FlexTech Alliance
for Displays & Flexible, Printed Electronics

FlexTech Trends

News from the world of displays and flexible, printed electronics

Q3 2012

FlexTech Trends

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Note from the President

by *Michael Ciesinski*

FlexTech Alliance extends a warm welcome to our newest members:

- CaloriQue
- Colnatec LLC
- Jet Propulsion Laboratory
- Liquid X Printed Metals
- Orbotech

We encourage our new and existing members to take full advantage of all the benefits FlexTech Alliance membership offers such as industry research from leading analysts, events designed to encourage networking, marketing opportunities, and a robust technical program.

FlexTech Alliance webinars, workshops and other programs bring together subject matter experts who are developing solutions and enabling technologies.

In this edition is an announcement for our next webinar - focused on encapsulants - plus summaries of FlexTech Alliance's workshops conducted in Q3 2012. From TFTs to inks to metrology, each of these workshops addresses critical issue for flexible electronics and displays.

If you were unable to attend any of these valuable workshops, you can still benefit from the information presented. Workshop proceedings are available for purchase on our knowledge portal. Visit www.flextech.org for information. Members receive discounted pricing.

The annual Flexible Electronics & Displays Conference & Exhibition is just around the corner. Learn how you can participate. Our Call for Papers as well as exhibitor and sponsorship opportunities can be found on pages 13 through 14.

Finally, the latest news from the FlexTech Alliance community appears on pages 16 through 28. 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.

Member Profile: Corning, Inc.

Glass, a Smart Surface of the Future

Most current applications for glass in high technology demand strength, durability, rigidness, and impenetrability. When Steve Jobs was searching for a unique glass for the original iPhone, he approached Corning and eventually Apple selected a product called Corning® Gorilla® Glass because it had all those qualities. But new applications in flexible, printed electronics including sensors, energy harvesting and storage, displays and solid state lighting can benefit from glass that is thinner than a sheet of copy paper, can be wrapped around a structure, and can be printed similar to how newsprint is produced - with the inherent strength of glass, but also flexible.

Corning Display Technologies, a division of Corning Incorporated, recently announced a new product called Corning® Willow™ Glass, which will help enable thin, light and cost-efficient applications including today's slim displays and the smart surfaces of the future. The thinness, strength and flexibility of the glass have the potential to enable displays to be "wrapped" around a device. It will support thinner backplanes and color filters for both Organic Light Emitting Diodes (OLED) and liquid crystal displays (LCD) in high performance, portable devices such as smart phones, tablets, and notebook computers. This new, ultra-slim flexible glass will also help develop larger and/or curved displays for viewing or mounting on non-flat surfaces.

FlexTech Alliance Funding

Last year FlexTech Alliance awarded Corning a grant to develop commercially viable methods for continuous printed electronic manufacturing on flexible glass substrates. The purpose was to demonstrate a working device, in this case an organic photovoltaic (PV), made with roll-to-roll printing technologies. The research project was recently completed in conjunction with Binghamton University's Center for Advanced Microelectronics Manufacturing (CAMM) and Western Michigan University's Center for the Advancement of Printed Electronics (CAPE). After the device was jointly designed, Corning provided the spooled flexible glass required for the project. CAMM and Corning provided the deposition and patterning of the device after which Corning cut the flexible glass substrates into 75mm x 300mm substrates compatible with CAPE's gravure printing equipment. Solar simulator testing was performed and confirmed by Western Michigan University.

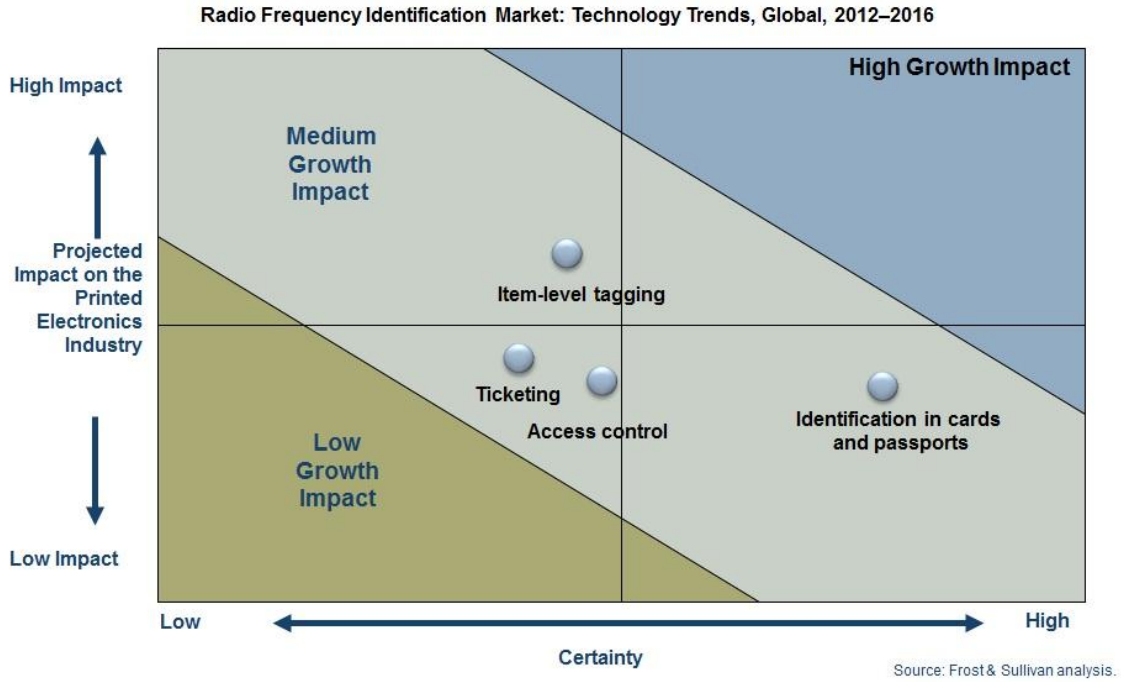
The possibility of manufacturing with a low-cost and high-throughput process on flexible substrates opens up a wide expanse of new applications that were not practical with traditional electronics. Displays based on organic light-emitting diodes (OLEDs) are already on the market, and while they aren't yet flexible, they demonstrate the viability of organic semiconductors in commercial applications. Merrill Lynch recently estimated the market for OLEDs will grow from US$4 billion in 2011 to $20B in 2015 and as high as $35 billion in 2017. Samsung alone is expected to spend $5 billion a year on OLED capital expenditures annually for the next several years. As the OLED display market develops, many of the new manufacturing solutions, technologies and materials that emerge may be applied to other flexible and organic electronic applications including OLED lighting, thin-film logic and memory, thin-film batteries, and organic PV.

With its new Willow Glass, Corning delivers the mechanical reliability of glass with a twist - flexible glass with all its benefits: high optical transmission, pristine surface quality, and dimensional and thermal stability. Ready to usher in the future of flexible, printable electronics.

Printed RFID—The Future of RFID Technology

By Nupur Sinha, Frost & Sullivan Electronics Practice Research Analyst

Radio frequency identification (RFID) tags made using printed electronics have been considered to be distant from commercialization, but they are moving close toward mass production. The market for them has witnessed a CAGR of 16.1 percent from 2007 to 2015. The rate at which the printed RFID is growing suggests that the printed electronics market is in its growing stages. Printed electronics is a nascent technology that enables manufacturing of electronic components and devices by using standard printing processes. The unique characteristic of this technology is its ability to manufacture a large number of devices or components at a low cost. RFID tags with printed electronics are available at a lower price, as standard printing processes are used to produce the integrated circuits (ICs) that are used for these tags. The conventional silicon chips are expensive and complicated due to the difficult silicon fabrication process.



The stupendous growth in the RFID market is driven by increased demand from various end-user industries. The global RFID market looks promising due to the demand from government projects in military, passport, identity card, and other mandated requirements such as animal tagging. The most significant opportunity for the RFID market lies in item-level tagging, which requires low-cost and high-volume production. This sets the perfect stage for printed RFID tags that are produced at lower costs, as silicon chips are not involved. However, it will take another 5-7 years for the market to evolve completely, as consistent performance remains a pertinent issue. Noteworthy mentions of participants that are currently transitioning their products from prototype phase to commercialization are Kovio and PolyIC.

Printed RFID will not only ensure low-cost production, but also broaden the application of RFID. The future areas of application could be electronic brand protection and electronic tickets among others. However, it leaves no doubt that the target sectors for printed RFID will comprise price-sensitive mass markets.

The reason behind the anticipated growth of printed RFID is its flexibility, which helps it integrate into products or packages. For instance, thin and flexible RFID tags can be applied to flexible package materials by laminating or direct application. In a further step, printed electronics can be directly integrated in the product, which can be later communicated with, through RFID and with the help of respective reader.

