

FlexTech Trends

News from the world of displays and
flexible, printed electronics

Volume 4 – Summer 2009

FlexTech Trends

Table of Contents

Note from the President by <i>Michael Ciesinski</i>	3
Market Update: E-Paper Display Technology and Market by <i>Sarah Han, Displaybank</i>	4
Raising Capital in Times of Economic Distress: Insights into Today's Venture Capital Community by <i>Tom French</i>	9
One-on-one: Interview with Tom Edman from Applied Materials	12
Symposium on the Future of Photovoltaics Manufacturing in the U.S. <i>FlexTech Alliance presents at the National Academy of Sciences</i>	15
Summary of FlexTech's Quarterly Flexible, Printed Electronics Workshop Clemson University, May 14, 2009	16
Partner update from the CAMM by <i>Mark Fihn and Mark Poliks</i>	18
Partner update from the FDC by <i>Shawn O'Rourke</i>	19
News from the FlexTech Alliance compiled by <i>Veritas et Visus</i>	22
<ul style="list-style-type: none"> • Prime View International reaches agreement to acquire E Ink • E Ink announces large format display in its electronic prototype kit • HP enables new field of flexible electronics with reflective display technology • Plextronics & NTERA demonstrate solar-powered NanoChromics displays • Plastic Logic demonstrates latest e-reader ahead of launch next year • FDC and Universal Display Corporation make breakthrough in flexible manufacturing process • Universal Display's shows off flexible OLED bracelet • UDC awarded \$750,000 SBIR contract from US Air Force for flexible OLED displays • UDC and Samsung present advances in long lifetime green phosphorescent OLEDs • DuPont Displays surpasses million-hour milestone for lifetime of new OLED material • Polytos project launched by the "Forum Organic Electronics" excellence cluster • NIST develops flexible memory components from polymer sheets • Kent Displays Names Dr. Asad Khan Chief Technical Officer • University of Texas licenses method that speeds electronics manufacturing to Versatilis • ECD to deliver photovoltaic systems for commercial roofs • And much more... 	
Join the FlexTech Alliance	27



Note from the President

by Michael Ciesinski

This Summer 2009 issue of DisplayTrends coincides with a U.S. stock market rally that is giving hope to seeing an end to the longest economic recession since 1938. Whether or not the rally proves sustainable, information on market dynamics is vital. The FlexTech Alliance will continue to provide you with timely updates on the markets for displays and flexible, printed electronics .

In this issue, contributors on market and financial perspectives are Sarah Han from Displaybank and Tom French from Heffernan Seubert & French LLP. Ms. Han's article (beginning on page 4) analyzes the e-paper market, typified by the enormously successful Amazon Kindle. In Displaybank's view the e-paper market will grow from ~\$70M in 2008 to \$2.1B in 2015. Tom French, an attorney based in Menlo Park, Calif., analyzes the current venture capital market. His article (beginning on page 9) advises us that funding, while tight, is available for the right teams with solid business plans.



Tom Edman of Applied Materials was elected chairman of the FlexTech Alliance earlier this year. In this issue of FlexTech Trends, Tom shares his thoughts on the alliance and his expectations going forward.

Member companies looking to supplement their internal R&D funding should be frequently scanning the Department of Energy website, especially the solid state lighting (SSL) section – <http://www.ssl.energy.gov>. As mentioned in the Spring 2009 issue of FlexTech Trends, economic stimulus funding in its various forms will be available for some time to come. A sample of current DOE SSL solicitations is available on page 11.

Our quarterly workshops on flexible and printed electronics are growing in popularity. On page 16, look for a summary of the May 2009 workshop at Clemson University, featuring a presentation from Proctor & Gamble on integrating electronics into consumer goods. Upcoming workshops include:

- August 20, 2009 at Binghamton University, in Binghamton, NY – focus on medical devices and health care
- October 23, 2009 at Semiconductor Equipment and Materials International (SEMI) in San Jose, Calif. – focus on substrates, barrier layers, encapsulation and measurement techniques of water vapor transmission rates (WVTR)

These workshops, provided free of charge, are great venues to pick up market analyses, understand customer perspectives, and network with potential partners. Visit www.flextech.org for details.

Cordially,

Michael Ciesinski
President



e-Paper Display Technology and Market

by Sarah Han

Sarah Han is currently an analyst at Displaybank. Before joining Displaybank, she was worked at Samsung Electronics and has six years experience in the display industry. Sarah has been involved in display marketing and survey activities involving numerous display related companies. At the moment, her research and studies are focused on the flexible display market.



Electronics paper, also called as e-paper, is a reflective display device like a regular paper which requires no self light source and has a native memory function which maintains images, even when the power is off. Most e-papers have outstanding viewing angle and resolution compared to the conventional LCD. They require no back light and can be realized on any substrate such as glass, plastic, metal, and paper. They utilize a simple manufacturing process that enable a low cost roll-to-roll process. In addition, they require power only when changing the screen so they can be operated at low power consumption.

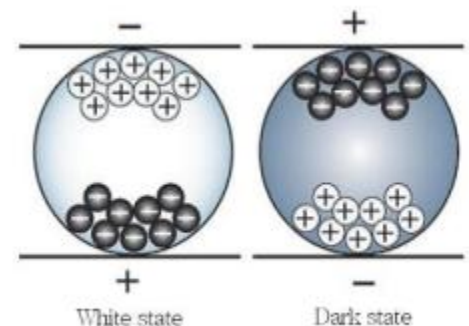
e-Paper is a display which replaces conventional paper prints and expectations are for market growth in applications such as e-newspapers, e-magazines, and e-books. Moreover, it can be applied in public displays such as bulletin boards, advertisement boards, and direction boards.

Technologies to realize e-paper are divided into electrophoretic display, twisted ball display, electrochromic display, Quick Response Liquid Powder Display (QR-LPD), and cholesteric LC which is an extension of MEMS based e-paper technology and LCD technology. However, it is difficult to realize a broad color gamut and rapid response time like that of LCD or OLED.

Nonetheless, the e-paper technology has outstanding properties like low-cost, slimness, and stability when compared to other display technologies so that product development applied to this technology is expected to accelerate. Representative e-paper technologies that have reached production stages are as follows:

Electrophoretic Display (E-Ink): Electrophoretic display technology has achieved the most technology development thus far and was developed by MIT Media Lab in 1996. This is a capsule type electrophoretic technology which operates ink corpuscles within a micro-capsule. A structure wraps around the micro-capsule (100~200μm in diameter). After dispersing ink corpuscles of a select color with a select electric charge and ink corpuscles of the other color with opposite electric charge, the micro-capsules are mixed with binder in between electrodes. A negative corpuscle approaches the surface to display the corpuscle's color when a positive voltage is affirmed, whereas an opposite voltage is affirmed to display the opposite corpuscle color.

E-Ink was established as a spin-off from the MIT Media Labs and uses black carbon-based material on TiO₂ corpuscles with outstanding white reflectivity.

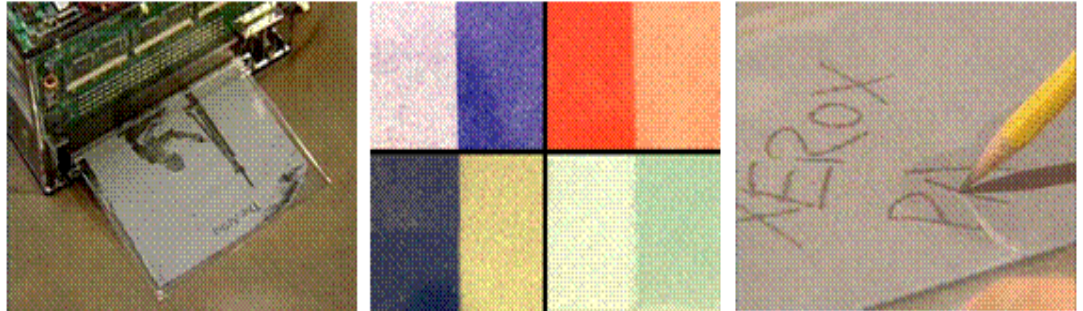


Such e-paper technology has outstanding visibility and properties similar to the texture of paper. It also has a memory function to consume extremely small amounts of power. However, the response time is about 100ms, so that full-motion video is not supported. The technology can enable color by adding a color filter, but is still currently in the R&D stage. Initially, a-Si TFT was widely used to realize active matrix e-paper in the past, but many developers now use the active matrix technology using OTFT as developed recently by Philips. The possibility for OTFT's production applications rises accordingly.

Twist Ball Type (Gyricon Display): Twist ball type Gyricon displays were developed by Xerox's Palo Alto Research Center (PARC) for the first time in the 70s. Gyricon sheets comprise a transparent plastic layer in

which polyethylene beads of 20~100 microns in diameter float in an oil solution. Half of the beads are negatively charged to display white and the other half are positively charged to display black. In other words, these beads are in a dipole state. They display white and black colors in a rotation method following the affirmed voltage. Xerox established Gyricon Media in December 2000 and although the company disbanded, Xerox continues the R&D activities. The company recently collaborated with 3M to develop Smart Paper which can be mass produced and delivered the Synchro Sign product, a guide novel display device using the Smart Paper.

