

Printed Electronics *NOW*

PE USA 2011 Showcases Growth of Commercialization of Printed Electronics Products

By David Savastano

There has been much potential for growth in printed electronics (PE) in recent years, as improvements in raw materials and equipment technology are continuing on a consistent basis. However, people are waiting to see more printed electronics products reach end users.

There have been success stories, such as E Ink and the eReader market and some novelty products. However, aside from E Ink, mainstream success has been elusive.

There appears to be good news ahead for the PE market, though. Much of the first day of Printed Electronics USA 2011, held at the Santa Clara Convention Center, has focused on some of the commercial successes of PE, as companies ranging from Procter & Gamble and MWV Packaging to T-Ink and Nth Degree are heading to market with compelling products that signal that commercialization of PE is moving closer.

Raghu Das, CEO, of IDTechEx, Printed Electronics USA 2011's organizer, led off the conference with an overview of the PE field, titled "Printed Electronics State of Play: 2012-2022." Das discussed successes in the last 12 months, market forecasts by sector, hottest applications and significant technology breakthroughs.

Das placed the printed and potentially printed electronics market to be \$4.5 billion in 2011. He broke down the PE market into three main strategies. The first, Replace Nothing, is a field that creates new value; eReaders, a \$1 billion industry, is one example.

The second category, Replacing Something Simple in Existing Electronics/Electrics, is seen in the work being done on PEDOT:PSS as an alternative to ITO on touch screens, as well as the development of conductive copper inks as an alternative to silver. The third strategy, Replacing a Whole Existing Electronic, can be seen in the work being done on OLED displays and lighting as well as RFID tags replacing conventional silicon RFID.

"This can take much longer than expected," Das added.

Das projected the potential PE market to be \$45 billion by 2021, led by OLED, which IDTechEx estimates will be 35 percent printed within the decade.

Dr. Kenneth McGuire, principal scientist at Procter & Gamble (P&G), was next, covering "Consumer Electronics Applications." P&G had sales of more than \$80 billion in 2010, having 24 \$1 billion brands, and its interest in PE has long been seen as an important signal. Dr. McGuire said that P&G focuses on the end-users experience, both at the first moment of truth (store shelf) and second moment of truth (actual usage of the product).

"Consumer understanding is at the heart of everything we do at P&G," Dr. McGuire said.

Dr. McGuire said that PE features three distinct areas - displays, logic and power storage - and all are needed to function for the system to work.

"I think of printed electronics as three distinct areas, and most do not overlap with today's industry," Dr. McGuire said. "For most applications, all three would be required, but how do you integrate all three?"

P&G did announce its first PE packaging system. In conjunction with Nth Degree, P&G recently designed a Puffs dispenser that utilizes printed electroluminescent lighting actuated by a non-disposable base with printed contacts. For P&G, the key is to have consumers see the value of the product.

"If the product is a first moment of truth application, where do you get the power," Dr. McGuire asked. "If it is a second moment of truth application, how do you communicate it to the customer?"

Michael Londo, director of open innovation at MWV Packaging, next analyzed "When Technology and Market Need Match," a look at how printed electronics can help provide security systems for retailers.

MWV has developed its Natralock system with Siren technology in conjunction with Western Michigan University, Alpha Shrink Solutions and Vorbeck Materials. It is a reusable module using conductive graphene inks that are flexographically printed inside the box. This system can impact inventory shrinkage in the marketplace without the use of bulky security systems; estimates place shrinkage at Wal-Mart at 1.4 percent, which for a company with more than \$400 billion in annual sales, works out to more than \$5.6 billion in lost or stolen inventory.

"We have done smart packaging since 2004," Londo said. "Brand owners are looking for security applications that do not detract from the first moment of truth. We can put the electrical wires on the inside of the box."

Londo noted that the system is robust, and able to pass multiple 3 foot drop tests, and for retailers, the return on investment would pay for itself within six months. He expects the launch of the new system in 2012, adding that “the technology push in conjunction with market pull provides these opportunities.”

Warren Kronberger, R&D director, The Marketing Store, talked of the potential of printed electronics in "The Promotional Marketing Landscape & Printed Electronics." Kronberger spoke of the changes in promotional toys over the years, from in-mold plastic toys to highly complex LED toys, and has collaborated with companies ranging from T-Ink and NXT on conductive projects.