Printed RFID can also help in inventory management, especially when used in conjunction with innovative software that manages read/write devices, collects and compresses RFID data, and makes it available to the merchandise information system to record entire goods flow. Plastics are already prevalent in the electronics industry, particularly in the field of dielectric materials, and the probable application of conducting and semiconducting polymers in soluble form or as liquid precursors makes them attractive for high-volume applications such as electronic identification.

Over the last few years, several start-ups in the printed electronics industry have been focusing on printing RFID antennae using conductive inks. One of the motivations behind this is to reduce hazardous waste generated by the usage of acid in etching away material to improve conductivity in the process of creation of an RFID tag. Another key factor is that printed antennae make it easier to attach the antenna to the RFID microchip, which involves a two-step process today—the antenna has to be created and then the RFID microchip has to be placed in a precise position to ensure that the two metal pads on the chip couple with the metal antenna electromagnetically. With conventional inkjet printing, the chip can be placed on the carton or plastic film first, and the printer can print the antenna right over the metal pads, creating a direct physical bond.

Overall, with transparent polymer transistor circuits being developed by companies such as Philips, PolyIC, OrganicID, and Motorola, chipless technology is fast becoming a reality in addressing mainstream RFID applications with price reductions in the order of 1-2 magnitudes. The end goal for RFID is to be printed on almost every item in the same manner as barcodes.

Thus, cost is the key factor that drives the demand for printed RFID tags. With the rate at which R&D is being carried out, printed RFID tags are all set to reach the commercialization stage, at least for some applications.
This article originally appeared on frost.com (http://www.frost.com/sublib/display-market-insight-top.do?id=248767435) on December 2011. For more information, please contact Jeannette Garcia, Frost & Sullivan Corporate Communications Associate- North America at Jeannette.Garcia@frost.com or 210.477.8427.

Product Designers are Key to Next Phase of Flexible Electronics Say Panel of Experts at FlexTech Alliance Workshop On Metal Oxide Thin Film Transistors

It was standing room only at the one-day workshop “Metal Oxide TFT Devices and Technology” organized by the FlexTech Alliance on July 11, 2012, in partnership with SEMI. The workshop focused on the progress of producing thin film transistors as an enabling technology for the flexible electronics industry.

Subject matter experts from different sectors, including manufacturing equipment and materials giants Applied Materials and Eastman Kodak; display companies like Sharp Labs and CBRITE; development groups from PARC and Cambridge NanoTech; and, research university contingents from Oregon State, Arizona State and Penn State, reported developments in TFT materials, fabrication and processing techniques, device applications and manufacturability.

“A paradigm shift in products and manufacturing is approaching,” said Dr. Malcolm J. Thompson, Chief Technical Advisor for FlexTech Alliance. “Products will be fabricated on $100,000 worth of printing equipment as opposed to $1 billion or more in traditional semiconductor fabrication equipment. The new flexible display and electronics industry we are creating will provide low cost fabrication and fast deployment of new products.”

View Malcolm Thompson’s video interview (http://youtu.be/5kRg7QGCkXc) .

The workshop included a lively panel discussion about market drivers for the industry. Panelists agreed that while the underlying technology is in an advanced development stage, a killer application in health care or consumer products will require more than good engineering. Product designers are key to the growth of the flexible electronics industry.

David Barnes, principal at BizWitz and a workshop panelist, noted that we are going back to the future by revisiting some of the compound materials considered decades ago for new applications such as large scale sensing devices and superior HD TV.

View David Barnes’ video interview (http://youtu.be/QJV4urqHw5) .

While the exact product or application that will ignite the industry is yet to be determined – anything from low power disposable diagnostics that manage pandemics to large-scale, portable roll-up displays that can be carried from home to home – developers have been focused on enabling technologies. Advancements presented at this workshop prove that solutions will be ready when product designers dream of the next killer application.

Moving to manufacturing is critical. For large-scale manufacturing, a consensus at the workshop agreed that a significant challenge was to develop a TFT process flow that does not require rigorous alignment among patterns in different layers. Also, the group noted that the fabrication of devices with lightweight and flexible substrates requires processing at low temperatures, often resulting in a performance trade off.

Following are highlights of the technical presentations.

- Dr. Tolis Voutsas of Sharp Labs of America began the presentations with a materials discussion and focused on display applications of amorphous oxide semiconductors (AOS) and their importance to thin film devices like TFTs. He highlighted the fundamental materials and device properties behind the success of AOS, reviewed the large-volume manufacturers that have commercialized AOS-based devices and speculated on future applications such as medical and 3D displays and digital outdoor signage.

- CBRITE, Inc. has come up with a proprietary self-aligned process which enables large size display back panels to be made in an R2R process with a flexible substrate. The company says it has developed high performance metal-oxide TFTs with mobility and stability as good as LTPS TFT and with off-current, uniformity and process simplicity as good as a-Si TFT. The self-aligned technique can be deployed in free standing or roll to roll processing to minimize the impact of substrate deformation.

- Dr. Neil Morrison, Manager of Applied Materials R&D R2R, commented that significant advances have been made in device patterning enabling the mass production of a variety of flexible electronic devices. He displayed feature sizes of less than 40nm produced on thin film layer stacks deposited on 50 micron thick polymeric substrates. He also acknowledged the important challenges in terms of deposition technologies used in roll-to-roll (R2R) manufacturing of these devices. Dr. Morrison reviewed the other principal challenges to R2R TFT device manufacturing including: choice of substrate, thermal budget, layer stack stress, patterning, defects and yield.

- Eastman Kodak's approach to the patterning and alignment of thin-film transistors on flexible substrates is a vertical transistor architecture, reported at the workshop by Dr. Shelby F. Nelson. The design has both high alignment tolerance and sub-micron channel lengths and it is compatible with flexible supports. Showing comparable materials properties to planar zinc oxide transistors, these devices demonstrate remarkable current-carrying properties, along with steep sub-threshold slope, and good yield.

- Cambridge NanoTech Inc. discussed its development of a high-speed Atomic Layer Deposition (ALD) system targeted to operate at the high volumes necessary for commercial roll-to-roll practices. By means of a unique high-speed precursor delivery and extraction mechanism, the system is able to deposit a range of materials from single component oxides for dielectric and conductive layers to more complicated binary and ternary semiconductors.

- Dr. Douglas A. Kezler from the Center for Sustainable Materials Chemistry at Oregon State University presented unique materials and processes for enabling high-performance operation of thin-film oxide transistors. Particular consideration was given to the deposition of insulators and passivation layers at modest temperatures by using water-based precursor chemistries.

- Dr. Bob Street from Palo Alto Research Center (PARC) reviewed device successes in specific applications. PARC recently came out with a prototype flat panel flexible x-ray image sensor based on oxide TFTs. Dr. Street cited that oxide TFTs have a faster response than a-Si for fluoroscopy and have the high mobility needed for pixel amplifiers, with lower manufacturing cost than LTPS.

- Dr. Thomas Jackson of Pennsylvania State University talked about some of the issues related to the widespread application of active thin film devices to real world applications, like a recent temperature sensor for implantable medical use PSU has developed. He discussed zinc oxide TFT technology to illustrate some of the challenges and potential solutions for active thin film electronics.

- Dr. David Allee of the Flexible Display Center at Arizona State University asserted that near term, viable applications for metal oxide TFTs include large area sensing arrays for radioactive particles, acoustic and ultra-sound waves, x-rays and other photons. Electronic textiles may also be achievable implementing wearable sensing arrays.

Workshop Proceedings

Unable to attend one of our informative workshops?

You can still benefit from the rich content by purchasing the proceedings.

Choose from Metrology, Ink/Substrate Interactions, Metal Oxide TFTs, Wearable Electronics or Transparent Conductors.

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FlexTech Alliance Workshop on Ink/Substrate Interactions Addresses Unique Challenges of Printing Electronics for Wide Spectrum of Materials and Devices

FlexTech Alliance hosted a workshop focused on ink and substrate interactions on August 1-2, 2012 at Western Michigan University's Center for the Advancement of Printed Electronics. The workshop examined the unique challenges of printing electronics on paper, plastic, glass, textiles, foil and other substrates. Perspectives from material suppliers, equipment manufacturers, and university research labs were presented.

"One of the most critical issues facing printed electronics is the interaction of ink and flexible substrates," stated Dr. Malcolm J. Thompson, Chief Technical Advisor to FlexTech Alliance. "Understanding these interactions is key to resolving performance challenges and providing the low-cost, conformable products made possible with printed electronics.

Dr. Margaret Joyce from Western Michigan's Center for the Advancement of Printed Electronics (CAPE) launched the morning's session with a discussion of coated paper technologies for printed electronic applications. Technical reviews followed from Corning and DuPont Teijin Films about manufacturing on glass and plastic substrates respectively.