The key technology for Gyricon, which is called Smart Paper, is to switch directions according to the voltage change by attaching black and white planes on a micro-capsule smaller than even sand. Either black or white background can be selected and after-image can be viewed without separate power supply. In addition, micron-capsules are filled between the anode and transparent thin film to allow even 0.1mm to be used in the display screen.



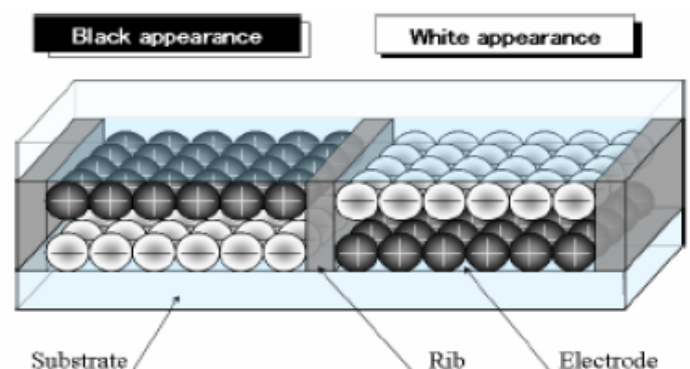
Gyricon display's operation principle is as follows. Several hundred balls of 30~100 μ m sizes are dispersed on a silicon elastomer cavity filled with oil in between two sheets of conductive substrate. Here, the dispersed balls are in hemisphere shapes with two strongly opposite sides. One side is in black to absorb the light, whereas the other side is in white to reflect the light. The white and black areas of the ball possess opposite electric charges so that the ball rotates according to the direction of electric field affirmed from the outside. Such property is used in creating an electric field to allow the black area to locate in the upper part when displaying the black color and allow the white area to locate in the upper part when displaying the white color. At this time, the ratio of ball and oil is nearly the same that the images are maintained for several days even after the affirmed voltage is removed once the ball's location is secured after it rotates once by the affirmed voltage.

The realization of display resolution and other electro-optical properties vary upon the size of ball. About 100ppi resolution can be realized when the ball size is about 100 μ m, whereas about 300ppi resolution is realized when the size is decreased to 30 μ m. The response time and power consumption can be improved but they entail issues of reduced contrast.

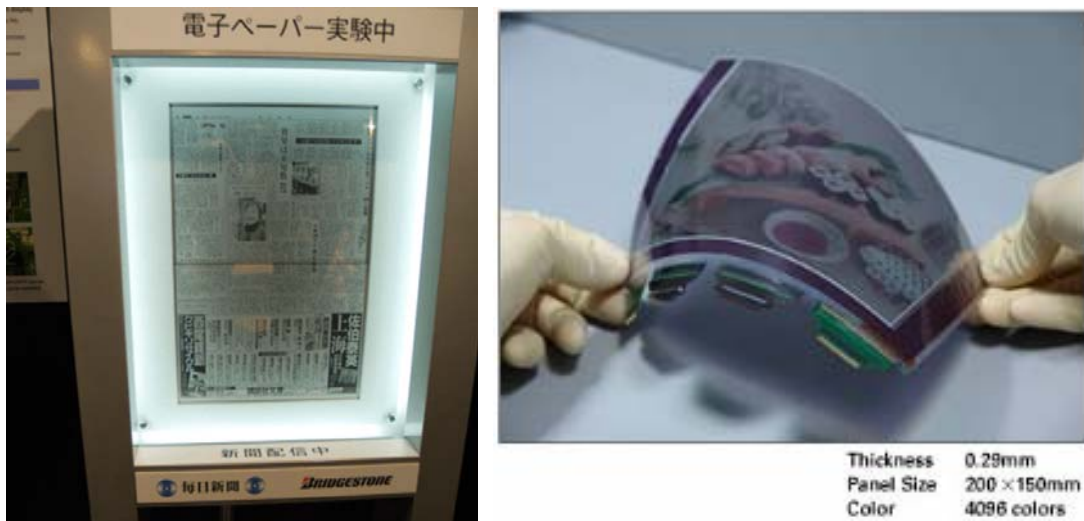
Gyricon displays show a 6~10:1 contrast ratio. The operating voltage and switching time for ball rotation are 50~150V and 80~100ms respectively. The operating voltage is relatively higher than other displays and the switching time from white/black is rather long, such that the Gyricon displays have difficulties in realizing motion pictures.

Quick Response Liquid Powder Display (QR-LPD):

The e-paper technology using QR-LPD was developed by Japan-based Bridgestone in 2004. The technology is similar to the conventional technology in using electrically charged particles, but its color switching time is very fast at 0.2ms since the ink particles are solid particles that operate as liquid so that the technology draws much attention. In addition, this e-paper technology absorbs and reflects the light close to the surface so that it has a wider viewing angle than the LCD.



Moreover, the technology uses color filters for colorization. The color filters are located either on the inside or outside of the front substrate and they are created by using either photolithography or ink-jet printing methods. However, there is an issue of having to greatly reduce the operating voltage of over 200V to about 10V in order to commercialize the QR-LPD.



Bridgestone's QR-LPD trial product

Cholesteric Liquid Crystal Display (Kent Display): In 1993, Kent Display presented e-paper technology using cholesteric liquid crystals which displays colors by selectively reflecting lights of different wavelength. This technology works by inserting cholesteric liquid crystal in between two sheets of glass substrate and affirming voltage to switch between an anti-reflective state and a reflective state.

The e-paper applying Kent Display's cholesteric liquid crystal does not need color filters and has a stable liquid crystal state so that it consumes no power to maintain the display. In addition, it is light, bendable, unbreakable, and low power consuming. It also has outstanding readability and a wide viewing angle.



Commercialization Trend: The commercialization of e-paper technology progresses following the leadership of US-based E-Ink. E-Ink's electrophoretic FPL (front plane laminate) is already manufactured in km units through a roll-to-roll process. Segmented displays on plastic substrates are also being produced. E-Ink plans to develop color display with improved response time in 2010. The company currently shows the most active commercialization of flexible display applications and targets to gradually secure the display market by supplying low-cost E-ink displays. E-Ink is expected to show more aggressive activities from now on.

US-based SiPix has independently developed flexible Microcup e-paper which shows outstanding electro-optical properties in 2004. The company launched Flex-It film, the next-generation display product based on Microcup technology, in May 2008. This film offers over 40% enhanced brightness and speed more than twice faster than the conventional products. It is also able to be mass produced through the roll-to-roll process.

Polymer Vision, Philips' spin-off, has manufactured 5-inch 80ppi rollable active matrix e-paper displays by combining laminated 25μm plastic substrates with E-Ink's e-paper panel on a 4 mask process solution-based OTFT back plane. The display is about 100μm in thickness and is 7.5mm in radius. The device operates well even after several hundred times of bending. In December 2007, the company announced to complete the

construction of flexible display factory in Southampton, England and begin mass production. The company also announced that the full production is scheduled to begin in 2H'09.

Plastic Logic, a spin-off from Cambridge University's Cavendish Lab in 2000, progresses in their developments of ink-jet based OTFT and flexible e-paper backplanes using the OTFT. Using ink-jet processes, Plastic Logic uses a technology that manufactures transistors with high integration without using masks on flexible plastic substrates. The company is also developing an e-book (model name: Reader) with application of this technology. Plastic Logic has constructed a flexible display factory in Dresden, Germany. The company began the line construction in May 2007, completed the facility carry-in by June 2008, and targets to being full production in 2010.

PVI (Prime View International) is a TFT-LCD panel maker established in Taiwan in 1992. PVI collaborated with Philips and entered the e-paper business in 2005. As a result, the company recently has developed LCDs and electrophoretic display based reflective display technology under the name of Magic Mirror. In addition, it plans to manufacture plastic based EPD starting in 2H'09. *(And recently acquired E Ink, as noted in the news section of this newsletter)...*

LG Display collaborated with E-Ink and presented B&W 10.1-inch and 6.0-inch color e-paper prototype developments at FPD2005 which was held in Japan. The display has 300µm thickness, 800x600 resolution, 4 grayscale, and 500ms response time. LG Display has presented a 14.1-inch flexible e-book display at SID in 2005. This was the world's largest flexible product development at that time. This display used the conventional a-Si TFT technology rather than glass on a metal foil to create an active array and applied E-Ink's technology to realize the e-book. The product has 1280x800 resolution, 16 grey-scales, and 300ms response time. LG Display plans to manufacture 11.5-inch flexible e-paper displays in 2H'09.

