PET (remaining over 90% transmission when reaching down to 20 Ohms/Sq. sheet resistance whilst achieving lower reflectance and more neutral color than ITO).

In terms of patterning, photo patterning, screen printable etchants, laser or direct patterning are all compatible with the material allowing for versatility in processing and hence, the ability to tune processing requirements of the final component.

Working with Nissha (touch sensor) and Synaptics (touch module) on the development of touchscreens, smart phones incorporating ClearOhm™ were first made available in early 2011. Cambrios is also working with Plextronics in the development of OLEDs using the materials developed by the two companies, leading to 30% higher efficiency and lifetimes similar to those achieved with ITO. Cambrios is also working with Ascent Solar on CIGS solar cells achieving efficiencies similar to ITO cells.

Bob Praino with Chasm Technologies focused on the use of carbon nanotubes and their use in transparent conductor applications with the company working with SWeNT and targeting resistivities of about 100 Ohms/sq.

William Ray with NthDegree Technologies talked about Cartesian and non-regular transparent conductor arrays, demonstrating some very interesting lighting elements utilizing networks of silver nanowires.

In more device-centric presentations, Solarmer Energy discussed their needs to drop their cost structure down (currently at about $6/Watt) with conductive electrodes and encapsulation being the highest costs in the material breakdown hence, having a big interest in ITO substitution but ITO is still giving best performance in terms of efficiency, when compared to PEDOT or PEDOT with metal grids.

Finally Synaptics discussed the need for novel transparent conductors for the touchscreen market, especially for projected capacitive. Bob Mackey did point out though that ITO is not really that expensive if one takes into account its performance levels and the invisibility of patterns when used with good index matching.

An important issue that arose from the workshop is the ability to come up with a specific cost of ITO films, as it's difficult to estimate its contribution to the overall cost structure of devices and of course the fact that lower cost solutions are not necessarily attractive since, performance levels need to be reached for many applications that are a prerequisite in order to displace the use of ITO.

Highlights from FlexTech Alliance Quarterly Workshop *"Hybrid Nanocomposites and Interfaces for Printed Electronics"* & Tour of Center for Organic Photonics and Electronics (COPE) September 13-14, 2011

Participants of this workshop experienced an exceptional event sponsored by Georgia Tech's Center for Organic Photonics and Electronics (COPE). One and a half days of presentations spanned the topics of energy storage, tuning electrical properties of transparent conductors, and hybrid materials for encapsulation and packaging. Speaker presentations were a comprehensive cross-section of functional layers, structures, barriers, materials and tools from industry and academia.

COPE Tour

Attendees were treated to a tour of the state-of-the-art interdisciplinary research building, the Molecular Science and Engineering Building. Included in the tour were the Marcus Nanotechnology Research Center, an organic chemistry laboratory and a device fabrication laboratory. Immediately preceding the facility tour, researchers spoke about the ongoing research projects, joint project/development opportunities and different applications and capabilities of the facility. Some of the current projects include OPV, OLED, organic and hybrid thin-film transistors, encapsulation and packaging, nanocomposites for energy storage, and nanolithography. For more information about the research and activities of COPE please visit www.cope.gatech.edu. Corporations interested in learning more about the research capabilities and facilities at Georgia Tech or about partnership opportunities are encouraged to contact Jason Martin at COPE. He can be reached via email at Jason.martin@chemistry.gatech.edu or at 404-385-3138.

Panel

The panel discussion addressed many specific issues of organic/inorganic interfaces as well as the challenges facing the flexible and printed electronic industry in general. When asked what the technical challenges were to the successful adoption of organic electronics, responses included: leakage current improvement, reduction of turn-on voltage, the importance of surface energy, and the need for good barrier films and encapsulants. Panelists agreed that while organics can be easier to process and potentially may lower costs, there are no killer applications yet. Big players are developing OLED lighting to position themselves as leaders and energy capture is also a potential application. More engineering is required for integration. There was general consensus that corporations in the U.S. need to think long term when it comes to developing new technologies with the understanding that profits won't be known for 5-10 years.

Georgia Tech Center for Organic Photonics and Electronics



COPE Tour

Presentation Topics

Tuesday September 13, 2011	
Pre-Tour Session	
High energy density capacitors for storage	Joseph Perry, COPE
Role of interfaces with hybrid materials for encapsulation & packaging	Samuel Graham, COPE
Tuning electrical properties of transparent conductors with surface modifiers	Seth Marder, COPE
Tour of COPE	
Wednesday September 14, 2011	
Morning General Session	
Market Trends in Emerging Organic Devices	Jonathan Melnick, Lux Research, Inc.
Organic field-effect transistors with novel architectures	Bernard Kippelen, COPE
Transparent Conductive Films	David Schroder, Blue Nano, Inc.
Printed Quantum Dot Light Emitting Diodes (QLEDs) for Displays and Lighting	Matt Stevenson, QD Vision, Inc.
Barriers and Encapsulants	Lorenza Moro, Samsung Cheil Industries
Physics of Interfaces for Organic Electronics	Antoine Kahn, Princeton University
Halogen-Free, UV-Curable High Refractive Index Materials for Light Management	Jeffrey Wang, Cytec Industries
Advances in Fast ALD Process for R2R Applications	Ganesh Sundaram, Cambridge NanoTech
Afternoon Panel Discussion	
Overcoming the Challenges of Organic/Inorganic Interfaces	

Georgia Tech Center for Organic Photonics and Electronics

Register Now!

FlexTech Alliance invites you to the 11th annual Flexible Electronics and Displays Conference and Exhibition

Date: February 6 – 9, 2012

Location: Arizona Grand Resort, Phoenix, AZ

Earlybird Registration is Now Open at www.flexconference.org

Join this field of international experts from industry, academia and R&D as we share the latest advances in flexible, printed electronics and displays. Organizations presenting at the conference include the 3M, Air Force Research Lab, Applied Materials, Corning, DuPont, E Ink, HP, IBM, Konarka, Lockheed Martin, Mark Andy, Microsoft, PARC, Samsung, Sharp, Sony and more.

New for 2012:

- Christopher Soles of the National Institute of Standards and Technology will chair the panel "Metrology and Standards for Printed, Flexible Electronics".
- The challenge of getting materials to work together is addressed through "The Path to Commercial Products" panel, chaired by Jennifer Ernst of Thin Film Electronics.
- "The Future of Flexible Photovoltaics" will be moderated by Gail Flower, editor of Industrial + Specialty Printing magazine.