The presentations gave detailed accounts of fabrication process advancements, case studies of devices designed and fabricated for specific application needs, and new applications and processes under development to take advantage of the unique properties of paper, glass and plastic. Several process challenges were examined including surface smoothness, solvent resistance and commercial availability of the substrate materials.

Experts from the University of Texas at Dallas and Arizona State University discussed the challenges of printing electronics on textiles with flexible CMOS, CBD CdS, and TFT processes. That was followed by a presentation by Dr. Nackbong Choi, Lehigh University, on flexible, printable electronics on metal foil substrates with offset roll printing technology. Several advantages were reviewed, including low CTE, high process temperature, strong resistance to chemicals, impermeability, and heat sink.

The afternoon session reported on current manufacturing capabilities and trends. Kevin Manes of Mark Andy began with a practical, hands-on discussion of current roll-to-roll printing equipment and the intricacies of the process tools. Next, Tim Luong of FUJIFILM Dimatix examined in detail inkjet print head deposition technology. Bob Praino of Chasm Technologies delivered a tutorial on the printing and coating ecosystem with a special emphasis on the rheology and drying of the inks and their importance on the overall success of the process.

The workshop concluded with presentations focused on printing devices: Dania Alsaid of CAPE (capacitors), UC Berkeley (high performance printed transistors), PARC (printed field-effect transistors) and HP (paper-based devices, sensors and MEMS). Workshop participants agreed that to ensure progress continues the industry should leverage design flows of conventional printing, incorporate multi-layer processes, deliver high quality patterns and uniformity, and evolve EDA tools.

FlexTech Alliance Hosts Printed Electronics Metrology Status and Needs Workshop at NIST

Industry Gathering Produces Approaches to Advance Manufacturing Strategies

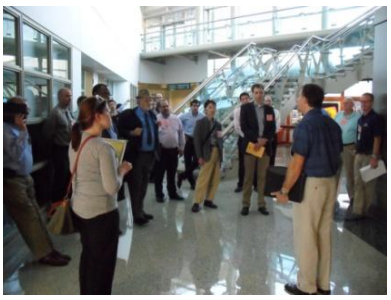
FlexTech Alliance hosted a metrology workshop on September 12-13, 2013 at the National Institute of Standards and Technology (NIST) in Gaithersburg, MD. The purpose of the workshop was to examine current requirements and identify future needs for flexible, printed electronics (FPE) manufacturing. Insights from both the integrated circuit (IC) and flat panel display (FPD) industries were presented.

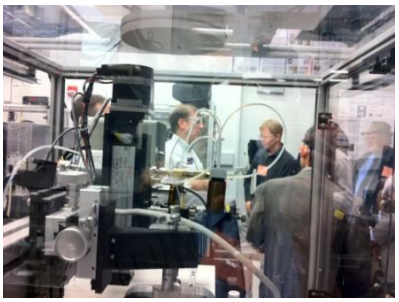
Chris Soles of NIST opened the workshop with an agency overview, noting multiple industry partnerships and that NIST wants to engage with the FPE industry on manufacturing metrology issues. He was followed by Marc Carter of IPC – Association Connecting Electronic Industries, who provided a history of FPE, stating that the technology was developed 70 years ago to address fuzing issues related to WWII munitions. Carter explained that IPC is part of a worldwide standards organization which is presently balloting 4 key topics including guidelines for printed electronics, base materials, functional materials, and assemblies.

Corning, Orbotech and Imprint Energy reviewed the challenges of obtaining measurements on a flexible substrate, such as plastic or flexible glass. These specifically relate to the differences in material characteristics including mechanical reliability, thermal effects such as expansion and contraction, and processing on a fast moving web as opposed to plate to plate or wafer to wafer. Other challenges being addressed include taking measurements on small, high-resolution displays, and reflective and often optically transparent material. These challenges require that new measurement methods be developed. According to Daniel Toet of Orbotech, position accuracy will be key if film measurements in FPE are to achieve the precision of those current being obtained in FPD manufacturing.

Speakers from Northfield Automation, JA Woollam, NVision, and DarkField Technologies related various, current methods to perform FPE metrology functions and the pros and cons of each. Essentially, these methods can include but are not limited to multiple forms of automated optical inspection (AOI), spectroscopic ellipsometry, conventional and dynamic interferometry, and solid state laser reflection. Jay Provine of Stanford University, who is working in the field of atomic layer deposition (ALD), reviewed several types of measuring techniques for thin films. He concluded that these methods offer insight in different ways and, taken together, provide a more complete measurement picture. However, the time and cost of multiple techniques have to be considered.

Malcolm Thompson, Chief Technical Advisor to FlexTech Alliance, summed up the workshop by stating “Metrology is at the core of yield management and the development of new manufacturing processes. There is much the FPE industry can learn from the IC and FPD manufacturing industries with respect to developing and implementing effective metrology strategies. The door is open to innovative tool and process developers seeking a growing market opportunity.”





Webinar Announcement

Join FlexTech Alliance and NanoMarkets for: "Encapsulants" Tuesday, November 13, 2012 8:00 AM PST / 11:00 AM EST

Important innovations based on new materials -- OLEDs, organic PV (OPV), dye sensitive cells (DSC) and CIGS -- promise both higher performance and higher efficiency in solar panels, lighting and displays. Unfortunately, all of these newer technologies are extraordinarily sensitive to water vapor and oxygen and without sufficient encapsulation, the lifetimes of the products in which they are used are reduced considerably. This can be a major problem for product developers such as those who are trying to build displays with extended lifetimes (such as those for TVs) and especially those that a focusing on solar roof panels that match the expected lifetimes of the roofs themselves, which can often be several decades.

This has created a major opportunity for manufacturers of effective and proprietary encapsulation schemes. And this opportunity has been extended and enhanced because of arrival of flexible substrates for both solar panels and displays; the encapsulation of flexible devices being especially challenging. At the same time, major new innovations in encapsulation are appearing -- new materials such as flexible glass, new encapsulation systems using multi-layer encapsulation, and new processes such as atomic layer deposition.

In this Webinar, we identify and quantify the market opportunities that are emerging from all these changes. Firms in the encapsulation space will learn how new business revenues will be generated by both large materials firms and startups with the new barrier materials and fabrication processes mentioned above. Manufacturers of displays and solar panels will gain an understanding of how the new encapsulation technologies can be leveraged by them to create new and innovative new products. The Webinar will also be of interest to investors and consultants with a stake in the development of the display, solar panel and packaging industries.

Lawrence Gasman is the Principal Analyst at NanoMarkets and one of its co-founders. Mr. Gasman has more than 30 years' experience of analyzing the commercialization potential of complex technologies and currently manages all of NanoMarkets' industry research. He also contributes his own analysis to NanoMarkets' core OLED lighting and BIPV programs.

Visit www.flextech.org for registration information.

2013FLEX

January 29 – February 1, 2013
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Phoenix, Arizona

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Attracting registrants from more than 200 companies, universities, R&D labs, and government agencies, the conference will address global technical and business issues, and advancements impacting the flexible electronics and displays value and supply chains.

Join this field of international experts from industry, academia and R&D. Submit your abstract on the latest technical and product advances in flexible, printed, electronics and displays.

The conference features the very latest research and developments in Flexible Electronics Applications, systems, devices, manufacturing, fabrication processes equipment and materials.

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To submit your conference paper for consideration,
go to http://flextech.org/fe-conference-paper-submit.aspx.
Complete the form with your contact information and abstract.
The abstract submission should be between 100 and 200 words.

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Be recognized as a leader in this exciting and disruptive field of electronics. Selected presenters will receive acknowledgement in the 2013FLEX program guide, on the conference website and in the conference proceedings. Speakers also receive a significantly discounted conference registration fee and are eligible for discounts on exhibition and sponsorship pricing.