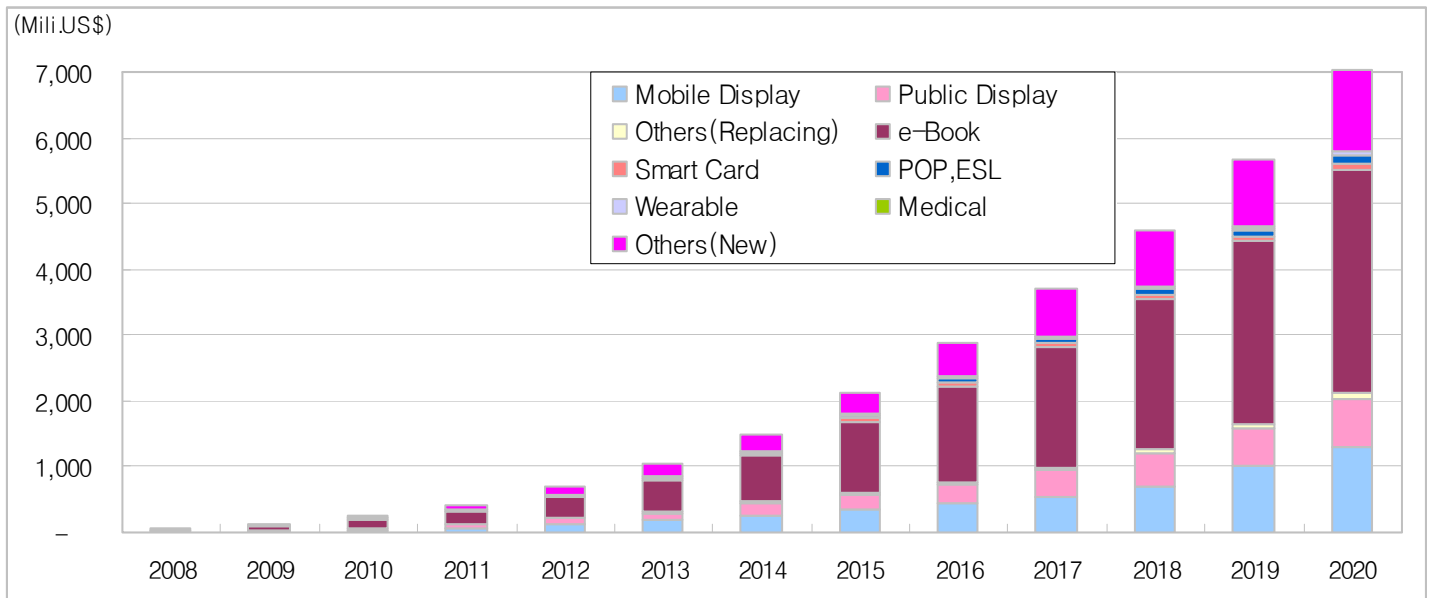
e-Paper Display Production Plan by Major Supplier

Panel Maker	LG Display	PVI	Polymer Vision	Plastic Logic
Technology	E-ink / TFT	E-ink /TFT	E-ink/OTFT	E-ink/OTFT
Substrate	Glass/ Metal Foil	Glass/Plastic	Plastic	Plastic
Main Size	6" / 11.5"	6" / 8"	5"	A4 size
Fab Location	Gumi (Korea)	Hsinchu (Taiwan)	Southampton (UK)	Dresden (Germany)
Mass Production	2009.2H	2009.2H	2009. 2H	2010.1H

(Source: Displaybank, e-Paper Display Technology and Market Forecast, May 2009)

e-Paper Display Market Forecast: Displaybank projects the e-Paper market to grow from \$70 million in 2008 to \$2.1 billion in 2015 and \$7 billion by 2020 – representing a compound annual growth rate (CAGR) of approximately 47%. Displaybank also projects the e-Book market to comprise 50% of the total e-Paper market during that same period – growing from \$35 million in 2008 to \$1.1 billion in 2015 and \$3.4 billion by 2020 – with the greatest regional demand coming from the US.

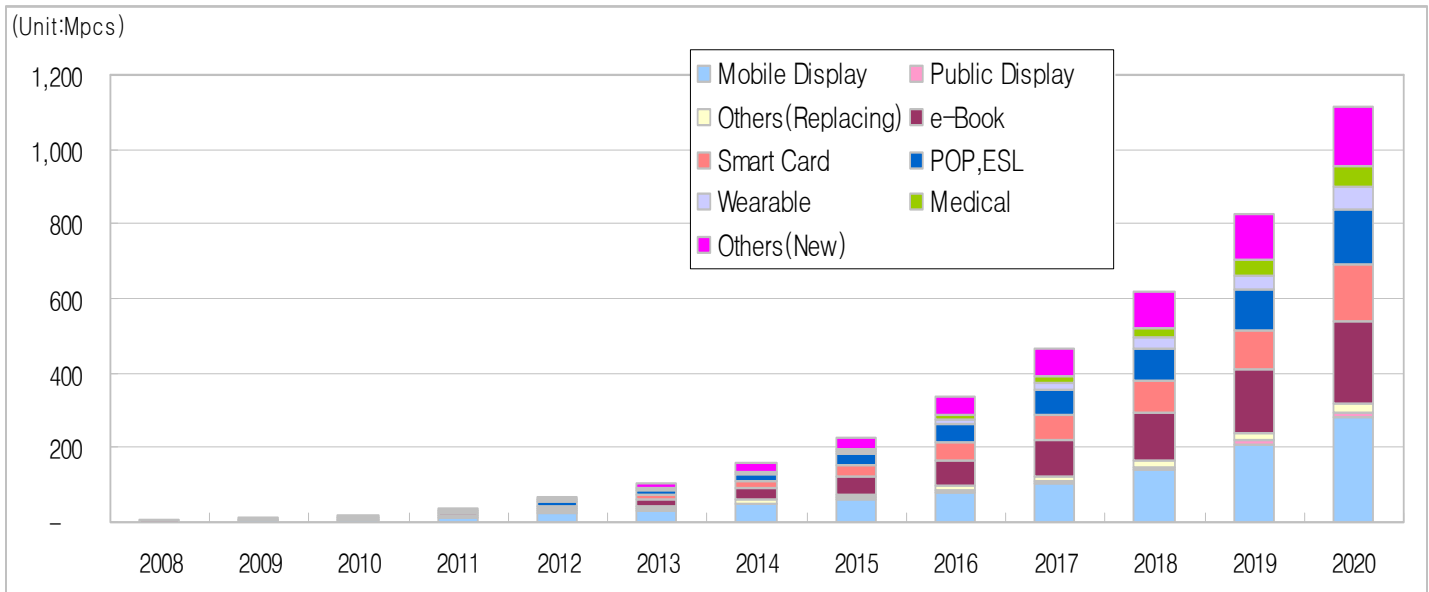
e-Paper Display Market Forecast – Revenue Basis



(Source: Displaybank, e-Paper Display Technology and Market Forecast, May 2009)

Displaybank also projects e-Paper display demands to grow from 20 million units in 2010 to reach 1.1 billion in 2020. In the existing application market, replacing application for Mobile Display will be commercialized that will grow the demand from 8 million units in 2010 to 320 million units in 2020 showing 48% increase. For the new/emerging application market, the demand is expected to show 63% from 10 million units in 2010 to 800 million units in 2020.

e-Paper Display Market Forecast – Unit Volume Basis



(Source: Displaybank, e-Paper Display Technology and Market Forecast, May 2009)

e-Paper Display technology not only has the visual effect of printed paper but it is also able to process information with flexible lower power consumption- These merits of e-Paper Display are expected to lead the e-Paper Display to be widely applied.

Raising Capital in Times of Economic Distress:

Insights into Today's Venture Capital Community

by Tom French

Tom French is a partner at Heffernan Seubert & French LLP, in Menlo Park, California. He has been practicing corporate law in Silicon Valley for over 30 years. His focus is on startups, emerging companies, and associations and consortia, where he is general counsel to the FlexTech Alliance. Tom can be reached at: tfrench@hsfllp.com



Whether your company is a pre-revenue startup, already has revenues, or is an established and profitable concern, access to capital is always necessary. It's a well-known fact that the current recession and the collapse of the financial markets has made capital-raising extremely difficult. Consequently, it might be quite easy under these conditions to become pessimistic and, perhaps, even conclude that little can be achieved until (i) the recession ends, and (ii) the venture capital (VC) community resolves its many problems and again approaches investing in technology companies with real gusto. However, that could be a very long wait.

Amidst a steady stream of pessimistic and, frankly, depressing economic news, there are trends and opportunities developing which are cause for optimism. These include:

- Some new VC funds have recently been created. While most existing venture capital funds are in a "hold" mode, conserving their cash to support those companies in their portfolios which they believe have a decent chance to survive the downturn, new, small venture funds are being created, funds which have no sick children to nurse and feed. These funds are committed to the principle of "small is better". Examples include Andreessen & Horowitz, a \$250M fund just formed by legendary Silicon Valley entrepreneur Marc Andreessen (NetScape, LoudCloud/OpsWare and Ning) and his long-time colleague, Ben Horowitz. Another recently-formed fund is Accelon Capital, a private equity fund whose founder and managing partner is Abhijit Phanse (CEO-founder of Scintera). Accelon reportedly has over \$100M in funds and will look at traditional venture deals, acquisitions and a variety of other structures.
- The top VC funds are still investing. Top-tier VC funds still have substantial uncommitted funds and the will to invest in good opportunities. Sequoia Capital, Kleiner Perkins and Benchmark, considered by most analysts to be among the best at what they do, and well-positioned financially to weather this storm, are actively seeking investment opportunities. No doubt, these funds are devoting more time than ever before to their existing portfolios, but, unlike many of the second-tier funds, they have access to continued investor capital (mostly pension and endowment funds) and confidence in their ability to find cutting edge winners to invest in.
- The angel investor community is more mature, has more funds available, and is currently making investments. With the pull-back by most VC funds in making new investments and even supporting old ones, many angel investors have stepped into this vacuum and partially met the need for risk capital. Deal tracking data of angel investing is not really available, and many news accounts suggest that angel investing has plunged along with other forms of early stage funding. But, anecdotal data suggests that more and bigger angels are making investments, often in larger amounts than what has traditionally been thought to be their comfort zone. Some angels are co-investing alongside traditional VC funds.