AGENDA

SUNDAY, FEBRUARY 5, 2012

Golf tournament, super bowl party, networking, and prize presentation

MONDAY, FEBRUARY 6, 2012

Short Courses Welcome Reception

TUESDAY, FEBRUARY 7, 2012

Keynotes, Industry Visionaries, Supply Chain Strategists

The conference opens with presentations from an extensive list of industry visionaries who will reveal their views on system requirements for deploying flexible, printed electronics. Confirmed speakers include Jennifer Ricklin of the Air Force Research Laboratory, Frank Caris of dpiX, Michael McCreary of E Ink, James Buntaine of Konarka, Michael Dudzik of Lockheed Martin and Steven Abramson of Universal Display Corp. Supply chain strategists will follow to explain the capability of tools, materials and manufacturing processes in advancing this emerging industry. Featured speakers include Om Nalamasu of Applied Materials, Peter Bocko of Corning , Paul Brauss of Mark Andy and Tim Claypole of the Welsh Centre for Printing and Coating. Other general session participants are senior executives from DuPont MCM, IBM, Plastic Logic, Polyera and Solvay.

Register now at www.flextech.org

TECHNICAL SESSIONS

WEDNESDAY, FEBRUARY 8, 2012

Track A

Flex Displays
Sony, Polymer Vision, Lux Research, HP, Henkel Corporation

OLEDs
EMD Chemicals, Display Search, 3M, HP, Thorn Lighting, Display Technology Center

Novel Devices
Microsoft, Nth Degree, US Army, PARC

TFTs on Flexible Substrates
PETEC, Georgia Tech, HP, Sharp, Alcoa Technical Center, Lehigh University, Merck Chemicals

Track B

Printing 1
UC Berkeley, IDTech EX, PARC, New Jersey Institute of Technology, King Abdullah University

Printing 2
NIAIST, Edward D. Cohen Consulting, Clemson University, Stevens Institute of Technology

Substrates & Films
Samsung Cheil, Veritas et Visus, DuPont Teijin Films, Corning Inc., Akron Polymer Systems

Commercial Products
Thin Film Electronics, PARC, UC Berkeley, Ink Tec Company, Rusnano

THURSDAY, FEBRUARY 9, 2012

Track A

Evolving Equipment
Northfield Automation Systems, University of Massachusetts, Colnatec, Micronic Mydata, New Way Air Bearings

Pilot Production and Beyond
Holst Center, Enfucell, Kent Displays, Kovio, Clemson University

Medical and Hybrid Electronics
PARC, MC10, American Semiconductor, KTH, Paper Battery Company

Track B

Metrology Panel
National Institute of Science and Technology, JA Woollan

Materials and Processes
Western Michigan University, MicroChem, PARC, UT Dallas Sartomer, Phoseon Technology

Barriers and Conductive Films
Solutia Performance Films, Cambridge NanoTech, Seoul National University, PChem Associates, WMU, Beneq Oy

Track C

Transparent Conductors 1
Cima NanoTech, Kyung Hee University, Heraeus Materials Technology, Chasm Technologies, Binghamton University

Transparent Conductors 2
NanoMarkets, Nth Degree, 3M, Cambrios, Duke University

Photovoltaics
MIT, Global Solar Energy, UCLA, Heliatek, Solarmer Energy

Register now at www.flextech.org

News and News Links from FlexTech Alliance

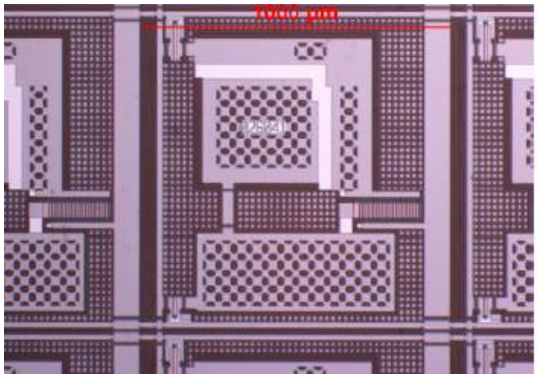
excerpted from Veritas et Visus newsletters

Kodak announces breakthrough PET film with low haze growth characteristics

Eastman Kodak's Industrial Materials Group announced it has developed a next generation of polyester film with extraordinarily low haze growth characteristics when the film is subjected to high heat in a variety of industry applications. The new film is an extension to the Kodak ESTAR (PET) film portfolio. It features improved haze stability along with high clarity, optical-grade surface quality and shrinkage characteristics of 1% or less in the machine and transverse directions. In laboratory tests, uncoated Kodak ESTAR polyester film with a thickness of 127 microns (5 mil) was subjected to temperatures of 150ºC for one hour with a change in haze from 0.2% to 0.4%. The same laboratory tests of the film with an adhesion promoting primer on one side resulted in a change in haze from 0.4% to 0.5% (ASTM D 1003). Kodak said the film is being considered as a possible replacement for flexible display processes involving ITO sputter deposition, and in mold decoration where uniform high clarity and low shrinkage characteristics are required. The new film is manufactured with a proprietary in-line process to control shrinkage and haze. It is available without any coating or can have adhesion promoting primer on one or both sides of the film. Currently the film is available in the 127 micron (5 mil) thickness, with a maximum width of 1441 mm (56.75 inches). http://www.kodak.com/go/img

HP Labs develops novel method for fabricating flexible AMOLED displays

HP Labs has developed a proof-of-concept proprietary solution to fabricate flexible active matrix OLED displays, which involves a process in which a well-defined micro OLEDs (µOLEDs) frontplane is directly laminated with an R2R processed active matrix flexible backplane built via self-aligned imprint lithography (SAIL) without any in-between alignment. Recently, significant progress has been made toward application of small molecule/polymer OLEDs in full color flat panel displays and other devices. However, current technologies for OLEDs in the market are still very limited, especially in terms of cost, size and flexibility. HP believes fabricating OLED displays using roll-to-roll manufacturing on plastic is the way to achieve low cost, light weight and flexibility. One of big challenges for fabricating flexible OLED displays is alignment on large area flexible substrates. A proof-of-concept AMOLED device has been built, which contains a flexible µOLEDs frontplane with OLED sizes of 50µm on PET and active matrix backplane on polyimide with pixel pitches of 1mm. Such an alignment-free method offers great possibilities of creating large area interactive displays such as wall-paper type of displays with very low cost that no other technology today can achieve, the company says.