IMPORTANT DATES

Submission of Abstract
October 5, 2012

Notification of Abstract Acceptance
October 22, 2012

Speaker Commitment to Present
October 29, 2012

Final Presentation Submission
January 4, 2013

Conference Website: www.flexconference.org
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excerpted from Veritas et Visus newsletters

IDTechEx reviews OPV market and technologies

The organic photovoltaics (OPV) market is showing signs of steady growth and is forecast to reach $630 million by 2022. OPVs bring lots of attributes to the market like excellent form factor, good performance under indoor lighting conditions, low capital expenditure, potentially very low energy production costs using printable plastics, IDTechEx says in its latest study "Organic Photovoltaics: Technologies, Markets & Players 2012-2022". However, not all is well with OPVs. The efficiency levels are low, despite the fact that the active semiconductor can be synthesized from many different molecular and polymeric materials. The constituent materials are still in low-volume production and therefore command high prices. The new market research study provides a detailed assessment of the technology and markets for OPVs, which are being used where conventional PV cannot go, changing the value-added opportunity. The report develops technology roadmaps or guidelines, which forecast improvements in module efficiency, lifetime and costs over the next decade. They provide a practical insight into how the technology is likely to evolve. It also assesses the merits of OPV technologies for a diverse range of market segments, including automotive, posters and point-of-purchase (PoP) advertisement, apparel, customer electronics, off-grid applications for the developing world, power generation, and building integrated photovoltaics. http://marketpublishers.com

FlexTech Alliance funded project with Polyera produces printable, high-performance electronic devices

FlexTech Alliance announced the successful completion of a project with Polyera Corporation to develop printable n-type organic semiconductors. The project was chosen to receive FlexTech Alliance funding of $0.3M with the goal of developing materials that can be printed on flexible, lightweight substrates, enabling the manufacture of electronics with novel form factors such as roll-up displays and flexible solar panels. "The outcome of this FlexTech Alliance funded project will have significant impact on the printed electronics industry," said Michael Ciesinski, CEO of FlexTech Alliance. "Applications like radio frequency identification tags (RFID), disposable diagnostic devices, rollable and low-cost solar cells, and flexible displays represent a multi-billion-dollar market for printed electronics in the future. This project has enabled Polyera to develop viable materials to help build this market." CMOS processes have long been the standard for traditional semiconductor manufacturing. Historically, CMOS, which utilizes both n-type and p-type materials, has not been possible with printed and flexible electronics, because only p-type organic semiconductors have shown the requisite level of performance on flexible substrates. With the advent of Polyera's high-mobility n-type organic semiconductors, printable CMOS circuits are now possible for the first time, leading to simpler circuit design and lower device power consumption. Additionally, organic materials have several advantages over inorganic materials. These new organic materials function similarly to traditional inorganic materials but with a major difference: they can be dissolved into solution. Because the materials are like ink, electronics devices can be printed using ink-jet, rotogravure, and other roll-to-roll printing processes, significantly reducing fabrication costs. http://www.flextech.org

Universal Display unveils OLED lighting prototype to demonstrate single-layer barrier technology

Universal Display Corporation unveiled a new OLED prototype using its proprietary UniversalBarrier technology. The company's UniversalBarrier single-layer barrier film technology, which has demonstrated excellent barrier performance and potential cost-effectiveness, has recently been shown to enable product designs not requiring an encapsulation bezel. This feature increases the potential active panel area and enhances the ability to tile panels together, offering significant benefits for rigid and flexible display and lighting product designs. OLED display and lighting devices require protection from environmental factors, like oxygen and moisture. Officially introduced in 2011, Universal Display's novel single-layer barrier technology forms a permeation barrier with hybrid organic-inorganic properties and enables cost-effective packaging of thin-film devices and plastic substrate systems. The technology could also be a key factor in enabling novel manufacturing techniques, including roll-to-roll printing of electronics. http://www.universaldisplay.com

Universal Display introduces new PHOLED emissive layer material systems

Universal Display Corporation introduced new red, green, and yellow UniversalPHOLED products. The new offerings include novel emission layer material systems with enhanced performance to provide OLEDs with additional advantages for smart phones, TVs, and solid-state lighting. 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. The new red UniversalPHOLED system, with CIE color coordinates of (0.66, 0.34), offers a luminous efficiency of 29cd/A with an operating lifetime of 600,000 hours (to 50% of initial luminance). The new green UniversalPHOLED system with CIE coordinates of (0.31, 0.63) offers 85cd/A and an operating lifetime of 400,000 hours. The yellow system with CIE coordinates of (0.44, 0.54) offers 81cd/A and 1,450,000 hours of operating lifetime. Since 2003, the company has offered UniversalPHOLED emitters for commercial applications, and today offers a line of red, green, yellow, and light blue emitters for use in OLED display and lighting products. Recently, the company introduced high-performance host materials to its product line. The company's proprietary hosts can be used alone or, as recently developed, in combination with complementary hosts from its material company partners. Designed to optimize the performance of the company's UniversalPHOLED emitter products, these host systems have also been developed to provide cost-effectiveness in display and lighting applications. http://www.universaldisplay.com

Universal Display and Plextronics announce alliance to develop next-generation OLED material systems

Universal Display Corporation and Plextronics announced they have entered into a strategic alliance to accelerate the development and commercialization of solution-based OLED material systems incorporating Plextronics' hole injection and hole transport materials with Universal Display's phosphorescent OLED emissive layer materials. The companies entered into a three-year joint development agreement, and Universal Display made a $4 million investment in Plextronics. This agreement is seen as an important step in Plextronics' efforts to further advance the development and commercialization of its Plexcore materials for phosphorescent OLED applications. Plextronics worked closely with Universal Display to develop initial Plexcore HIL products for Universal Display's Universal P2OLED platform. The results of these efforts were compelling to the point it made sense to expand the relationship to include hole transport layer materials in order to achieve the next level of performance. By combining Universal P2OLED printable, phosphorescent OLED material systems with Plextronics' hole injection and transport materials, the goal is to develop high-performance, solution-based OLED material systems that can enable the implementation of ink-jet, nozzle and other potentially cost-effective, solution-processing manufacturing techniques. http://www.universaldisplay.com http://www.plextronics.com

UDC and L-3 Display Systems deliver ruggedized AMOLED prototype to US Air Force

Universal Display Corporation and L-3 Display Systems announced the delivery of a novel AMOLED display system prototype to the U.S. Air Force for use on a pilot's knee in tactical cockpits. The knee-mounted display system, designed with touch functionality by L-3 DS, contains an unbreakable, full-color, phosphorescent OLED display built on a plastic substrate. This ejection-safe electronic flight bag system is designed to replace the paper maps and checklists traditionally held on the pilot's knee, through the use of flexible OLED technology, which can mitigate the hazards of traditional glass-based displays. Designed and built under an Air Force Research Laboratory Small Business Innovation Research (SBIR) Phase II program titled "Low-Power, Direct-View Flexible Displays," the prototypes are rated at Technology Readiness Level (TRL) 5 and use a 4.3-inch diagonal, 480 x 320 pixel, active-matrix OLED display. The AMOLED displays were built using Universal Display's high-efficiency UniversalPHOLED phosphorescent OLED materials and technology on a plastic substrate system. The displays were assembled into a ruggedized package with touch functionality provided by L-3 DS. The delivered systems will be evaluated by the U.S. Air Force. **http://www.universaldisplay.com** **http://www.L-3com.com**

Novaled develops new air-stable n-dopant and ETL materials for OLED TV and mobile displays

Novaled announced a new class of n-doped electron transport layer (ETL) materials for OLED TV and OLED mobile displays. By pairing either of its two new air-stable dopants with either of its two new host molecules, Novaled can achieve the optimum combination of efficiency, voltage and lifetime for a specific display application. This innovative approach results in materials that are air-stable and can double the lifetime of the display compared to the previous OLED stack. The new materials are the next step toward achieving an optimum balance between long lifetime and high power efficiency for display applications using OLEDs. Novaled's new generation of materials includes NET-164 and NET-142 hosts, and NDN-77 and NDN-87 ETL dopants. Using various combinations of these dopants and hosts, Novaled can optimize OLED performance for lifetime or efficiency, depending on application requirements.

Thus the new generation material addresses two previous OLED weaknesses: low driving voltage causing lower lifetime due to higher charge carrier density in the emission zone; air-sensitive n-side dopant materials requiring more complicated loading in mass production tools. To achieve maximum efficiency in white PIN OLED devices, Novaled uses evaporation processable outcoupling layers – thin NET-61 layers in n-doped ETLs. The use of crystallizing outcoupling enhancement layers leads to corrugation of the reflective cathode, reducing the plasmon absorption losses. Novaled has deepened its expertise on effective outcoupling and showed data about a three-unit white stacked PIN OLED using NET-61. http://www.novaled.com

Henkel Corporation's clear adhesive increases durability and extends product life

As touch panel interfaces become the norm on mobile devices, laptops and tablets, Loctite liquid optically clear adhesives (LOCA) from Henkel Corporation are improving the viewing experience, increasing display durability, extending product life, reducing power consumption and enabling thinner device designs. New dual cure technologies allow full cure in shadowed areas, and offer vastly reduced shrinkage to control display distortion and eliminate Mura. When used on AR glass, Loctite LOCA products increase the contrast ratio in sunlight by 400% and minimize the refractive index mismatch to glass and PMMA, minimizing light loss due to reflection.

Reduced light loss means the user enjoys a superior viewing experience and the device consumes far less power, which extends battery life. Loctite LOCA products increase display robustness significantly; for example, LOCAs can increase ball-drop impact resistance as much as 300% for gaps up to 1mm. And displays withstand higher heat and humidity, and resist temperature cycling. As they absorb impact load and protect gap-free display surfaces, these adhesives allow the production of thinner panels.