- Reports of the death of IPOs are premature. There have been a few technology IPOs over the last 12 months – not many – and most of them have held their own in the after-market. Some examples: LogMeIn.com, Rosetta Stone, Open Table, and Solar Wind. Why should we care about IPOs? One reason to care is that they are a harbinger of public confidence in the market and the technology sector of our economy. A steady, positive trickle of IPOs can influence VC funds that look to this data as a possible basis for being optimistic that there might once again be an alternative to the acquisition avenue of liquidity for their investments, an avenue that is generally viewed as offering lower valuations than IPOs.
- The stock market is showing signs of strength, in spite of the continual flow of bad economic data. The Dow Jones, S&P and NASDAQ averages have climbed 12%, 14% and 18%, respectively, in the last 90 days alone. This suggests either borderline insanity or a conviction that the worst of the recession has occurred, and that better times lie ahead. Venture capitalists and other key suppliers of capital to the technology industry monitor this data closely.
- Some big – even jumbo - tech IPOs are believed to be in store for early 2010. A lot of buzz is being generated about a possible IPO by FaceBook. Should that occur, we can be certain it would be a huge offering, easily exceeding \$1B. It would be the most exciting tech IPO since Google's offering in 2004. Others that are often talked about include LinkedIn and Twitter. While these are all web-based companies, there are indicators that several relatively low-profile but rapidly growing alternative energy and energy play companies are looking at a possible public offering in 2010 and will show enormous revenue growth and impressive profits.
- Foreign public markets are opening up to U.S. technology companies. The AIM market in London is old news, but it continues to be a worth-looking-at alternative for U.S. companies who aren't yet ready for the cost and complexity of a an offering on Nasdaq. Another very interesting development is that Taiwan, which has historically prohibited foreign companies from registering shares, recently adopted legislation which represents a major departure from the past. The Gre Tai Exchange (rough translation: emerging markets) was created and it is aimed specifically at smaller, developing companies. While there are minimum revenue and profit levels which are imposed, the bar is set fairly low. Just as important, the cost of doing an offering in Taiwan is considerably lower than on AIM or NASDAQ. And there is plenty of capital in Taiwan, a very tech-savvy nation, on the sidelines waiting to invest in foreign tech companies. A Silicon Valley company, Array Networks, was the first foreign company to complete registration requirements of the Gre Tai Exchange, and an eager queue of over 15 foreign registrants – over half of which are reportedly Silicon Valley-based – is in the pipeline.
- U.S. government economic stimulus money is available in significant amounts to companies which offer solutions in the exploding alternative energy sector. If your company is developing or utilizing technology which has applicability in the alternative energy sector, you may want to consider government funding grants or loans that might be made available to you. The field is crowded and the government is nearly overwhelmed with requests, but vast sums remain to be allocated to those who persevere.
- Existing government-backed funding is still an active arena and should be explored: DARPA, the Defense Department-backed federal agency, has for years been funding, directly and indirectly, R&D in technology areas which have the potential for military applications. The funding often is in the form of an outright grant, which does not require repayment or equity dilution.

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U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy
Solid-State Lighting

<i>Title/Subject</i>	<i>Due Date</i>
New OLED Encapsulation Technology	August 10, 2009 at 3:00 p.m. EST
New OLED Electrode Technology	August 10, 2009 at 3:00 p.m. EST
New substrates for OLED devices	August 17,2009 at 3:00 p.m. EST
Prototype Manufacturing of Hybrid OLED Luminaire	August 24, 2009 at 3:00 p.m. EST
High Volume Manufacturing of Hybrid OLED Luminaire	August 24, 2009 at 3:00 p.m. EST



Interview with Tom Edman from Applied Materials



As Applied Materials' Corporate Vice President & General Manager of Corporate Business Development, Tom Edman is responsible for mergers and acquisitions, corporate strategy, venture investing and macroeconomic analysis. Prior to joining Applied Materials, Edman was president & CEO of Applied Films, a capital equipment company supplying the display, solar and architectural glass industries. He holds a bachelor's degree in East Asian studies from Yale University and a master's degree in business administration from the Wharton School of Business. Formerly, Edman served as chairman of the American Electronics Association.

Congratulations on your recent selection as the new chairman of the Governing Board for the FlexTech Alliance. Please tell us about some of the areas where you hope to focus the group. Thank you. I am excited to take on this challenge, and am thankful to the Governing Board for selecting me.

The present timing represents a particularly exciting opportunity as FlexTech transitions to a broader mission that includes flexible substrates while continuing to support the U.S. display industry and infrastructure.

When you hear the phrase “flexible electronics” what does it mean to you? I place my emphasis on the term “flexible” rather than electronics. FlexTech is focused on critical markets that require flexible substrates, including flexible printed electronics, solar and display. There are many processing commonalities across these technologies that will require similar solutions as these industries transition to flexible substrates.

What are some of your thoughts about how the FlexTech Alliance can provide value to the industry? The FlexTech Alliance has a great opportunity to bring together a diverse set of companies that are interested in flexible processing technology. As flexible substrate needs continue to grow, I believe the FlexTech Alliance can provide a forum for these companies to focus on infrastructure requirements, market research needs, technology roadmaps, and general information exchange.

When talking to prospective new members to the FlexTech Alliance, what sorts of things do you say to convince them to join the consortium? I speak to them about the success of the USDC in the display industry that helped to enable the success of a number of infrastructure-related companies including Applied Films (my previous company). I believe the FlexTech Alliance can build upon the excellent reputation of the USDC in Washington as we broaden our mission. This is the right time for companies to come together to have an extensive impact on the growth of flexible substrate processing.

Although US-centric, the FlexTech Alliance encourages membership from companies around the world. Do all members have the same access to funding and support, or do US companies enjoy some advantages? Certainly, the roots of our organization are in the U.S. and in our interaction with the U.S. government. As such, U.S. companies certainly have played the core roles in our organization though we have also been fortunate to have the U.S. affiliates of key European companies join in the past. There is no question that this is now an international industry and we are looking at how we can more broadly involve international organizations in the FlexTech Alliance going forward.

Are there some specific markets or technologies that you think deserve more attention from the FlexTech Alliance than was afforded in the past? I believe the broadening of the FlexTech Alliance mission will allow us to address a number of key industries outside of display. At a recent board meeting, we discussed the exciting developments around touch panels, solar, energy storage and other applications of flexible substrate technologies. All of these industries face similar challenges in commercializing roll-to-roll processing capability.

The annual conference was the first in the industry focused on the topic of flexible displays (and more recently expanded to include flexible electronics generally). The success of the conference has apparently inspired numerous other conference organizers, such that many in the industry believe there is a bit of a glut in terms of conferences on the topic. Any comments, and what sorts of things do you envision the FlexTech Alliance will do to keep things fresh? I have attended the flexible display conference since its beginning, and continue to believe that it is unmatched in the quality of its presentations and participants. This year, we added the business conference to the first day which met with a very positive response. To maintain our position as the premium conference for the flexible electronics industry worldwide, we will continue to expand our conference offerings and future exposition space.

Please give us some background information about Applied Materials, especially as it relates to the FlexTech Alliance. Applied Materials is a leader in providing nano-manufacturing technology solutions around the world. The company's critical focus is on lowering the cost of manufacturing for promising new technologies – particularly in the semiconductor, display and the energy industries. Applied joined the USDC in its early days as a flat panel display equipment manufacturer. As Applied has grown overall and in the display industry in particular, it has continued to work with the USDC and its goal of supporting the flat panel display infrastructure. Applied is encouraged to see the broadening of the mission as well at the FlexTech Alliance as this matches the company's broadened interest in roll-to-roll vacuum processing of thin films, and its goal of lowering overall costs for its customers.



Flexible Displays and Electronics Report

Are flexible displays finally ready for mass adoption?

The 300+-page *Flexible Displays and Electronics Report* contains detailed data and unparalleled analysis on the readiness of various flexible display technologies and their commercial opportunities.

In this new report, DisplaySearch and the FlexTech Alliance forecasts that flexible display revenue will increase from \$85M in 2008 at a compounded annual growth rate of 58% to \$8.2B in 2018. In addition to market forecasts by technology and application, this comprehensive report covers:

- Market readiness of core technologies, suppliers, and manufacturers
- Market drivers impacting the growth of flexible displays and electronics
- Analysis of electrophoretic, electrochromic, OLED, RFID, flexible substrates, active matrix backplanes and more
- Product roadmaps and capacity by technologies and applications

Contact us today for more information on the *Flexible Displays and Electronics Report* and how you can get a complimentary copy of the 85-page Flex Tech Alliance (with assistance from cintelliq) report “*Flexible Electronics: Government Investment and R&D Programs in the U.S. and European Union*”.



A FlexTech Alliance Special Report

Flexible Solid State Lighting:

Technology, Manufacturing and Market Assessment

Summary:

This report is a complete overview of the technologies and market opportunities for print-based, flexible, solid state lighting (SSL). With new SSL technologies, novel form factors can extend and expand lighting applications. It is in this space that print-based, flexible, SSL technologies are poised to enter and change the market place.