A pixel of the AMOLED backplane

NanoMarkets releases report on markets for flexible glass

NanoMarkets announced the release of its latest market report on substrate and encapsulation materials titled, "Markets for Flexible Glass – 2011". In this report NanoMarkets quantifies the opportunities for ultra-thin glass that is sufficiently flexible for use in roll-to-roll (R2R) manufacturing and in lightweight displays, as well as intrinsically flexible products such as rollable displays and conformable solar panels. While the majority of revenues generated by flexible glass will come from sales into the display and solar industries, this report also looks at other applications including lighting and sensors. It also, examines how flexible glass will compete against plastics, sheet metal, metal foils and other flexible substrates. In addition, the report discusses the manufacturing challenges that still remain for flexible glass and the likely roadmap for this material as it enters the marketplace.

Among the firms and major research facilities that are discussed in this report are AGC (Asahi Glass), Corning, DuPont, DuPont Teijin Films, ITRI, Lawrence Berkley National Lab, LiSEC Nippon Glass, and Tokyo Electron Glass. Flexible glass will be an enabling technology for roll-to-roll (R2R) fabrication of high-performance e-paper and OLED displays. It offers the high transparency, robustness and good barrier properties associated with glass, while at the same time providing lower manufacturing costs. The advantages of flexible glass as a substrate in R2R processes have recently been demonstrated in joint development work done by Corning and ITRI (Taiwan). R2R processing using flexible glass is also expected to drive flexible glass into the solar panel sector within the next couple of years.

Thin glass is an established way to reduce weight in glass products such as windows. Ultra-thin flexible glass will continue this tradition for mobile displays; where low weight for laptops, tablets and smart phones is a key marketing factor. Flexible glass will also have an important role in weight reduction for the solar panels, since here weight reduction avoids the need for special roofing support. While intrinsically flexible products such as rollable displays and comformable building-integrated photovoltaics (BIPV) panels offer good prospects for flexible glass, large sales of flexible glass for these products lie three to five years away. Although the first flexible glass products are likely to be premium priced, but the price of this novel kind of glass will come down quickly, since the volume of glass used for a given area is less with flexible glass than with conventional glass. However, considerable manufacturing challenges remain for flexible glass itself. Firms marketing flexible glass will have to demonstrate sufficient mechanical reliability for R2R fabrication; flexible glass will have to offer high strength edges and surfaces as well as control of stresses during device manufacturing. End users will also have to be assured that patterning from a spooled glass substrate can be effectively achieved. http://www.nanomarkets.net

DuPont introduces new silver conductor

DuPont Microcircuit Materials (MCM), a business unit of DuPont Electronics & Communications, has introduced its latest screen printed silver conductor material for the printed electronics market. DuPont 5064H silver conductor ink provides resistivity less than or equal to six milliohms per square per mil, making it among the most conductive and cost-effective screen printed silver conductor material on the market today. DuPont 5064H can be printed onto a variety of substrates, including polyethylene terephthalate (PET), polyethylene-naphthalate (PEN), DuPont Kapton polyimide films, paper, and more. The composition is solvent based and was designed to be screen printed in semi-automatic or high volume reel-to-reel applications. http://mcm.dupont.com

FlexTech Alliance to feature system requirements and supply chain strategies at 2012 conference

FlexTech Alliance announced the speakers, panel sessions, agenda and short course offerings for its 2012 Flexible Electronics & Displays Conference & Exhibition, to be held in Phoenix, Arizona, February 6-9, 2012. Supporting the FlexTech Alliance mission to develop the electronic display and the flexible, printed electronics industry supply chain, conference sessions span the full cycle of R&D through to product integration. Topics include: materials, process and tool development; overcoming challenges of pilot production; and end product usage such as biomed devices, solar energy harvesting, OLED lighting and military applications. Results of FlexTech Alliance funded projects from Henkel, Solarmer Energy, Western Michigan University and Corning Inc. will also be presented.

The conference opens with presentations from an extensive list of industry visionaries who will reveal their views on system requirements for deploying flexible, printed electronics. Confirmed speakers include Jennifer Ricklin of the Air Force Research Laboratory, Frank Caris of dpiX, Michael McCreary of E Ink, James Buntaine of Konarka, Michael Dudzik of Lockheed Martin and Steven Abramson of Universal Display Corp. Supply chain strategists will follow to explain the capability of tools, materials and manufacturing processes in advancing this emerging industry.

Featured speakers include Om Nalamasu of Applied Materials, Dipak Chowdhury of Corning and Tim Claypole of the Welsh Centre for Printing and Coating, Other general session participants are senior executives from DuPont MCM, IBM, Plastic Logic, and Polyera. Three new panel sessions, designed to provide varying perspectives on pressing issues, have been added to the 2012 conference. Christopher Soles of the National Institute of Standards and Technology will chair the panel "Metrology and Standards for Printed, Flexible Electronics". The challenge of getting materials to work together is addressed through "The Path to Commercial Products" panel, chaired by Jennifer Ernst of Thin Film Electronics. "The Future of Flexible Photovoltaics", will be moderated by Gail Flower, editor of Industrial + Specialty Printing magazine. http://www.flexconference.org

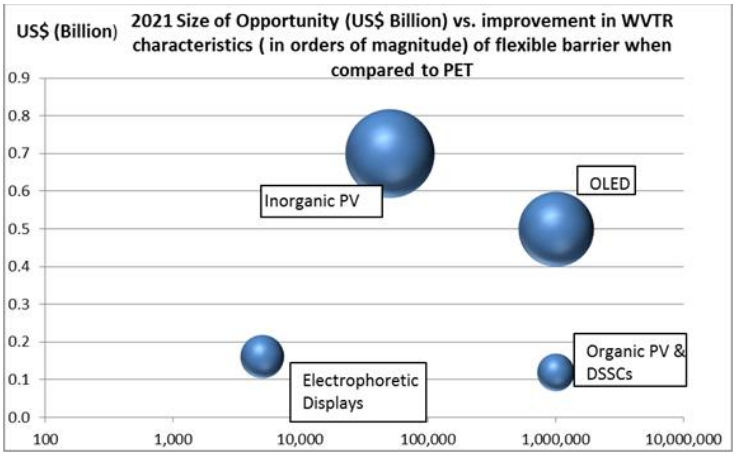
FlexTech Alliance requests proposals for flexible printed electronics

The FlexTech Alliance is actively seeking proposals for the design, development, and delivery of new or substantially improved process technology and manufacturing equipment, materials and components used in the fabrication of electronic displays and flexible, printed electronics. This is an open solicitation. FlexTech Alliance will support technical approaches that are revolutionary as well as approaches that are evolutionary improvements upon existing capability. Of particular interest are topics that impact the four market segments of sensors, displays for communication, energy harvesting and storage, and solid state lighting devices. The pre-proposal deadline for this RFP cycle is January 10.
http://www.flextech.org/documents/2012%20FTA%20Open%20Solicitation.pdf

IDTechEx says barrier layers for flexible electronics a billion dollar opportunity by 2020

IDTechEx, the market research firm in the field of printed electronics, has been closely following the developments of barrier films that will enable flexible electronics, leading to the next generation of devices, characterized by lighter weight, robustness and innovation in form factor. Although initially expensive, as flexible electronics become more predominant, barrier solutions will improve and their cost slowly will come down due to improvements in manufacturing and economies of scale. By 2020, IDTechEx predicts that flexible barrier manufacturing will be a market of more than $1 billion, mainly due to photovoltaics and OLED displays, as described in detail in the report "Barrier Films for Flexible Electronics: 2011-2021".