The seven products in the Loctite LOCA line include two dual cure adhesives designed to cure in shadowed area where light cannot reach. Loctite 5192 is a high-temperature-resistant, non-yellowing UV/moisture cure silicone that shrinks very little and contributes minimal stress to the surface of the LCD, reducing Mura defects. Loctite 3192 is a general-purpose UV/heat cure acrylic with a refractive index that delivers excellent brightness, clarity and color. Ideal for high volume production, this product heat cures in just one minute at 80ºC. Designed for both TP1 (touch panel to cover lens) and TP2 (cover lens to LCD) bonding, Loctite 3196 is a general-purpose, impact-absorbent UV acrylic that protects the display surface from damage.

This unique adhesive can also replace the air gap designed into TP2 applications. UV cure Loctite 3193 delivers high adhesion to plastic, while Loctite 3195 is a general-purpose adhesive for TP1 glass-to-glass bonding. Loctite 3195DM is a high viscosity dam material compatible with most UV acrylic LOCAs. Loctite 5192DM is a high viscosity silicone dam material designed for use with Loctite 5192 UV/moisture cure silicone. Loctite LOCAs provide better adhesion and reliability than optically clear double-sided tapes, are more suitable to large panel assembly, and are much better for gap filling. Compatible with many display and touch panel sizes, LOCAs eliminate the need to inventory die-cut OCAs in varying sizes. LOCA products can be applied and cured using automated processing equipment with little surface preparation. Repair and rework is done during pre-curing phases of the assembly process. http://www.henkelna.com/loca

ASU develops large flexible OLED display with mixed-oxide TFTs

The Flexible Display Center (FDC) at Arizona State University announced that it has successfully manufactured the world's largest flexible, color OLED prototype using advanced mixed-oxide thin film transistors (TFTs). Measuring 7.4 diagonal inches, the device was developed at the FDC in conjunction with Army Research Labs scientists. It also meets a critical target set by the US Department of Defense to advance the development of full-color, full-motion, video flexible-OLED displays for use in thin, lightweight, bendable and highly rugged devices. Mixed-oxide TFTs offer a highly cost-effective approach for manufacturing displays that deliver high performance, including vibrant colors, high switching speeds for video and reduced power consumption. Furthermore, mixed-oxide TFTs can be manufactured on existing a-Si production lines, eliminating the need for specialized equipment and processing, thereby reducing costs compared to competitive approaches. http://flexdisplay.asu.edu

NanoMarkets introduces new report on OLED materials opportunities

OLEDs have broken through in the past 18 months, and there are now clear signs that OLEDs will finally live up to their long-promised potential. In this new environment, the requirements for OLED materials will also continue to grow, and the next few years will present plenty of opportunities for OLED materials suppliers to break out of their niche, specialty status, says a new report from NanoMarkets. OLED displays are now part of the mainstream, with Samsung's Galaxy smart-phone products, the shipments of which exceeded iPhones in the first quarter of 2012, leading the way. OLED TVs from both LG and Samsung are entering the market this summer and fall, and other manufacturers are likely to follow in the near term. Finally, OLED-based lighting is also already on the market, and although these products consist almost entirely of low volume luxury lighting at the present time, the industry is striving toward larger panels for general and architectural illumination markets that may just be the next big things in the lighting market. All of these trends mean that the addressable market for OLED materials is rapidly growing and will continue to do so. Not only is the number of modules growing, but the average sizes are getting steadily larger. This growth and shift in the relative importance of different applications means that materials suppliers to the OLED industry will have expanded opportunities to generate revenues selling their materials - from substrates and transparent conductors to organic semiconductors, emissive materials, and encapsulation technologies.

This report is the latest update from NanoMarkets on the OLED materials markets. In it, they quantify the opportunities that are emerging from the booming OLED display industry and in the nascent OLED lighting market, where the key determinants of success will be device efficiency, lifetime, and reduction in total cost of ownership. They also analyze the strategies of some of the major players in this space, ranging from giant chemical firms such as BASF, DuPont and Sumitomo to important specialty firms such as UDC, Novaled, and Plextronics. They consider commercial implications of technology developments and predict what they will mean to the industry overall. For example, they check in on what is going on in the development of longer lifetime blue emitters badly needed by the display sector, and the on the availability of quality white emission schemes that have shown great promise for use in OLED lighting applications. Finally, the report contains detailed volume and revenue forecasts for materials used for OLEDs broken out by material type and functionality, as well as by application and by deposition method wherever possible. http://www.nanomarkets.net

FlexTech Alliance announces 2013 flexible electronics and displays conference

FlexTech Alliance announced that its 2013 Flexible Electronics & Displays Conference & Exhibition is scheduled for January 29 – February 1, 2013. The conference, now in its 12th year, is moving to the Phoenix, Arizona Convention Center to accommodate its continuous growth. The new venue will provide technologically advanced amenities in a vibrant downtown location, while maintaining the networking atmosphere that has long characterized the conference. With the expanded exhibit space, attendees will be able to engage with more suppliers, customers and partners in flexible, printed electronics R&D, design and manufacturing. The 2013 conference will feature over 100 business and technical presentations on topics such as wearable electronics, flexible displays, OLED displays and lighting, and smart sensors, plus product exhibitions, short courses, academic research and valuable networking events. http://www.flextech.org

Corning unveils ultra-thin and flexible Willow Glass

Corning announced details of a major new glass design at the eighth annual Display Week in Boston, a trade event hosted by the Society for Information Display. Named Willow Glass, Corning's new glass is manufactured in such a way that allows it to reach temperatures of up to 500°C (932ºF) while maintaining a thickness of just 100 microns – or about that of a sheet of paper. Willow Glass will support thinner backplanes and color filters for both OLED and LCD displays, making it suitable for smartphones, tablets and notebook computers, in addition to more exotic implementations for gadgets which require a curved display - perhaps opening the way for a more lightweight and wraparound version of Google's Project Glass. Though Willow Glass is not the only flexible display product available to manufacturers, Corning's reputation coupled with an efficient production process seems to hand the company an advantage over the current competition. Further insight into the manufacturing process can be gained from the short video below: http://www.corning.com/news_center/news_releases/2012/2012060401.aspx

Willow Glass is said to be the thinnest and most flexible glass Corning has ever produced

Thinfilm files patent for printable protection for memory devices

Thin Film Electronics ASA announced that it has developed and is patenting a low-cost printable protection for ferroelectric memory products. The protection safeguards nanoscale structures from mechanical stress, including shear forces, ensuring printed memory products meet customer requirements for durability while being highly cost efficient. The low-cost printable protection is currently used in two Thinfilm "Memory" products: The 20-bit single-line Thinfilm Memory for consumer applications such as toys, games and info-kiosks, and the bit-scalable Thinfilm Passive Array Memory, were delivered as engineering samples earlier this year. Thinfilm's novel printed protection layer is also expected to be applicable to other sub-micron-thickness functional components. Printable protection differs significantly from the conventional approach of protecting printed devices, which seals them using foil or a protective sheet. In the new Thinfilm approach, stress and scratch-resistant films are printed on top of the memory during the manufacturing process making the patent-pending technique particularly suitable for high-volume production. The patent application for the low-cost printable protection has been submitted to the Swedish Patent and Registration Office, as well as to the World Intellectual Property Organization under the terms of the international Patent Cooperation Treaty. http://www.thinfilm.no

NanoMarkets releases OLED lighting market report

Industry analyst firm NanoMarkets announced the release of its latest report on OLED lighting titled "OLED Lighting: Companies, Products and Strategies – 2012". This report shows that OLED lighting industry has come a long way in the last two years; OLED luminaires are available at affordable prices and a surprisingly large number of major electronics and lighting companies have developed plans to take OLED lighting into the mainstream general lighting market. Performance criteria for OLED lighting are close to acceptable for many real world applications. NanoMarkets continues to project the OLED luminaire market as $6.4 billion by 2017. This report analyzes in depth the product/market strategies of leaders of the OLED space including: Acuity Brands, AUO/Lextar, Blackbody, First-o-Lite, GE, Kaneka, Konica Minolta, LG, Lumiotec, Mitsubishi, Moser Baer, NEC, Novaled, Osram, Panasonic, Philips, Pioneer, Samsung, Sumitomo, Visionox and WAC Lighting. The report also provides insight into the strategies of smaller and emerging companies in this space.