Experts agree that new lighting technologies are needed to promote energy efficiency and help reduce the emission of green house gases. Introduction of light emitting diode (LED) and organic LED (OLED) light sources can contribute to accomplishing these goals because of their high conversion efficiency of electricity to visible light.

The 329 page report contains charts, graphs, cost of ownership analyses and many other means to visually depict the flexible SSL market's characteristics and dynamics. Interested in the market for OLED lamps? Device architectures? Materials? Manufacturing, and conversion processes? Then this is the report for you.

Member Price: \$1995

Non-Member Price: \$2,495

Visit www.flextech.org to download the executive summary and table of contents.

Report Features:

- The market opportunities for print-based lighting systems.
- How OLED devices manufactured for display applications need to be adapted for lighting applications.
- Identification and assessments of specific materials that meet the requirements for fabricating white OLEDs with high efficiency and long lifetimes.
- The manufacturing issues associated with producing cost effective light-emitting printed devices.
- Conversion operations required to turn a printed light-emitting structure into a product that can be sold to a consumer.

Produced and Distributed by:

FlexTech Alliance™
for Displays & Flexible, Printed Electronics

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Symposium on the Future of Photovoltaics Manufacturing in the US

National Academy of Sciences

April 23, 2009

The FlexTech Alliance (FTA) participated in a National Academy of Sciences (NAS) Symposium on *the Future of Photovoltaics Manufacturing in the U.S.* The day-long symposium, held in Washington, DC on April 23, 2009 was organized in cooperation with the U.S. Department of Energy. FTA was part of a panel on "Next Generation Flex Display Opportunities", which also included the National Institute of Standards and Technology (NIST) and the Palo Alto Research Corporation (PARC).

Other organizations making presentations at the day-long symposium included Applied Materials, BP Solar, Dow Corning, DuPont, First Solar, IBM, IMEC, NREL, Solar Fields and SunPower. Capitol Hill was represented by Rep. Gabrielle Giffords (D-AZ) and Rep. Marci Kaptur (D-OH).

The Alliance's presentation, *New and Synergistic Opportunities in Flexible and Printed Electronics*, outlined how flexible, printed electronics – including flexible photovoltaics – represents an enormous economic and technical opportunity for U.S. manufacturers and its supply chain. As electronic products become larger, manufacturing methods must adapt. "Micro" and "nano" technologies are important, but device characteristics, e.g., ruggedness, low weight, and conformability, are more important in some applications. Essentially, the new products must be flexible, deformable and, eventually, low cost.

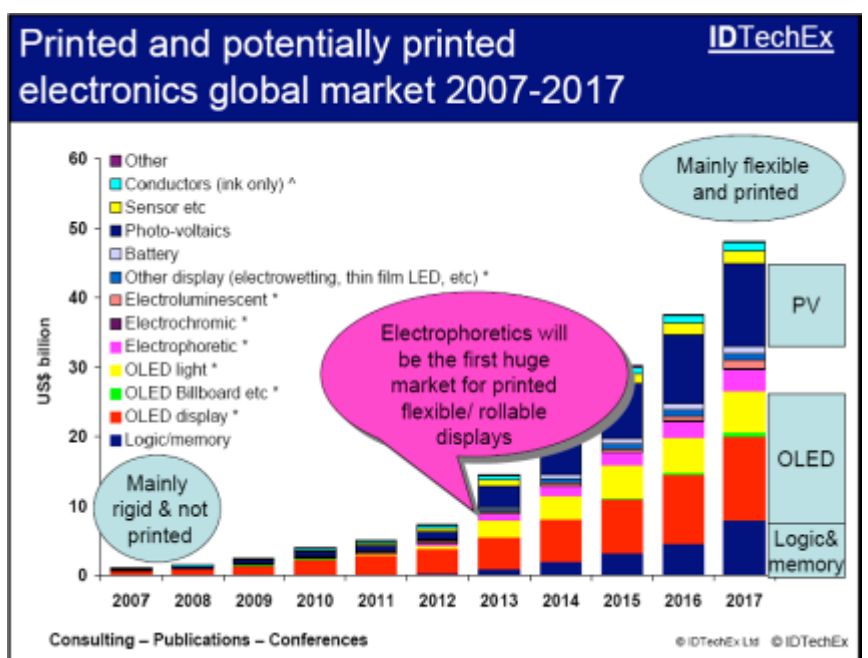
	Flexible & Printed Electronics	Silicon Electronics
Transistors	thousands	billions
Feature Sizes	10's of microns	10's of nanometers
Cost of Fab	~\$ 10M-\$200 M/fab	\$ 2-3 B/fab

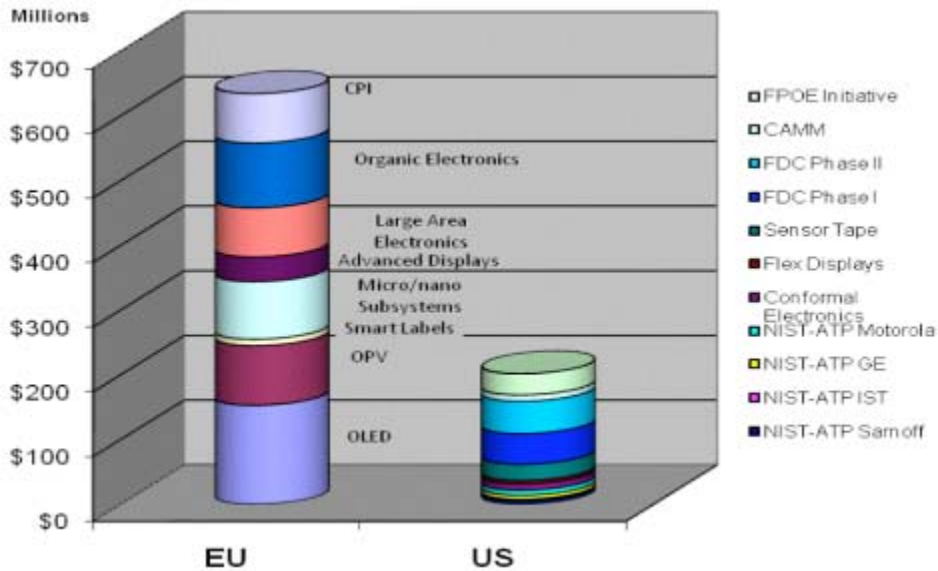
The market opportunity for this diverse industry shows significant growth potential over the next 5-7 years, forecasted to reach nearly \$50 billion in 2017. One of the new equipment processes, roll-to-roll manufacturing (R2R), offers significant advantages over processing of individual substrates, as it can be high speed continuous processing modularized for different unit steps or integrated into a complete line.

Supply chain investments are already being made in substrates, materials, barriers, tools, and processes. Challenges remain for the U.S. to effectively compete in today's global market. Principal among these challenges are increased R&D funding and developing prototypes. The EU is expected to outspend the U.S. in development by over \$500M from 2001-2013.

The other key factor to address for ultimate success in this arena is the transition from R&D to volume manufacturing of products. High volume production capability is achieved through investments in tooling and processes. These must be accompanied by investments in testing and quality control.

FTA urged U.S. policy makers to gain widespread industry buy-in for much





needed collaboration in common infrastructure development and more innovative manufacturing methodologies. Sustained federal and state R&D commitments can ensure fundamental materials knowledge, support tools and processes, and early prototyping of critical needs that drive learning cycles. Consideration of a cross-agency federal initiative is warranted to facilitate cooperation and to move more quickly towards successful commercialization of flexible, printed electronics.

Summary of FlexTech's Quarterly Workshop on Flexible, Printed Electronics

Clemson University

May 14, 2009

The FlexTech Alliance held a quarterly Printed Electronics Workshop, hosted by Clemson University. The Workshop focused on providing end-user markets and technology updates with presentations from Procter & Gamble (commercial electronic applications), the Department of Defense (military applications), and the South Dakota School of Mines & Technology (materials registry program). Discussions focused on the use of printing platforms to produce electrical or functional devices, with breakout groups that centered on the opportunities related to medical sensor applications, materials registry requirements, and commercial packaging sensor applications.

- Procter & Gamble reported that “consumers at heart of what we do”, such that “innovation is our lifeblood”, advising that there are six things P&G needs to succeed with printed electronics: value, scale, toughness, power, safety, and help (with integration into products).
- The DOD advised that they are a driving force for the printed electronics market, representing a microcosm of civilian life with all functions represented but on a smaller scale. The military is an early adopter and as such is a good “test market” that is not as cost sensitive as the commercial markets, therefore providing a good vehicle to move technologies to manufacturing. The military also supports a large infrastructure, commands considerable expertise, and can provide substantial experience in the area of contract manufacturing.
- The South Dakota School of Mines reported on their registry for FPOE materials and manufacturing processes – creating a simple, simple, easily accessible database presenting technical information on functional materials & manufacturing /prototyping processes that enables more efficient selection of application material-sets for FPOE community.
- Clemson University discussed opportunities to use printing platforms to produce electrical or functional devices, including lighting, sensors, power, displays, RFID, and security applications. Each of the commercial printing processes has opportunity for functional ink applications. Printed electronics will use platform/combo style machines in the mediums of flexography, gravure, screen, litho, and inkjet printing. Evaluation criterion includes ink film thickness, imaging/printing resolution,

inking system/ formulation, printing platform capabilities, and functionality. There is a need for an industry partner network to better showcase technology and solutions.