Although it is currently possible to fabricate many different kinds of flexible electronic products such as displays or solar cells, in order for them to be commercially successful, they must also be robust enough to survive for the necessary time and conditions required of the display. This condition has been a limitation of many flexible electronics. Beyond flexibility and functionality, one of the most stringent requirements is encapsulation. Many of the materials used in flexible electronic products are chemically sensitive, and will react with many environmental components. OLED displays and organic solar cells are particularly sensitive in this regard. They require the use of low work function metal cathodes, which are extremely sensitive to water, oxygen, and a variety of other materials.

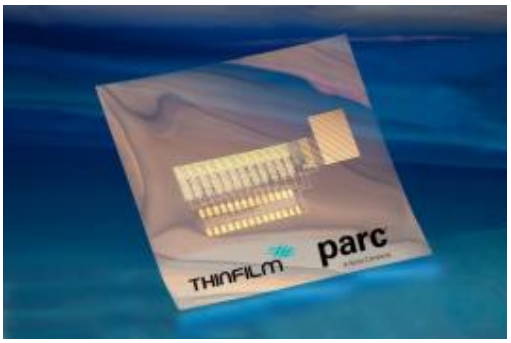


Size of opportunity for barrier films in 2021

Glass and metal substrates provide good barriers to oxygen and water, but plastic substrates do not. So in order to fabricate organic electronics on plastic substrates, rigorous encapsulation is required. Chemical requirements of barrier materials are the permeation rate of water through the barrier must meet the specified requirements, e.g. WVTR $<10^{-6}$ g/m^2/day and OTR $<10^{-3}$ cm^3/m^2/day; the barrier must be resistant to any processes, e.g., printing, lithography, that are carried out on it during the fabrication of the OLED display; the deposition process must be compatible with the active components in the display; and the barrier must be stable for the lifetime of the display, i.e., maintain its characteristics, exhibit good adhesion to the display surface and a similar thermal expansion coefficient to the layers beneath. Mechanically, the barrier must be flexible - sometimes even tightly rollable, repeatedly. The barrier, or layer(s) covering it, must be mechanically robust, i.e., tough enough to allow the user to handle the display without loss of barrier performance. The barrier must retain its barrier properties as a function of in-flex use during the lifetime of the display. Optically, the barrier must be (and stay) optically transparent from 400-700nm. Almost all barrier layers are based upon technologies that coat a base polymeric material with materials that are dense, transparent, and impermeable (to oxygen and moisture). In this way, the optical and mechanical characteristics of the base plastic can be preserved, while obtaining the barrier properties of the coating materials. The barrier materials used for the coatings are normally layers of inorganic oxides or hybrid/composite layers of organic and inorganic materials. Each pair is called a dyad. The inorganic materials are particularly impermeable and the organic ones are good for smoothing and filling imperfections.

One of the key benefits of flexible electronics would be that they can move away from glass substrates, making them more robust. In many cases companies do not need fully flexible or rollable displays, at least initially. Fairly rigid substrates are fine compared to rigid glass, which has little ability to flex. Other benefits are that the final components are typically lighter, thinner, easier to transport and easier to fit. In 2011 22% of printed electronics will be conformal or flexible, the rest rigid (usually being that they are on a rigid glass substrate). In 2021, according to IDTechEx forecasts, the amount that is conformal/flexible rises to 43% of the total value, representing a market surpassing $19 billion. The bubble chart gives an idea of the size of opportunity for barriers used in inorganic PV, organic PV and DSSCs, OLEDs and electrophoretic displays in 2021 when compared with the necessary improvement of WVTR properties of a barrier layer against PET. It is obvious from the chart that although the opportunity for inorganic PV and OLED technologies is comparable in size, the difficulties in developing adequate barriers for OLEDs make that particular sector a much more arduous task. Similarly, organic PVs and DSSCs present an opportunity that is similar in size as that for flexible e-readers but encapsulation of e-reader devices is not as demanding as in the case of organic solar cells. Companies of different sizes are involved in the manufacture of barrier layers, start-ups such as TerraBarrier (a spin-off from IMRE in Singapore) and Vitriflex (working with CIGS company Nuvosun to develop flexible barriers for PVs), or giants like 3M. Even companies like Henkel are involved, mainly working on the development of the right type of adhesives to be used in the stacks of components that make up the final device. http://www.IDTechEx.com/barriers

Thinfilm unveils first scalable printed CMOS memory



Thin Film Electronics ASA (Thinfilm) together with PARC, a Xerox company, announced they have produced a working prototype of the world's first printed non-volatile memory device with complementary organic circuits, the organic equivalent of CMOS circuitry. Thinfilm Addressable Memory consists of Thinfilm's printed memory and PARC's transistors. The company says that this demonstration is a significant milestone toward the mass production of low-cost, low-power ubiquitous devices that are a key component of the "Internet of things". The prototype was demonstrated at PARC on October 24. Thinfilm Addressable Memory combines Thinfilm's polymer-based memory technology with PARC's transistor technology using complementary pairs of n-type and p-type transistors to construct the circuits. The addition of the integrated circuits makes the roll-to-roll printed Thinfilm memory addressable by printed logic.