One of the main selling features claimed for OLED lighting is energy efficiency. Two years ago, OLED lighting wasn't very efficient, offering around 20lm/W. Today, it is much closer to CFLs and LEDs as OLED lighting panels now routinely reach 45lm/W to 65lm/W. Prominent OLED lighting firms are confident that they will soon offer panels in the 100-150lm/W range, which would then enable OLED lighting to rapidly penetrate general lighting markets. Firms that have announced superior efficiency performance in product roadmaps include Panasonic, LG and Philips. OLED lights already compete with CFLs on lifetimes but remain challenged by LEDs. Still OLED lighting lifetimes continue to improve rapidly. Philips believes that OLED lighting panels will reach 40,000 hours by 2018. LG says it can reach this by 2015.

Firms in the OLED lighting space see office lighting as an early revenue generator. For this to happen, panels must be much larger than they are today. Major OLED lighting firms expect progress in this area soon. The often-conservative Philips plans 1x1m panels by 2018; Panasonic will have 600x600mm panels by 2019. The Korean firm, Jusung Engineering has already built a 730x920mm panel, although not as a commercial product. There is a revival of interest in solution processing as a way of producing low-cost OLED lighting panels to profitably meet the price points of general lighting. Although GE's efforts in this area are behind schedule, Sumitomo's announcement that it is making a strong effort to print OLED lighting panels has given new life to printing OLED lighting panels. The Pioneer/Mitsubishi alliance is also developing a printing process for some layers of its panel. http://www.nanomarkets.net

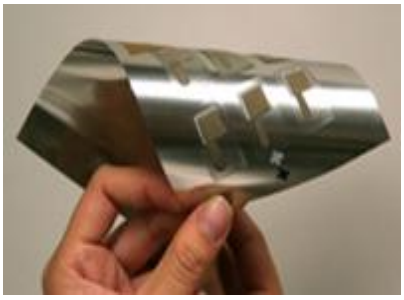
Semprius CPV module factory ready to roll

Semprius will open its new Henderson, North Carolina, manufacturing site in late September. The facility, currently employing 50 people, is being set up with an initial production run-rate of 6 MW. It will make modules using Semprius' proprietary micro-transferring process – a technology previously shown to deliver record-breaking module conversion efficiencies of nearly 34%. The company has project work under way that could exceed the initial 6 MW nameplate capacity, and reports that the plant could be "de-bottlenecked" to reach a 30 MW capacity with only a very modest increase in equipment. The company plans to hire more than 250 people if its expansion goes according to plan. Semprius has received investment from ARCH Venture Partners, Illinois Ventures, Intersouth Partners, the CIA's investment wing In-Q-Tel, Morgan Creek Capital Management, and Siemens. Together, they have invested some $40 million in the start-up over the past 15 months, while Semprius has also received state and county incentives worth another $8 million. http://www.semprius.com

Polyera Achieves 5.2% all-polymer organic solar cells

Polyera achieved a certified world-record 5.2% efficient fully-polymeric organic solar cell in an inverted bulk heterojunction architecture combining their new ActivInk PV2400 donor and NV2400 acceptor materials. These results significantly improve upon previously reported records of less than 3% for fully-polymeric cells. The device performance was certified by Newport's PV Cell Lab. The results are important for demonstrating the potential of eliminating traditionally used fullerene-based acceptor materials, which have several drawbacks including high cost, difficulty in production scaling, morphology instabilities and poor light absorption. http://www.polyera.com

Imprint Energy's ZincPoly technology brings opportunities in printed battery market



For a printed electronics system to be fully functional, a source of power has to be included. Ideally, a printed battery will be thin, flexible, low cost and utilize non-toxic materials. It should also be customizable into any shape. Imprint Energy, a start-up out of the University of California at Berkeley, is achieving all of these goals for its Zinc Poly printed batteries. The company's energy dense batteries are also rechargeable, and are expected to have a lifetime comparable to Li-Ion counterparts.

Imprint Energy was co-founded by Brooks Kincaid and Dr. Christine Ho when they were graduate students at the University of California at Berkeley. After winning several business plan competitions, the company raised seed capital from Dow Chemical's venture group. With Dow's initial investment, significant customer-funded development projects and several research grant awards, Imprint Energy has been able to grow to a full-time staff of eight employees and establish its own research laboratory, where the company is working to further develop and scale battery innovations. Imprint Energy has made several notable advancements in the field of printed batteries. The most notable is the development of a low cost, fully printable, solid-state rechargeable battery. Imprint Energy has already received investment and development funding from interested customers, suppliers and partners. The company has a well-publicized partnership with Thin Film Electronics ASA to develop battery technology for use with Thin Film's printed memory, sensor and logic technologies. The company has additional undisclosed relationships aimed at developing the Zinc Poly battery technology for larger capacity, non-printed electronic device applications. http://www.imprintenergy.com

Phillips 66, SCUT, and Solarmer Energy set a world record in solar power conversion efficiency

Phillips 66, South China University of Technology (SCUT), and Solarmer Energy have successfully set a new world record in power conversion efficiency for polymer-based organic photovoltaic (OPV) cells. The 9.31 percent efficiency was certified by the Newport Technology & Application Center's Photovoltaic Lab in Long Beach, California. The new record was achieved as a result of collaboration between Solarmer's materials development team; the Alternative Energy group at Philips 66 Technology led by its director, Dr. Ting He; and Prof. Hongbin Wu's research group at SCUT. The champion cell utilized a new polymer jointly developed by Solarmer and Philips 66, combined with the interface technology developed at SCUT's Polymer Optoelectronic Materials and Devices. OPV is lightweight, has a better performance in low light and is easier to manufacture – making it a potentially cost-effective renewable energy technology on par with current conventional energy technologies.
http://www.phillips66.com http://www.solarmer.com

Xenon announces system for production-line sintering of printed electronics

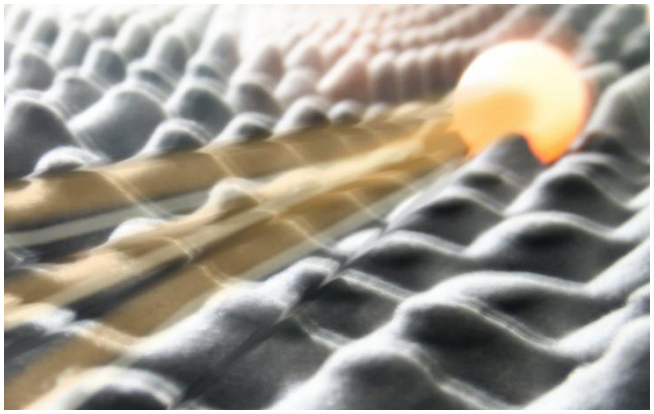
Xenon Corporation announced the availability of the Sinteron 5000 system, one of the first commercial systems for sintering printed electronics products at manufacturing speeds. According to the company, the Sinteron 5000 system uses Xenon's patented pulsed light technology to deliver high-energy bursts of pulsed light for sintering silver nano-inks on the production line at up to 100 feet per minute, without harming or overheating substrates such as plastic, film, cloth or paper. Pulsed UV Sintering is an essential step in producing printed inks that have the proper conductivity. The Sinteron 5000 includes ten independently controlled lamps with a touch panel that allows operators to precisely control roll speed, active lamps, overlap between lamps, lamp pitch, and lamp footprint. An integrated 16-inch-wide conveyor can be easily removed for roll-to-roll applications.
http://www.xenoncorp.com

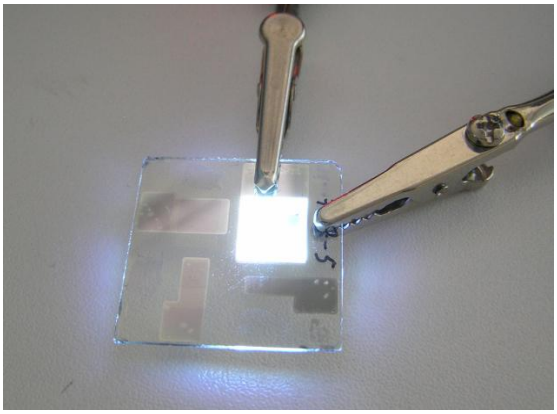
Georgia Tech researchers study how to avoid charge traps in plastic electronics

Plastic electronics hold the promise of cheap, mass-produced devices. But plastic semiconductors have an important flaw: the electronic current is influenced by “charge traps” in the material. These traps, which have a negative impact on plastic light-emitting diodes and solar cells, are poorly understood. However, a new study by a team of researchers from the University of Groningen and the Georgia Institute of Technology reveals a common mechanism underlying these traps and provides a theoretical framework to design trap-free plastic electronics. Plastic semiconductors are made from organic, carbon-based polymers, comprising a tunable forbidden energy gap. In a plastic light-emitting diode (LED), an electron current is injected into a higher molecular orbital, situated just above the energy gap. After injection, the electrons move toward the middle of the LED and fall down in energy across the forbidden energy gap, converting the energy loss into photons. As a result, an electrical current is converted into visible light. However, during their passage through the semiconductor, a lot of electrons get stuck in traps in the material and can no longer be converted into light. In addition, this trapping process greatly reduces the electron current and moves the location where electrons are converted into photons away from the center of the device. The traps are poorly understood, and it has been suggested that they are caused by kinks in the polymer chains or impurities in the material.