In the area of medical sensor applications, the goal is to build a product demonstrator to showcase printed, flexible electronics as a viable method to fabricate functional electronics and to identify a platform technology to serve as a model for other applications, including security sensors, structural health monitoring, and eventually active control of surfaces in response to stimuli.

With regard to materials registry requirements, the goal is to develop an industry registry for flexible, printed electronics materials and manufacturing processes, creating a simple, easily accessible database of technical information on functional materials and manufacturing/prototyping processes which will enable more efficient selection of application material-sets

In the area of commercial packaging sensors, the goal is to build a product demonstrator using flexible packaging as a media for communicating functional and electronic applications in packaging. The focus is on how the consumer chooses and uses a brand.

In conclusion the workshop was focused on ways to enhance potential future technology development and R&D funding. Product demonstrators need to be developed to showcase viability. The current areas of interest are related to consumer packaging and medical applications.



Save the Dates! Two Events in Binghamton, NY

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August 19, 2009

2nd Flexible Electronics Symposium

Binghamton University, Binghamton, New York

***Joint Networking Dinner**

August 19, 2009

Cost: \$30.00



August 20, 2009

Quarterly Flexible Printed Electronics Workshop:

"Flexible Electronics Medical Applications"

Binghamton University, Binghamton, New York

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Partner update from the CAMM

Uni-Pixel Displays joins the Center for Advanced Microelectronics Manufacturing

by Mark Fihn and Mark D. Poliks, Director of R&D at Endicott Interconnect Technologies, mpoliks@eitny.com

Uni-Pixel Displays recently joined the Center for Advanced Microelectronics Manufacturing (CAMM) at Binghamton University, State University of New York. Supporting the CAMM's mission to demonstrate the feasibility of roll-to-roll (R2R) flexible electronics manufacturing, Uni-Pixel will leverage its recent grant from the FlexTech Alliance to further advance its R2R Conductor Patterning Capabilities that it has developed for its Opcuity Active Layer Films.

Uni-Pixel is the developer of a color display technology called Time Multiplexed Optical Shutter ("TMOS"). The company believes that its advances in inkjet patterning of conductors on thin films can become the basis for developing printed flexible circuits for solar, biomedical, micro-fluidic systems and other markets.

Leading the project for Uni-Pixel will be Dr. Ram Ramakrishnan who has been the key scientist behind the advances in Uni-Pixel's conductor patterning development. During the course of development of the unique polymer films used in the company's TMOS displays, Uni-Pixel has pioneered a method to use an inkjet printing system to pattern conductors on films at significantly thinner trace widths than previously achieved. This discovery provides the potential to enhance roll-to-roll printed electronics manufacturing by dramatically improving flexible printed circuitry, while at the same time reducing the cost of production. Dr. Ramakrishnan has led the efforts that have developed methods that use surface structure and surface chemistry to achieve sub-5 micron trace widths on the surface of flexible substrates. Currently this process is conducted in a batch environment at Uni-Pixel where the methods and results have been well refined.

As a contribution to the CAMM's capabilities to support Uni-Pixel's project, a specific inkjet system platform will be acquired and installed at the CAMM. This printer will provide Uni-Pixel with the capability to support the transition of its processes and techniques.



Mark Poliks (left) and Bahgat Sammakia (right) of New York's Center for Advanced Microelectronics Manufacturing in Binghamton, N.Y. congratulate Dr. Ram Ramakrishnan (center) of Uni-Pixel Displays, Inc. on his advanced conductor patterning developments at Uni-Pixel and the collaboration planned to advance the techniques into roll-to-roll manufacturing processes for the flexible printed electronics industry.

Partner update from the FDC

by Shawn M. O'Rourke, Director of Engineering, Flexible Display Center

The Flexible Display Center at Arizona State University exhibited various electrophoretic flexible display technology and applications demonstrators, including an early build of a 3.8-in diagonal color EPD display utilizing an in house developed flexible color filter as well as their 4.1-in diagonal PHOLED display on PEN, at the SID 2009 conference in San Antonio, TX. They also presented two talks: Flexible CMOS and Electrophoretic Displays, as presented by D. Allee in collaboration with UT-Dallas, B. Gnade and AM PHOLED Displays on Temporary Bonded Polyethylene Naphthalate Substrates with 180°C a-Si:H TFTs, as presented by Doug Loy.

The FDC has also taken delivery of a deposition system from Vitex to allow for the processing of thin film encapsulation on OLEDs and continues to make steady progress in processing a-Si TFTs on GEN II (370mm * 470mm) HS-PEN using their proprietary bond/debond process.



Amorphous Si TFTs on Temporary Bonded GEN II HS-PEN in Process at the Flexible Display Center

Additionally, the FDC and the University of Texas at Dallas (UT Dallas) announced that they have successfully produced CMOS circuitry on a flexible plastic substrate. Primarily designed to advance flexible electronics, the new plastic CMOS circuits have demonstrated exceptional power efficiency, one-third the power consumption of traditional thin film transistor circuitry, making flexible CMOS ideal for potential applications such as smart medical bandages or triage patches. The research and development project has focused on integrating two types of thin film transistors (TFTs), n-type amorphous silicon and p-type organic silicon, to fabricate CMOS logic gates on flexible polyethylene naphthalate (PEN), a high-temperature polyester film. The electrical duality between the NMOS and PMOS transistors achieves dramatically reduced power consumption for flexible circuits. <http://www.utdallas.edu>



CALL FOR PAPERS

9th Annual FLEXIBLE ELECTRONICS AND DISPLAYS CONFERENCE

February 1-4, 2010

*Pointe Hilton Squaw Peak
Phoenix, AZ*

Submission Due Date: September 14, 2009

FlexTech Alliance invites you to submit an abstract for our **9th Annual Flexible Electronics and Displays Conference and Exhibition 2010** (www.flextech.org). This is the premier event in North America to hear about the latest technical and market advances in flexible, printed electronics and displays. Join a field of international experts from industry, academia and R&D labs, addressing technical and business issues, advancements impacting the flexible electronics field, and areas where displays are a key driver. Conference sessions will focus on the emerging field of flexible, printed, and organic electronics manufacturing, including solar and photovoltaics, solid-state lighting, RFID, sensors, touch, energy storage, medical devices, and flexible display applications and markets.

Our annual conference attracts over 400 attendees, representing at least 200 companies, universities, R&D labs, and government agencies. Attendees represent technical, marketing, product development, manufacturing, and business planning functions, as well as the many different segments of the flexible electronics and displays value and supply chains.

This year's agenda will focus on all critical topic areas in displays and the emerging field of flexible, printed, and organic electronics. Topic areas sought in the **Call for Papers** are:

- Strategic Market and Business Overviews
- Materials Advancements for Flexible Electronics
- Manufacturing on Flexible Substrates
- Flexible Displays
- Flexible Electronics-Based Applications and Products, including
 - Solar/Photovoltaics
 - Solid State Lighting and OLEDs
 - Printing Processes and Technologies
 - Equipment for High-Throughput Electronics Manufacturing
 - Smart Sensors
 - Touch
 - Medical Devices
 - Energy Storage/Batteries
 - RFID

Important Deadlines:

- | | |
|--|-------------------------|
| • Submission of Abstracts | September 14, 2009 |
| • Notification of Abstract Acceptance | October 8, 2009 |
| • Presenter Commitment to Present | October 15, 2009 |
| • Draft IEEE published paper submissions | November 2, 2009 |
| • Final IEEE published paper submissions | December 14, 2009 |
| • Final PowerPoint Submission | January 18, 2010 |

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News and news links from the FlexTech Alliance

excerpted from Veritas et Visus newsletters

Prime View International reaches agreement to acquire E Ink

Prime View International announced that it has signed a definitive agreement to acquire E Ink Corporation for approximately \$215 million. The new company will expand capacity and develop improvements for e-paper display screens. The deal is the culmination of a transformation at PVI over the past four years to focus on electronic paper displays. In 2005, PVI acquired the e-paper business of Philips Electronics and partnered with E Ink to provide displays for electronic books including the Sony Reader and the Amazon Kindle 2 and Kindle DX. PVI also invested heavily in dedicated driver chips and touch screens for e-paper, as well as flexible displays, which will be marketed later this year. In 2008, PVI bought a 74% stake of Hydys Technologies of Korea, quadrupling capacity for the transistor backplanes used in e-paper. With the merger, PVI gains substantial intellectual property and employee talent, while securing supply of a critical component during the rapid growth phase of the market, and adding alliances and relationships across the e-paper and flexible display industry. <http://www.eink.com>

E Ink announces large format display in its electronic prototype kit

E Ink announced that it has enhanced its lineup of AM-300 EPD Prototype Kits by adding a 9.7-inch display to its suite of offerings, enabling development across a wider range of application sizes. This third generation, high-resolution developer kit also contains a graphical electronic paper display with pen input. The Broadsheet kit enables customers to quickly prototype and develop next generation e-paper products. <http://www.eink.com>