The vision of a world filled with the “Internet of things” is where everything is connected via a smart tag. These smart tags require the commercial availability of devices that: have rewritable memory, are low cost, support integration with sensors and other electronic components, are environmentally friendly, and can be produced using high volume, roll-to-roll printing. The demonstrated prototype, rewritable memory with logic circuitry, meets all of these requirements. http://www.thinfilm.se

Philips shows off luminous textiles

Philips has developed patented technology to create mood and atmosphere in a specific space, whatever its function. Through integrated LED lights, coupled with the texture of the panels, sound is not only absorbed to create a comfortable working environment but the retail and hospitality experience can also be enhanced through the display of dynamic visual content. It allows for a space to be completely transformed and enables a brand’s identity to shine. The product is the result of a recent agreement between Philips and Kvadrat Soft Cells, who manufacture acoustic panels. http://www.philips.com

Philips’ LEDs are integrated into Kvadrat textiles

Universal Display and PPG Industries announce new OLED supply and service agreement

UDC and PPG announced that the companies have entered into a new organic light-emitting diode (OLED) materials supply and service agreement. Under the new agreement, PPG will remain the exclusive manufacturer of Universal Display’s proprietary phosphorescent OLED materials. The new agreement is substantially similar to the current agreement. http://www.ppg.com http://www.universaldisplay.com

Plastic Logic introduces the Plastic Logic 100 for Russian education

Plastic Logic announced the availability of the Plastic Logic 100 for Education, an electronic textbook designed with the needs of students and educators in mind. The device provides a more effective way for students to carry, access, and review all their textbooks. Plastic Logic CEO Indro Mukerjee officially debuted the electronic textbook at an event held at the Moscow Planetarium during a visit by British Trade Minister Lord Green. The event, organized by RUSNANO and UK Trade and Investment (UKTI), highlighted Plastic Logic as an example of the joint technology cooperation between the UK and Russia. The Plastic Logic 100, featuring a textbook-like and safe reading experience, allows for a backpack worth of textbooks to be ready and available at a student’s fingertips at any time in an extremely lightweight package. For educators, the Plastic Logic 100 provides a simple, yet powerful tool capable of securely delivering an entire year’s worth of textbooks in one place without the risk of students not having what they need with them. The Plastic Logic 100 has more advantages than both books and the LCD displays found in most e-reader and tablet devices. Based on Plastic Logic’s groundbreaking work in organic electronics and nanotechnology, the device is the first in the world to feature PlasticPaper technology. Because the base is not glass, the Plastic Logic 100 display is large, thin, lightweight and is uniquely shatterproof and rugged – which is especially important given constant use by students. http://www.plasticlogic.com

Samsung invests into Novaled

Samsung Ventures Investment Corporation and Novaled announced that SVIC has become a shareholder of Novaled. Novaled is a key player in OLED technology and organic materials surrounding the emitting materials. The Novaled PIN OLED® technology aims at reducing the energy consumption while offering longer lifetimes. "Our investment in Novaled is consistent with our strategy to work closely with established market leaders." says Michael Pachos, Senior Investment Manager at SVIC. "Novaled is a technology leader and has built a significant business in the OLED space. The company has demonstrated both a technical and business vision in driving adoption of OLED displays and lighting and we look forward to contributing to the progress of Novaled." The details of the deal have not been communicated. http://www.novaled.com

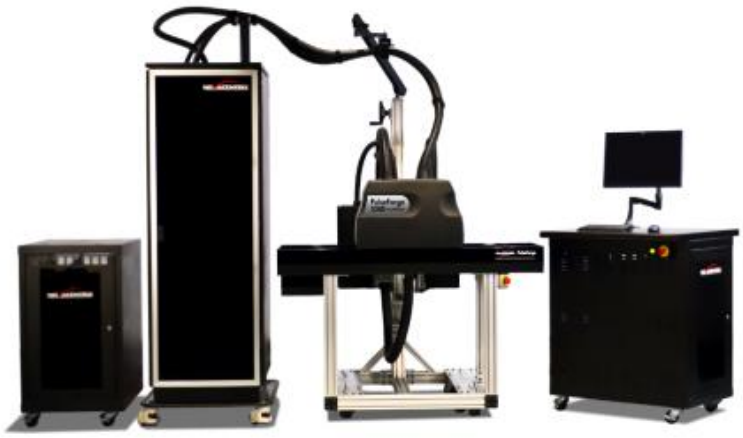
Novaled launches OLED luxury luminaire series

The world's latest in avant garde lighting – unique luxury light-art masterpieces hand-crafted from innovative high-tech light sources and high-edge materials –was unveiled under the new brand name Liternity, a trademark of German company Novaled AG. The limited-edition Liternity luminaires combine advanced OLED technologies just a few nanometers thick and exotic high-end materials to enable completely new and imaginative ways of designing with light in ultra-flat form factors. The first product of the Liternity series, a new desk lamp named Victory, also was introduced. It is the world's first luminaire to showcase OLED lighting in an ultra-thin, ultra-strong carbon-fabric base. The Victory desk lamp, 35cm high and 40cm deep, sports a dynamic silhouette from every perspective. Its design includes two arms with four embedded ultra-flat OLEDs that provide pleasant, diffuse light over the entire surface. Several layers of clear lacquer allow a fascinating 3D impression of the accurate work deep inside done by a leading carbon manufacturer. Very lightweight and nearly indestructible carbon material originally developed for aerospace applications forms an open filigree-like lamp base that adds flexibility, beauty and stability. The OLEDs used for "Victory" lamps are based on German technology and materials of Novaled. http://www.liternity.com

Victory luxury desk lamp with ultra-flat OLEDs

DuPont advances Printed Electronics development efforts by employing NovaCentrix PulseForge tools

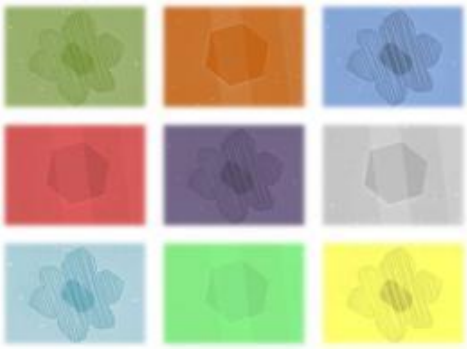
DuPont Microcircuit Materials (MCM), part of DuPont Electronics & Communications, announced an arrangement with NovaCentrix regarding MCM's use of NovaCentrix's PulseForge tools which MCM anticipates will further its development of state-of-the-art materials and processing technology, as DuPont continues to expand its portfolio of functional inks for the growing printed electronics industry. DuPont anticipates that the capability of the PulseForge tools, combined with proprietary functional inks designed and developed by DuPont, will deliver low resistivity fine line conductors with high adhesion that can enable highly differentiated ink offerings with lower cost of ownership for printed electronics producers. DuPont expects to both characterize portions of its existing product offering and develop new high-performance, cost-effective products, to ensure its printed electronics customers have an even wider range of products available.