The Georgia Tech group, led by Professor Jean-Luc Bredas in the School of Chemistry & Biochemistry, investigated computationally the electronic structure of a wide range of possible traps. “What we found out from the calculations is that the energy level of the traps measured experimentally matches that produced by a water-oxygen complex,” said Bredas. The fact that the traps have a similar energy level means that it is now possible to estimate the expected electron current in different plastic materials. And it also points the way to trap-free materials. This energy gap represents the difference in energy of the outer shell in which the electrons circle in their ground state and the higher orbital to which they can be moved to become mobile charge carriers. When such a mobile electron runs into a trap that is within the energy gap it will fall in, because the trap has a lower energy level. The results of this study are therefore important for both plastic LEDs and plastic solar cells.

The experimental work for this study was done in the Zernike Institute of Advanced Materials (ZIAM) at the faculty of Mathematics and Natural Sciences, University of Groningen, the Netherlands. The theoretical work to identify the nature of the trap was carried out at the School of Chemistry and Biochemistry and Center for Organic Photonics and Electronics at the Georgia Institute of Technology, Atlanta, USA. The work at the University of Groningen was supported by the European Commission under contract FP7-13708 (AEVIOM). The work at Georgia Tech was supported by the MRSEC program of the National Science Foundation under award number DMR-0819885. http://gtresearchnews.gatech.edu





Charge traps; white PLED

Aixtron delivers a flexible organic electronics production system to a major Asian customer

Aixtron announced that it has delivered a production-scale PRODOS Gen-3.5 Polymer Vapor Phase Deposition (PVPD) system to a major Asian customer. This system will be used to produce novel flexible electronic devices through the deposition of organic polymer thin films. Aixtron says that the new system has been designed to be a perfect match for the customer's production environment for Gen 3.5 substrates (650x750mm). The customer will be able to develop new applications including "flexible flat panel displays with benefits such as lightweight, ruggedness, low power consumption, color brightness, and superior legibility". http://www.aixtron.com

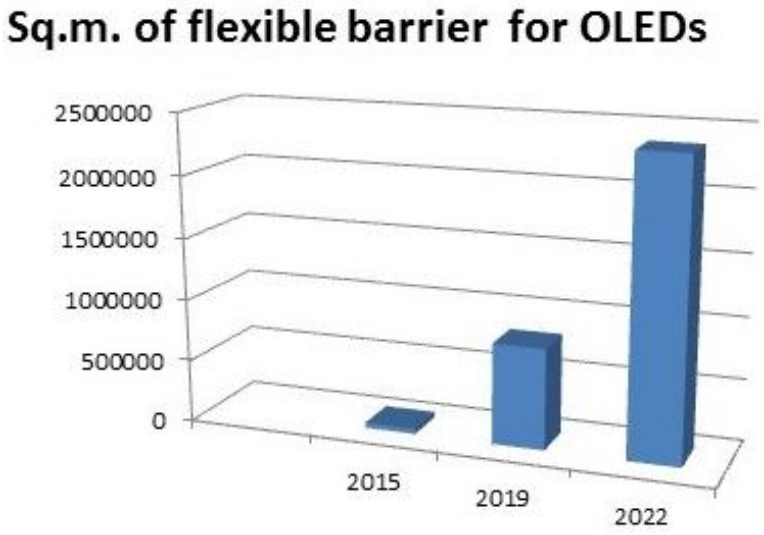
NanoMarkets brings out latest report on transparent conductor market

Industry analyst firm NanoMarkets announced its latest report on the transparent conductor (TC) market which includes the dominant indium tin oxide (ITO), along with other transparent conducting oxides (TCOs), conductive polymers, silver grids and coatings, copper, carbon nanotubes and graphene, and nanocomposite materials of various kinds. In this report NanoMarkets provides in-depth analysis of applications including touch-screens, OLEDs, e-paper, thin-film and building-integrated PV (BIPV), organic/DSC PV, smart windows, etc. The report examines implications for TCs of the rise of flexible and transparent electronics and provides an in-depth discussion of how non-ITO TCs may be able to break into the LCD market. For each application the report contains separate eight-year forecasts in terms of value ($ millions) and volume (square meters). Each forecast is also broken out by material type. Firms discussed in the report include 3M, Agfa, Asahi Glass, Atmel, Cambrios, Cima NanoTech, Corning, Dow Chemical, Evonik, Ferro, Fujitsu, Harima Chemicals, Heraeus, Hitachi, Idemitsu Kosan, Indium Corporation, Kodak, LG, Linde, Mitsubishi, Mitsui, Nippon Mining and Metals, Nitto Denko, PolyIC, Pilkington, Saint-Gobain, Samsung, Schott, SKC, Sony, Oike, Sumitomo, Teijin, Toray, Tosoh, Ulvac, Umicore, Unidym, and many others. Today most firms offering alternatives to ITO focus on the touch-screen sensor market but this sector is too small for many of these firms to generate significant revenues. Instead, NanoMarkets believes that the current rapid development of the OLED display and lighting market looks as if it will give a big boost to the makers of non-ITO TCs. While ITO is widely used in OLEDs it is not well suited to this application and the OLED sector is already beginning to seek alternative TCs. Likewise with flexible displays. ITO may not work well for high-throughput R2R processes and one could never use ITO in a rollable display. There are good reasons to suppose that flexible displays will become a sizable market so this could be a major factor in the mainstreaming of non-ITO TCs. NanoMarkets expects resurgence in thin-film solar panels for use in BIPV. This will advantage firms selling tin oxide and zinc oxide materials and there is considerable research activity currently seeking the best dopants for these materials for TC applications. Silver-based TCs seem to have taken off commercially and can now be found in a number of commercial cell phone models. By contrast, nanotube-based TCs have made little commercial progress. The best hope for them lies in the fact that a few firms with deep pockets -- Samsung, Linde, and Toray, for example - still back this approach. Meanwhile, Agfa, Heraeus and Kodak seem to be making progress with their low-cost conductive polymer TCs. The materials have considerable potential for growth in small displays for electronic labels and smartcards. http://www.nanomarkets.net

IDTechEx predicts a $1 billion opportunity by 2022 for flexible barriers

As more and more flexible devices are becoming available, the need for better performing barriers and encapsulation materials at lower cost points intensifies. The stringent requirements make this a difficult task for some applications, although others, with less intensive demands are already appearing in the market. Examples include flexible electrophoretic displays (e-paper) currently being commercialized as e-book readers, smart labels, etc. IDTechEx forecasts a $1 billion opportunity for the market for encapsulation materials for a variety of applications, with details on the market and the way it's going to develop in the report “Barrier Films for Flexible Electronics 2012-2022”. According to IDTechEx, in 2012 6% of printed electronics will be conformal or flexible (mainly due to the huge rise in the adoption of OLED on glass for smart phones and tablet applications) while the rest will remain rigid (usually being that they are on a rigid glass substrate). In 2022 the amount that is conformal/flexible rises to 32% of the total value. Supporting that increasing trend are interviews with companies like 3M, who are describing their efforts in making flexible barriers available at price points that are comparable to that of optical glass, increasing competitiveness as well as offering unique selling points such as lighter weight and increased robustness. Nokia, presenting at IDTechEx Printed Electronics events, has shown roadmaps to move to OLED displays in their cell phones - when they are available on plastic substrates. Samsung has already moved on to OLED displays even though they are still on glass and they tend to be quite fragile. In these cases and in others such as laptops or e-readers for children or educational purposes, the companies do not need flexible or rollable displays but they do benefit from the added robustness that flexible substrates offer. These trends lead to an overall market forecast by IDTechEx of $200 million dollars by 2022 for the display market alone, as described in the report Barrier Films for Flexible Electronics 2012-2022. In OLED displays in specific, almost 2.5 million square meters of barrier material will be utilized in the making of more robust and in some cases flexible displays.