HP enables new field of flexible electronics with reflective display technology

HP announced the launch of a new display technology for the personalization of consumer electronics products. Electronic Skins, or eSkins, is a flexible reflective color film that can be applied to a variety of devices – including mobile phones, digital cameras, MP3 players, netbooks and notebooks. eSkins also can reflectively display icons and alphanumeric characters. HP eSkins technology offers brand manufacturers new ways to personalize their products with an electronically controlled color surface created using HP's roll-to-roll manufacturing platform. Designed to make fine-scale circuitry on plastic substrates, the platform processes flexible screens in rolls rather than individual sheets, offering the potential for more cost-effective manufacturing. This new device architecture is compatible with roll-to-roll plastic circuits that can be combined with proprietary, electrically controllable "inks" to achieve print-like color performance, as well as transparency. Using a technology similar to color printing, HP is developing the capability to produce specific "ink" colors within the Pantone Matching System range. The print-quality colors have visibility in direct sunlight and can electronically shift into a transparent state, revealing the surface below the eSkin. <http://www.hp.com/>



HP Electronic Skins, or eSkins, is a flexible reflective color film that can be applied to a variety of consumer electronic devices for product personalization

Plextronics & NTERA demonstrate solar-powered NanoChromics displays

Plextronics and NTERA recently demonstrated a functional demonstrator features NTERA's innovative NanoChromics display technology, and is directly powered by a Plextronics Organic Photovoltaic (OPV) solar cell printed with Plexcore ink technology. This integrated demonstrator does not require any active electronic components, which captures the simplicity of combining these printed electronic technologies. By combining energy harvesting technologies (such as OPV) with printed displays, it's possible to achieve cost-effective, self-powering solutions for these applications. <http://www.ntera.com> <http://www.plextronics.com>

Plastic Logic demonstrates latest e-reader ahead of launch next year

Plastic Logic has demonstrated a touch-screen reader designed to compete with Amazon's Kindle DX. It will launch it next year. The Plastic Logic product will reportedly include a touch screen, a tabbed interface for managing recent content, and the ability to natively display a variety of office content, such as Excel and PowerPoint documents. It will also offer WiFi connectivity in addition to 3G. One content provider for Plastic Logic's consumer market, however, could be Google. Google is in the process of reaching a settlement with the copyright holders that sued it over its book-scanning activities. That settlement would turn Google into a book retailer, selling copies of out-of-print books that it has digitized. <http://www.plasticlogic.com/>

FDC and Universal Display Corporation make breakthrough in flexible manufacturing process

The Flexible Display Center (FDC) at Arizona State University and Universal Display Corporation introduced the first a-Si:H active matrix flexible OLED display to be manufactured directly on DuPont Teijin's polyethylene naphthalate (PEN) substrate. The 4.1-inch flexible backplane display was manufactured at the FDC utilizing a 180°C thin film transistor process. The integration of Universal Display's PHOLED frontplane delivers a key enabling technology for the flexible OLED. The PHOLED materials allow the OLED to convert up to 100% of the electrical energy into light. <http://www.flexdisplay.asu.edu> <http://www.universaldisplay.com>

Universal Display's shows off flexible OLED bracelet

Universal Display Corporation announced that its designer OLED bracelet. The bracelet uses the company's energy-efficient phosphorescent, flexible, and transparent OLED technologies. The bracelet features a wrap around electronic OLED display using Universal Display's phosphorescent OLED materials on a flexible metallic substrate. The resulting display is then integrated into a contemporary bracelet design. Emory Krall, Universal Display's OLED prototype designer, transformed the company's OLED bracelet concept into this wearable art form. This wearable concept utilizes the unique design capabilities of OLED technology, including its light and thin form factor and flexibility, as well as the low power consumption of the company's PHOLED technology. Krall, who has designed a wide range of products including lighting and furniture, has had his work featured in numerous gallery exhibits, as well as various books and magazines. <http://www.universaldisplay.com>

**UDC awarded \$750,000 SBIR contract from US Air Force for flexible OLED displays**

Universal Display Corporation announced that it has been awarded a \$750,000 Small Business Innovation Research (SBIR) Phase II contract from the United States Air Force Research Laboratory. Work under the program, titled "Low-Power, Direct-View Flexible Displays," will focus on the development of a non-glass, ejection-safe, flexible OLED display prototype for prospective use by pilots in tactical cockpit settings. Developed in collaboration with L-3 Communications Display Systems and LG Display, the flexible phosphorescent OLED display prototype will be energy efficient, offer full-color video rate and have wireless communications capabilities. In addition, it will have the capability to be wrapped around a cylinder for easy storage during flight. The design goal is to provide Air Force pilots with a replacement for printed maps and checklists typically held on their knees in tactical cockpits. <http://www.universaldisplay.com>

UDC and Samsung present advances in long lifetime green phosphorescent OLEDs

Universal Display Corporation announced new highly-efficient green PHOLED performance advances, achieving two milestones. A green PHOLED with NTSC color at CIE (0.20, 0.73), high luminous efficiency of 110cd/A, and a low voltage of 3.6V at 3,000cd/m² was achieved. A second device structure using this green PHOLED material system also achieved an ultra-high luminous efficiency of 160cd/A along with CIE (0.28, 0.69) and low voltage of 3.8V at 3,000 cd/m². Replacing the green fluorescent OLED material typically used in an AMOLED with this new green PHOLED can result in a 37% power saving. <http://www.universaldisplay.com>

DuPont Displays surpasses million-hour milestone for lifetime of new OLED material

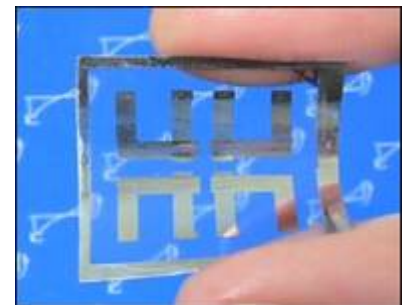
DuPont Displays announced it has developed a new, proprietary third generation (Gen 3) solution-based OLED materials technology, which has led to substantial performance gains for printable OLED light-emitting materials. A DuPont Gen 3 green OLED material achieved a record lifetime of over 1,000,000 hours, while two new Gen 3 blue materials have been developed that set new standards for longevity and color, the company says. <http://www.DuPont.com>

Polytos project launched by the “Forum Organic Electronics” excellence cluster

Merck announced that it has launched the “Printed Organic Switches and Chips” project (Polytos) together with its partners in the excellence cluster known as the “Forum Organic Electronics”. The aim of this project, which is being sponsored by the German Federal Ministry of Education and Research (BMBF), is to develop new materials, concepts, components, manufacturing processes and software for printed organic circuits with integrated sensors for applications in the packaging industry. In addition to Merck, the consortium partners involved in the project are BASF, Pepperl+Fuchs, PolyIC, Robert Bosch, SAP, the University of Heidelberg, the Technical University of Darmstadt and the University of Mannheim. Copaco, Innovation Lab, and VARTA Microbattery are associate partners. The consortium partners are aiming to complete the first basic demonstrators in a three-year period. The total costs of Polytos will amount to around € 13.8 million. The German Federal Ministry of Education and Research will provide funding of around € 7.2 million; the industry partners will contribute around € 6.6 million themselves. <http://www.innovationlab.biz>

NIST develops flexible memory components from polymer sheets

The National Institute of Standards and Technology (NIST) found a way to build a flexible memory component more cheaply from readily available materials and NIST has filed for a patent on the device. The researchers took polymer sheets and experimented with depositing a thin film of titanium dioxide on their surfaces by a sol gel process. By adding electrical contacts, the team created a flexible memory switch that operates on less than 10 volts, maintains its memory when power is lost, and still functions after being flexed more than 4000 times. <http://www.nist.gov>

**Kent Displays Names Dr. Asad Khan Chief Technical Officer**

Kent Displays announced the naming of Dr. Asad Khan as Chief Technical Officer (CTO). Dr. Khan replaces Dr. J. William Doane, a pioneer in reflective LCD technology and Director Emeritus of the Liquid Crystal Institute at Kent State University. Dr. Doane has moved to the role of Senior Advisor and will remain on Kent Displays' Executive Committee. <http://www.kentdisplays.com>

University of Texas licenses method that speeds electronics manufacturing to Versatilis

The University of Texas at Austin licensed a time-saving technology for electronics manufacturing to Versatilis LLC of Shelburne, Vt. The technology, a dual-tone photo-resist that saves steps in the manufacturing process, was developed by Dr. Grant Willson, a professor in the Department of Chemical Engineering, and his students under a development agreement with Versatilis. The underlying technology eliminates costly masking steps and problems encountered in attempting photolithography on flexible substrates. It uses multiple wavelengths of light to capture multiple patterns in photo-resist layers simultaneously rather than through a repetitive, sequential process as is conventionally done. <http://www.versatilis.com>

ECD to deliver photovoltaic systems for commercial roofs

Energy Conversion Devices (ECD) and Johns Manville (JM) reached a multi-year agreement for ECD to supply its UNI-SOLAR laminates to Johns Manville. To support its entry into the field of solar energy, at less than one pound per square foot, UNI-SOLAR laminates are lightweight, non-intrusive and require no rooftop penetrations or mounting systems, eliminating the negative impact on roof life and performance that is associated with penetrating PV systems. Additionally, these thin-film PV laminates provide a solid return on investment through a low installed cost and low cost-per-kilowatt-hour of energy produced when compared to traditional rigid glass panel PV alternatives. <http://www.ovonic.com>