DuPont MCM is an established high-volume supplier of electronic inks and pastes and has developed a broad range of printed electronic materials commercially available today. This growing range of DuPont MCM functional inks is used for forming conductive traces, capacitor and resistor elements, and dielectric and encapsulating layers that are compatible with many substrate surfaces including polyester, glass and ceramic. The company recently announced another key collaboration with Holst Centre to advance technology specifically in the area of printed structures on flexible substrates, which has application in flexible display, RFID, lighting, biomedical and Organic Photovoltaic (OPV) markets. http://www.novacentrix.com http://mcm.dupont.com

Oak Ridge National Laboratory finds hydrogen may be key to growth of high-quality graphene

A new approach to growing graphene greatly reduces problems that have plagued researchers in the past and clears a path to the crystalline form of graphite's use in sophisticated electronic devices of tomorrow, reports *Nanowerk News*. Findings of researchers at the Department of Energy's Oak Ridge National Laboratory demonstrate that hydrogen rather than carbon dictates the graphene grain shape and size. Hydrogen not only initiates the graphene growth, but controls the graphene shape and size. The researchers describe a method to grow well-defined graphene grains that have perfect hexagonal shapes pointing to the faultless single crystal structure. Until now, grown graphene films have consisted of irregular- shaped graphene grains of different sizes, which were usually not single crystals. Using their new recipe, the researchers have created a way to reliably synthesize graphene on a large scale. The fact that their technique allows them to control grain size and boundaries may result in improved functionality of the materials in transistors. Semiconductors and potentially hundreds of electronic devices. http://www.ornl.gov



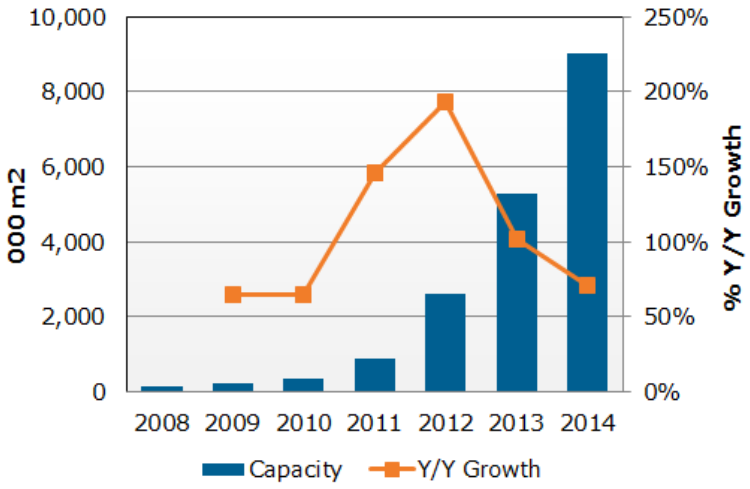
Graphene grains come in several different shapes. Hydrogen gas controls the grains' appearance

AMOLED manufacturing capacity reported by DisplaySearch

"SMD currently accounts for nearly 100% of commercial AMOLED shipments, and its A2 Gen 5.5 fab and planned future factories will account for much of the expected capacity growth. Other existing and potential AMOLED manufacturers are watching SMD's progress and aggressive expansion plans, hoping that they will be able to leverage advances in equipment technology and take advantage of growing interest in AMOLED displays for smart phones and other applications," explained Charles Annis, DisplaySearch Vice President of Manufacturing Research. "AUO, LG Display, ChiMei Innolux and IRICO are also forecast to build either pilot or mass production AMOLED lines in the next two years, while other companies are currently considering entering the market." LCD panel makers have suffered negative net profit margins for four consecutive quarters, and with excess a-Si LCD capacity for TV production, FPD equipment spending is now forecast to fall by more than 40% in 2012. On the other hand, supply of AMOLED displays has been very tight in 2011. As SMD ramps A2, many more AMOLED displays will hit the market, and demand is expected to grow in turn. AMOLED displays are a bright spot in the FPD manufacturing industry, offering hope for FPD supply chain companies. "In addition to the opportunities that capacity expansion can provide, many companies are racing to develop material and equipment technologies to support AMOLED manufacturing. Successful development of oxide semiconductors, high resolution lithography, laser-induced thermal imaging (LITI), vertical, scanning evaporation, thin film encapsulation and flexible substrates – just to name a few – could mean big payoffs for some supply chain companies as production of AMOLEDs ramps up," Annis added. Most of the new AMOLED capacity coming on-line is optimized for small/medium display production. But high-quality and theoretically low-cost AMOLED TV remains the ultimate target for FPD makers. Both SMD and LG Display are moving ahead with Gen 8 AMOLED TV pilot production plans for 2012. How successful they will be and what additional capacity expansions AMOLED TV might drive are still unclear, but these are key trends to follow in the FPD manufacturing industry. http://www.displaysearch.com

AMOLED manufacturing capacity forecast to nearly triple in 2012, predicts DisplaySearch

The long-anticipated growth in size and volume of AMOLED display manufacturing is finally becoming a reality, with Samsung Mobile Display's (SMD) ramp-up of the first Gen 5.5 AMOLED fab. The company began installing equipment in its A2 factory in December 2010 and is now expected to reach maximum capacity of 80,000 substrates per month by the end of Q1'12. As analyzed in the DisplaySearch Quarterly FPD Supply/Demand and Capital Spending Report, this development is forecast to drive growth in AMOLED capacity from 890,000 m2 in 2011 to 2.6 million m2 in 2012; capacity is expected to then double again in 2013. http://www.displaysearch.com



E Ink and Chunghwa Picture Tubes form strategic alliance

E Ink Holdings (EIH) and Chunghwa Picture Tubes (CPT) in July formed a strategic alliance with the e-paper supplier investing NT$1.5 billion ($51.9 million) to acquire 3-year zero-interest unsecured convertible bonds to be issued by the TFT LCD maker. The alliance is expected to see CPT use its 6G plant to produce e-paper backplanes and FFS (fringe field switching) panels for EIH. E Ink will hold about 6.6% of CPT, who will produce 7 and 10.1-inch FFS LCDs for E Ink. FFS is similar to IPS in terms of performance: wide viewing angles, little shift in contrast and colors. http://www.eink.com

UDC announces agreement with Panasonic Idemitsu OLED Lighting for OLED lighting products