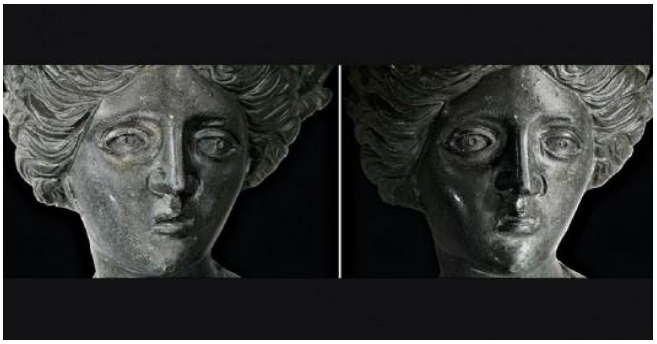
The trend of flexible/conformal devices claiming a part of the now mature glass-based market is also appearing in the photovoltaics sector. Although the more established technologies, such as crystalline silicon and CdTe will always remain glass based and will continue to cater for the largest amount of rooftop and solar farm installations, in some cases, specific requirements will lead to further adoption of flexibly encapsulated solar cells. Light weight requirements for example, integration into portable devices or conformal deposition of solar cells would make an ideal case for solar cells that are not glass-based. The growth in this sector is not as fast as initially forecasted a few years ago, and that's mainly relating to the slower than expected development of 3rd generation technologies (organic photovoltaics and dye sensitized solar cells) and some difficulties in their commercialization. Limitations in these technologies' lifetime and efficiency are making it harder for them to compete with other thin films that can also be flexible and lightweight (CIGS or a-Si for example) but these issues are hopefully going to be resolved in the next few years. Encapsulation materials going into the photovoltaics sector are going to be forming another large segment of the overall barrier layer market. IDTechEx forecasts a $380 million market by 2022 for barriers for inorganic photovoltaic technologies such as CIGS and amorphous silicon. This would correspond to a total area of barrier materials in excess of 12 million sq.m. by 2022. http://www.idtechex.com/barriers



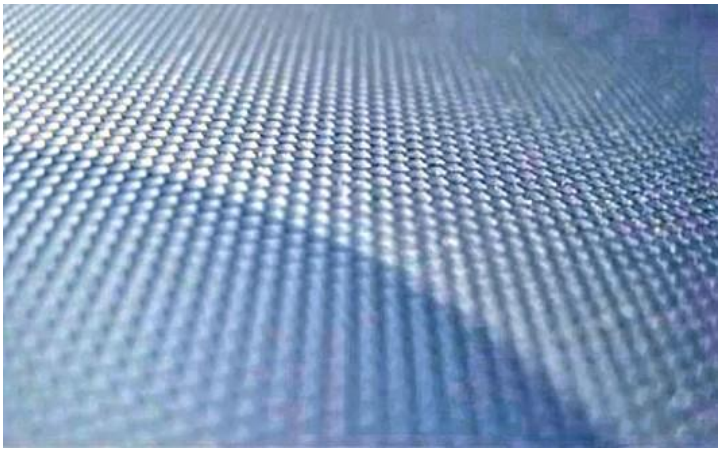
Area of flexible barriers forecasted for utilization in OLED displays

US researchers develop reflectance paper that displays photographs in a new light

A novel printing method yields photos that respond to different angles of light the same way a three-dimensional object does. The technique, which uses specially designed “reflectance paper” covered with thousands of tiny dimples, was developed by a team of researchers at the University of California, Santa Cruz, Hewlett-Packard Laboratories, and 3M. Ordinary printed photos look the same regardless of the angle of the light because flat paper can't reflect light the way three-dimensional objects do. With the reflectance paper, each pixel has a little dimple that has all angular directions on its surface. Now one can print ink over it in a way that controls the angles of light that will be reflected from each pixel. The mathematical “reflectance function” describes how light is reflected from each point on an object. Measuring the reflectance functions for an object or scene can be done by taking photographs lit from many different lighting directions. Art historians and restorers use these techniques for documenting important works of art and historical artifacts. The researchers at HP Laboratories eventually teamed up with at 3M to develop the reflectance paper. At UCSC, they worked to write the software code for printing the reflectance functions. http://news.ucsc.edu/2012/08/reflectance-paper.html



Images of a statue from one piece of reflectance paper as seen with incident light from either side

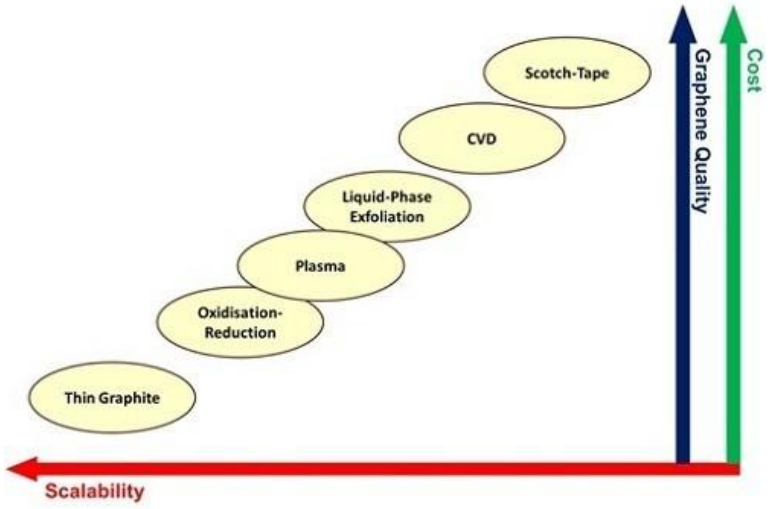


Magnified surface of a piece of reflectance paper; Top shows the semi-transparent mask covering the mirrored spherical dimples, left shows the mirrored dimples, and right shows the mask itself

IDTechEx forecasts a $100 million graphene market in 2018

Graphene promises to offer excellent material properties in almost all applications. Its extraordinary performance has led many to call it the superlative or wonder material. However, the reality is different. The latest report on graphene "Graphene: Analysis of Technology, Markets and Players 2013-2018" from IDTechEx diligently separates hype from reality using their detailed knowledge base, which was built by interviewing relevant players across the industry and tracking/interpreting global developments. They forecast a $100 million market for graphene in 2018. They find that there are many different types of graphene, each offering a different set of properties. The differentiating parameters include the number of layers, purity, oxygen content, crystallinity and form (powder or sheet). Depending on the specifics of these parameters, the quality of the so-called graphene can vary, from that of the ideal material towards that of graphite oxide. Each graphene type is manufactured using a different technique and all techniques differ in terms of their cost structure, volume production capability and ultimately, potential target markets. The manufacturing techniques include micro-cleavage, chemical vapor deposition, liquid-phase exfoliation, oxidization-reduction and plasma.

The main market driver so far has been the R&D sector. The industry is now gearing up to move beyond research activities and a diverse range of other applications are actively being developed. These include RFID, smart packaging, supercapacitors, composites, ITO replacement, sensors, logic and memory. In many cases, the main go-to-market strategy for graphene would be replacing an existing component in an existing product. Depending on the target market, the incumbent or rival materials could be carbon black, carbon fiber, graphite, carbon nanotubes, silver nanowires, ITO, silver flakes, copper nanoparticles, aluminum, silicon, GaAs, ZnO, etc. The strength of graphene's value proposition is different for each target market. In many cases, graphene enables performance premiums, giving space for premium pricing. Cost will however remain critical. This is because ultimately graphene's value proposition can often only be defined against the incumbent material option. IDTechEx finds that composites and energy storage applications will be the largest near-term market opportunity for graphene beyond R&D. The composite space is broad and diverse. IDTechEx also expects that graphene will first penetrate markets that have low cost sensitivity, but demand high performance. In the energy storage space, graphene will first be used in supercapacitor devices, mainly due to its high surface-to-volume ratio. They forecast that graphene will have limited success in the transparent conductor market, because it falls short both on cost and performance compared to incumbent and alternative options. Market success will be limited in the transistor area, both in analogue and digital applications. This is partly due to a lack of bandgap and the high level of standards set by incumbent solutions. http://www.idtechex.com



Scalability, cost and graphene quality trends for different manufacturing techniques

Member Company Benefits

Member benefits are focused on providing commercial advantages in a competitive marketplace.

Technical Program

Opportunity for pre-competitive R&D Funding
FlexTech Alliance sponsors an industry-wide R&D funding program available exclusively to its members.

Gap Analysis and Roadmapping
Members receive complimentary admission to FlexTech Alliance workshops and tours of R&D and production facilities. Workshops are designed to identify and resolve key technical challenges.

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FlexTech Alliance research reports provide valuable insights into the technological and economic trends of our member companies' primary markets. Free to members*, the data package consists of reports from :

-DisplaySearch -NanoMarkets -Veritas et Visus
-Insight Media -FlexTech Alliance *Restrictions apply

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The Flexible Electronics and Displays Conference and Exhibition
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Regional Workshops, Meetings, and Business Conferences
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Branding opportunities - Members receive an expanded and highlighted listing in the searchable on-line directory as well as posting rights and advertisement placement on FlexTech's home page.
Product demos – FlexTech Alliance can help facilitate the development of product demonstrators.

To schedule a membership overview meeting, call FlexTech Alliance at (408) 577-1300