Dow Corning transforms business to focus on sustainability, efficiency and alternative energy

Dow Corning is transforming its business strategy to help customers to be more efficient, innovative and sustainable as they navigate dynamic economic, social and environmental megatrends. The company will focus on innovating materials and solutions for critical industries such as electronics, construction, health and personal care, among others. The company anticipates more than 50 percent of its innovation portfolio will be on projects linked to sustainability. A significant area of focus will be solar power to help the solar industry move towards being economically competitive with conventional energy sources, and become a sustainable energy option. <http://www.xiameter.com>

NanoGram announces inkjet-able nano-particle silicon ink

NanoGram announced the successful fabrication of the first TFT produced by ambient printed nano-silicon to reach a carrier mobility of 2.0 cm²/Vs. The TFT is based on a non-pyrophoric material and was produced by Sharp Laboratories of America. NanoGram's printable silicon material is based on nano-scale crystalline silicon particles formulated into inks, which can be ink-jetted or spin coated onto a substrate and then fabricated into a TFT. The proprietary ink technology was developed as part of NanoGram's technology development agreement (TDA) with Teijin Limited. <http://www.nanogram.com>

FlexTech Alliance awards Uni-Pixel contract to develop roll-to-roll conductor patterning process

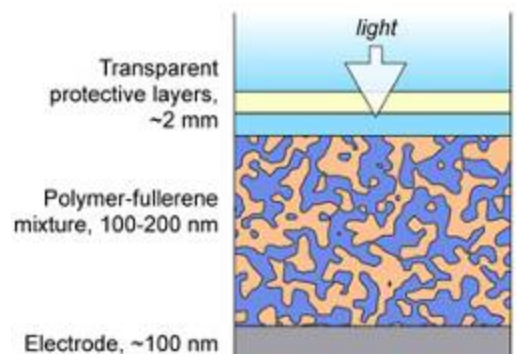
Uni-Pixel was recently awarded a contract by the FlexTech Alliance for further advancement of its Roll to Roll Conductor Patterning Capabilities that it has developed for its Opcuity Active Layer Films. Uni-Pixel has developed methods that use surface structure and surface chemistry to achieve sub-5 micron trace widths on the surface of flexible substrates. Currently this process is conducted in a batch environment at Uni-Pixel where the methods and results have been well refined. This contract and grant from the FlexTech Alliance serves to recognize this industry leading capability and provide support to demonstrate this process for conductor patterning in a continuous flow system. <http://www.unipixel.com>

Uni-Pixel announces availability of Opcuity finger print resistant film test samples

Uni-Pixel announced the availability of test samples of its Opcuity FPR (finger print resistant) film. Opcuity FPR leverages newly developed production techniques to produce a transparent protective cover film that can be applied to any touch screen display surface – preventing finger prints and other smudges while maintaining an optically clear view of the device display. The film also provides scratch protection, anti-glare and offers a silky smooth touch interface for device users' fingers. Uni-Pixel has been working to perfect the production technique and to prove its compatibility with roll-to-roll production systems. The completion of recent test runs has demonstrated success and produced pilot production samples that can be applied to touch screen enabled hand held devices. <http://www.unipixel.com>

NIST scientists develop improved organic solar stack

The National Institute of Standards and Technology (NIST) has developed a new class of economically viable flexible solar power cells. Organic photovoltaics start out as a kind of ink that can be applied to flexible surfaces to create solar cell modules that can be spread over large areas as easily as unrolling a carpet. The NIST team has developed "ink" that is a blend of a polymer that absorbs sunlight, enabling it to give up its electrons, and ball-shaped carbon molecules (fullerenes) that collect electrons. When the ink is applied to a surface, the blend hardens into a film that contains a haphazard network of polymers intermixed with fullerene channels. <http://www.nist.gov>



Philips sells its remaining stake in LG Display for €630 million

Royal Philips Electronics announced it has sold its remaining stake in LG Display to investors in a capital markets transaction. This transaction represents 13.2% of LG Display's issued share capital, or 47.2 million of common stock, and reduces Philips' holding to zero. The transaction will provide Philips with net proceeds of approximately €630 million, and is expected to result in a non-taxable gain of approximately €70 million in the first quarter of 2009, which will be recognized in financial income and expenses. <http://www.philips.com>

FUJIFILM Dimatix introduces new DMP-3000 Materials Printer

FUJIFILM Dimatix introduced today its new Dimatix Materials Printer (DMP), the DMP-3000, a non-contact, fluid deposition system capable of jetting a wide range of functional fluids using multiple FUJIFILM Dimatix fluid deposition printheads interchangeably. The new DMP-3000 features a printable area of 300x300 mm and maintains a positional accuracy and repeatability of $\pm 5 \mu\text{m}$ and $\pm 1 \mu\text{m}$, respectively. Multiple FUJIFILM Dimatix printhead models including the 1 and 10 picoliter DMP Cartridge-based printheads and the SX3 and SE3 hybrid production-worthy printhead models are used interchangeably with the DMP-3000 printer. Because FUJIFILM Dimatix cartridge printheads and high performance printheads can be used interchangeably within the same unit, scale-up from development to production can readily occur. <http://www.dimatix.com>

Cytec Joins Flexible Display Center

Cytec Industries announced its membership to the Flexible Display Center (FDC) at Arizona State University. Cytec joined the FDC to provide innovative solutions to the unmet material needs of the current flexible display market, and in turn to partner with some of the leading institutions and companies in this fast emerging market space. <http://www.cytec.com> <http://flexdisplay.asu.edu>

Cytec and IMEC collaborate to extend the lifetime of organic solar cells

US specialty chemicals and materials group, Cytec Industries, has teamed up with IMEC, a leading European nanoelectronics research center, to commercialize enabling technologies for extended-lifetime organic photovoltaic devices. The two-year initiative is co-sponsored by the Institute for the Promotion of Innovation by Science and Technology, Belgium, according to optics.org. To date, the bulk of the international research effort on organic solar cells has focused on increases in conversion efficiency. However, the operational lifetime of organic solar cells must also be improved to beyond five years – now being tackled by Cytec and IMEC. IMEC unveiled plans for a €70m expansion of its R&D facilities. The investment will fund an extra 2800m² of laboratory space to support research on 22nm CMOS. <http://www.imec.be>

Konarka and Arch Aluminum & Glass sign advanced product development agreement

Konarka Technologies announced the company has entered into an advanced product development agreement with Florida-based Arch Aluminum & Glass. The companies plan to collaborate on building integrated photovoltaics (BIPV), photovoltaic materials used to replace conventional building materials. The memorandum of understanding outlines the integration of Konarka's patent-protected thin film solar material into glass for various commercial BIPV applications. <http://www.archaluminum.net> <http://www.konarka.com>

PNNL and Vitex develop process to help protect flexible solar power panels

A transparent thin film barrier used to protect flat panel TVs from moisture could become the basis for flexible solar panels that would be installed on roofs. Researchers at PNNL will create these flexible panels by adapting a film encapsulation process currently used to coat flat panel displays that use OLEDs. The work is made possible by a Cooperative Research and Development Agreement recently penned between Vitex Systems and Battelle, which operates the Pacific Northwest National Laboratory (PNNL). The encapsulation process and the ultra-barrier film are already proven moisture barriers, but researchers need to find a way to apply the technology to solar panels. If successful, this process will reduce solar panel manufacturing costs to less than \$1 per watt of power, which would be competitive with the 10 cents per kilowatt-hour that a utility would charge.

<http://www.pnl.gov> <http://www.vitexsys.com>

**Infinite Power Solutions launches its THINERGY micro-energy cell**

Infinite Power Solutions (IPS) unveiled its THINERGY family of micro-energy cell (MEC) products and accompanying technical specifications. THINERGY MECs are the world's most powerful batteries for their size and outperform all other micro-batteries (primary and rechargeable), including Li coin cells, printed batteries and other thin-film batteries (TFBs). Combined with ambient energy harvesting, THINERGY MECs deliver perpetual power to wireless sensor nodes and other micro-systems for more than a decade of maintenance-free operation. <http://www.InfinitePowerSolutions.com>



Industry Research – FlexTech research reports provide valuable insights into economic and technology trends of the electronic displays and flexible electronics industries and its primary markets. Providers include DisplaySearch, Fuji Chimera, Insight Media, Toray Research Council, and Veritas et Visus. Collectively, the reports are a \$27,000 value!



R&D Program – FlexTech's R&D has two elements for members:

- Gap analysis and technical roadmapping that identifies and resolves key technical challenges
- Pre-competitive R&D funding to provide funds for projects defined by member interests.



Networking & Partnering

- Technical Conferences & Workshops – led by our flagship event, the *Flex Conference*
- Regional Meetings – great networking events at member locations
- Business Conference – connection with potential investor and partners



Member Marketing

- On-line Resources – www.flextech.org is a portal for members' corporate information
- Advocacy – industry voice with the media and federal and state governments
- Demo Creation – FlexTech facilitates the development of product demonstrators

**To Schedule a Company Meeting, Call Kay
Mascoli at 1-408-993-8111**
**For More Information and Membership Forms,
visit**
www.flextech.org