Universal Display Corporation announced that it has entered into a technology license agreement with Panasonic Idemitsu OLED Lighting Co., Ltd., a joint venture between Panasonic Electric Works Co., Ltd. and Idemitsu Kosan Co., Ltd. Under the new agreement, Panasonic Idemitsu OLED Lighting (PIOL) will be licensed to integrate Universal Display's proprietary UniversalPHOLED phosphorescent and other OLED technologies and materials into OLED lighting products. Under the license agreement, Universal Display has granted license rights under various patents and associated know-how owned or controlled by Universal Display for PIOL to manufacture and sell OLED products for lighting applications. PIOL will pay Universal Display running royalties on its sales of these products under the agreement, with a portion of the royalties prepaid. The parties have also entered into a separate material supply agreement. The terms of both agreements run through July 31, 2014. OLEDs are considered a potential solution for introducing more energy-efficient, environmentally-benign and design-friendly lighting products. Universal Display's phosphorescent OLED technology and materials have demonstrated a four-to-one power advantage over other OLED technologies, resulting in record energy-efficient OLEDs. Advances in OLED lighting, including those demonstrated by Universal Display, now allow OLEDs to meet a variety of niche lighting performance targets and demonstrate the potential for OLEDs to achieve general lighting targets established by the US Department of Energy. It has been estimated that by 2016, OLEDs could generate well over $20 billion in worldwide savings of electricity costs and could save over nine million metric tons of carbon emissions from the US alone. http://www.universaldisplay.com

Universal Display reports white phosphorescent OLED panel performance exceeding US DOE targets

Universal Display Corporation announced advances in the company's white OLED lighting technology and showcased a potential application using white OLED lighting panels. The company's recent achievements further demonstrate the readiness of all-phosphorescent white OLED panels for use in introductory energy-efficient lighting products. The company reported these advances in two papers delivered during the Society of Photo-optical Instrumentation Engineers (SPIE) Optics + Photonics Conference, held at in San Diego, August 21-25. Universal Display presented record-breaking operating lifetimes and other performance advances for the company's white OLED lighting panels in a paper titled "High Performance Phosphorescent White Stacked OLEDs for Solid State Lighting." He reported that the company's 15x15cm^2 warm white PHOLED panel, using a stacked OLED (SOLED) architecture, exceeds the US Department of Energy (DOE) commercial panel target of 10,000 hours (at an initial luminance of 3,000cd/m^2) by more than 20%. Typically, the company reports white OLED lighting panel performance based on a simple RGB OLED design that uses a minimal number of layers. This SOLED design incorporates more layers as a means to significantly extend device lifetime. The single RGB OLED design should require fewer steps to manufacture, while the stacked OLED design can enhance lifetime performance and is gaining momentum in the industry. Using the all-phosphorescent SOLED design, the company's white OLED lighting panel achieves 90,000 hours (to 70% of an initial luminance of 1,000cd/m^2), a luminous efficacy of 55lm/W and a color rendering index CRI of 86. This corresponds to a similar white SOLED pixel that achieves 120,000 hours (to 70% of an initial luminance of 1,000cd/m^2), 63 lm/W, and a CRI of 83.

Universal Display also presented recent advances in a paper titled "Phosphorescent OLEDs for High Efficacy Long Lifetime Solid State Lighting." It showcased an all-phosphorescent, white OLED luminaire designed into an under-cabinet lighting system as an example of an application that white OLED panels are ready to address (*see photograph*). Funded, in part, under a DOE Solid State Lighting program titled "High Efficacy Integrated Under-Cabinet Phosphorescent OLED Lighting Systems," this prototype exhibits key advantages that OLEDs can offer for lighting. The warm white OLED panels emit uniform, dimmable and energy-efficient light, offering a power efficacy of 70lm/W when operated at 190 lumens (~1000cd/m^2), and 61lm/W when at 420 lumens (~2200cd/m^2). The panels operate at a low voltage of ~4V and, by comparison to incandescent and other lighting technologies that generate heat during operation, generate minimal heat. In addition, their very thin form factor and modularity create significant design advantages for this and other lighting applications. http://www.universaldisplay.com

Highly energy efficient white OLED lighting panels are integrated into an under-cabinet lighting system to illuminate a kitchen area, demonstrating the pleasing diffuse light of white OLEDs

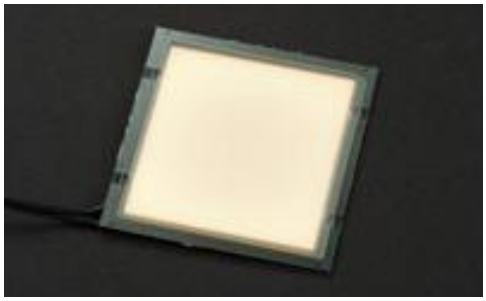
IPC sets up printed electronics standards program

IPC, an association connecting electronics industries, is expanding into printed electronics. To address opportunities and issues in flexible and printed electronics for its members, IPC has set up four standards subcommittees. Dan Gamota will lead IPC's printed electronics initiative. Gamota is a veteran of Motorola and was heavily involved in the company's printed electronics R&D. He has since set up his own business, Printovate Technologies. IPC, the global industry association for printed circuit board and electronics manufacturing service companies, was founded in 1957 as the Institute for Printed Circuits. One subcommittee will examine base materials, substrates that form the base for electronics assembly, including plastics, metals and glass. Another will explore functional materials. Researchers will study a broad range of additive materials such as a range of inks that have conductive, photovoltaic (PV) and dielectric properties.

An objective is to detail the inks and other additive materials that will be used to create printed electronics-based devices and components. The subcommittee will research conductors and insulators. OLEDs and other organic light emitting materials will also be studied by the subcommittee. The two remaining subcommittees will provide design guidelines and final assembly requirements. The final assembly document will focus on the broad scope of requirements for systems that use printed electronics, ranging from throwaway applications to devices that need to be fairly rugged, such as new flexible and e-paper display technologies. http://www.ipc.org

Konica Minolta to begin OLED-lighting panel production

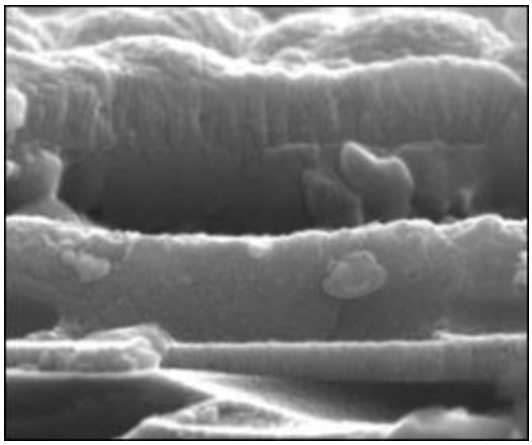
Tokyo-based Konica Minolta Holdings says that this autumn it will start production of OLED lighting panels with reportedly the world's highest-level power efficiency, to which its own developed organic materials and layer structure have contributed. The panels will be produced by Philips Technologie GmbH, based in Germany. OLED lighting is attracting attention as the next-generation lighting having such unprecedented features as thin, light weight, and surface light source. In addition, it features high energy efficiency, relatively low temperature, and reduced environmental footprint since it is mercury-free unlike fluorescent lightings. Furthermore, OLED lighting technology is mild to the eyes since it is free of ultra-violet rays. Konica Minolta considers OLED lighting as one of the most promising environmental and energy conscious new businesses, where it can take full advantage of its own core technologies.



Luminance	1,000 cd/m^2
Luminous efficiency	45 lm/W
Luminous flux	12 lm
Current	71.5 mA
Voltage	3.6 V
Lifetime（LT50）	8,000 hours
Color temperature	2,800 K
Size (Length x Width x Thickness)	74 x 74 x 1.9 mm

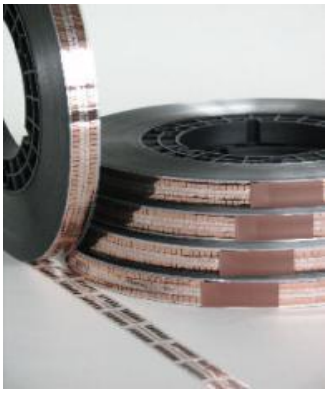
Oregon State University develops inkjet printing for solar devices

The next generation of high-performing, rapidly produced and cheaper thin-film solar devices could come courtesy of the common inkjet printer. Oregon State University has created working CIGS (copper indium gallium selenide) solar devices with inkjet technology. Part of the advantage of this approach is a dramatic 90% reduction in wasted material. Instead of depositing chemical compounds on a substrate with expensive vapor phase deposition – wasting most of the material in the process – inkjet technology could be used to create precise patterning with very low waste. One of the most promising compounds and the focus of the current study is called CIGS chalcopyrite. CIGS has extraordinary solar efficiency: A layer of chalcopyrite one or two microns thick can capture the energy from photons about as efficiently as a 50-micron-thick layer made with silicon. In the new findings, published in the journal Solar Energy Materials and Solar Cells, researchers created an ink that could print chalcopyrite onto substrates with an inkjet approach with a power conversion efficiency of about 5%. The OSU researchers say that with continued research, they should be able to achieve an efficiency of about 12%, which would make a commercially viable solar cell. http://www.oregonstate.edu



This scanning electron microscope cross-sectional image shows the various compounds of a new chalcopyrite solar cell only a few microns thick, which can be created much less expensively with inkjet printing.

Thinfilm develops printed memories for secure documents



Thinfilm, the Scandinavian firm developing a suite of printed memories for applications ranging from toys to disposable price tags, has developed its core technology for secure documents and high-volume consumer applications. The passive array memory is a roll-to-roll printed, non-volatile rewriteable memory with double the capacity of Thinfilm's standard 20-bit-single-line memory, currently being piloted in toys and games. More storage capacity allows information to be encoded, making the technology suitable for securing documents, ticketing and other applications where encryption, or user-programmed stored ID, is desirable. Thinfilm's 40-bit passive array memory devices are in test production with the aim of making samples available later in 2011. Memories with higher densities - up to 121 bits per array - are under development also, with planned production in 2012 (up to 121 bits per memory array). The passive array architecture separates the memory from the read-write electronics, dispensing with the need for active circuitry within the memory array and memory cell. Thinfilm's patented array architecture makes high-density printed memories possible. Storage capacity for passive array memories depends on how finely patterns can be printed. High-volume roll-to-roll printing techniques are evolving to enable compact memories with higher densities. With the Palo Alto Research Center, Thinfilm is prototyping devices that include printed transistors and its addressable memory, where the transistors drive logic for reading and writing data to the memory cells. http://www.thinfilm.se

Fujifilm Dimatix launches new materials printer

Fujifilm Dimatix introduced the DMP-5005, complementing its line of materials printers. The DMP-5005 is a large format, non-contact, fluid deposition system capable of jetting a wide range of fluid types using the Fujifilm Dimatix 16-jet, 1 or 10 picoliter user-fillable cartridges for product and process development and up to five sequentially operating 128-jet, 1 or 10 picoliter printheads with up to five different functional fluids. The new DMP-5005, like the earlier introduced DMP-5000, has a printable area of 500x500mm and maintains a positional accuracy and repeatability of ±5 microns and ±1 micron, respectively. The printer uses a temperature controlled vacuum platen to accurately register, maintain and thermally manage substrates during printing. These substrates include plastic, glass, ceramics, and silicon, as well as flexible substrates ranging from membranes, gels, and thin films to paper products. An integrated drop visualization system captures droplet formation images dynamically as droplet ejection parameters are adjusted to produce a tuned printhead and fluid combination. Also, sophisticated electronics allow each printhead to be calibrated on a per nozzle basis to provide the ultimate in printing accuracy. A second camera system allows precise pattern printing location feature measurement and observations of fluid drying behavior. The new DMP-5005 uses the Dimatix materials cartridge 16-jet printhead for initial development with easy scale-up to multiple production-worthy D-class printheads for more complex applications. The Dimatix materials cartridge is a 16-jet, user-fillable, snap-in replaceable printhead and fluid supply used with all DMP models and is available in 1 picoliter and 10 picoliter drop volumes. The industry-first 1 picoliter cartridge can deposit features as small as 20 microns and below to fabricate products such as organic thin-film transistors (TFTs) and printed circuits. D-class printheads have 128 individually addressable jets and are constructed using silicon MEMS technology similar to the Dimatix materials cartridge, thus enabling direct translation of findings from one printhead to the other. With the industry's only 1 picoliter production piezoelectric printhead, the D-128 DPN printheads are also the only printheads with integrated cooling capability to maintain fluid viscosity for operation over heated substrates. The D-128 DPN 1 picoliter and 10 picoliter printheads share identical physical features for easy interchangeability. Both are further enhanced using driver-per-nozzle capability, which allows the ultimate in printhead tuning between each of the 128-jets. This trimming feature ensures drop volume uniformity, essential for dispensing applications or modifications to drop velocity for increased placement accuracy, critical for patterning applications especially when using very small drop sizes. http://www.dimatix.com

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