“Printed electronics can play a new role in the play experience,” Kronberger said. “For the most part, printed electronics is invisible to customers.”

During their talk, Andrew Ferber and Jeff Gentile, co-chairmen of T-Ink Inc., offered a compelling case for the use of PE throughout everyday life. In the past decade, T-Ink has developed PE systems that Gentile noted encompassed “the low hanging fruit,” such as promotional items, and is now moving quickly forward into more commercial platforms.

One of the most fascinating examples of PE that is heading into the marketplace in 2012 is T-Ink’s printed modules for automotive roof liners. Replacing much larger, heavier modules, T-Ink has created a lightweight, more functional printed system for automakers. T-Ink’s printed roof liners reduce the component’s weight by 70 percent, and its width from 2.75 inches to 0.25 inches. Even more impressively, T-Ink’s printed module offers fast switching on the order of 10 times. The company anticipates more than a million of the units will appear in cars in 2012.

“We can replace physical 3-D switches with 2-D printed components,” Gentile said.

T-Ink has had numerous successes in segments ranging from toys video games and smart wear in recent years, and Gentile added that this new platform will allow T-Ink to reach new markets such as construction and transportation in the coming years. Ferber noted that T-Ink has more than 2,000 ink and coating formulations, and can print its systems through offset, gravure, flexo, rotary, pad printing, spray coating or any standard printing process.

“If designers can draw a product, we can print it,” Gentile concluded. “We create game-changing products and services through conductive ink to connect the world.”

The military and aerospace industries are also actively pursuing PE solutions. Dr. Brian Fuchs, mechanical engineer, U.S. Army, presented "Overview of Materials Printing Capabilities and Prototype Development for U.S. Army Applications." Dr. Fuchs discussed the potential for printed electronics in Army applications.

“We are always interested in state-of-the-art technology such as printed electronics for military systems,” Dr. Fuchs concluded.

Jeff Duce, design engineer for Boeing, discussed "Applications, Needs, and Requirements for Printed Electronics in Aerospace." He focused on commercial airplane applications, and the benefits printed electronics bring to Boeing. For example, the Boeing 747-8 uses a form of printed electronics on its damage detection sensor on the VCK flaps, and PE can also be utilized in areas ranging from entertainment displays to integrated wiring.

“We need our airplanes to be more efficient,” Duce said. “Printed electronics are lower weight, and a 1 percent weight reduction on airplanes can create billions in operating cost savings while adding capability. Printed electronics is a key enabler, and Boeing needs new developments in printed electronics.”

Sriram Peruvemba, chief marketing officer, E Ink Holdings, then discussed "My eReader Ate the Library." Peruvemba offered his thoughts on change in the field of education and the role of traditional textbooks vs. electronic displays, and said that E Ink Pearl holds 90 percent of the market share.

Peruvemba noted that 30 percent of libraries in the U.S. have reduced their hours, and that libraries have been on the decline for a long time.

“Elementary school kids are now doing their research on the web,” Peruvemba said. “Libraries will still be around for a long time, but it is about access to knowledge and cost of content.

“eTextbooks are the future of education,” Peruvemba concluded. “The potential market is billions of devices. All textbooks will become electronic in the future.”

Dr. David Hamby, research scientist for OSRAM Sylvania, discussed OLED lighting in "Challenges and Opportunities for Printed Electronics in the Lighting Industry." He discussed inorganic LEDs in general lighting and requirements for printed electronics in lighting.

“One of the most obvious opportunities is printing the circuits,” Dr. Hamby said. “Printed circuits open up material choices such as PET, and the value proposition is lower cost, large area printed circuits through roll-to-roll manufacturing. Roll-to-roll printing of OLEDs offers the promise of fast, high volume processes and an easier supply chain.”

Dr. Mikyong Yoo, senior materials engineer for Artificial Muscle, discussed "Conformable ViviTouch stickers - a New Dimension to Actuators." Dr. Yoo highlighted Artificial Muscle's ViviTouch pressure sensitive adhesive stickers

utilized on haptic actuators for areas such as gaming controllers, creating different frequencies for actions such as helicopters flying about and explosions.

“Gaming controllers and headphones are limited to a standard buzzing technique,” Dr. Yoo said. “ViviTouch brings new sensory dimensions to mobile gaming.”

Dr. Peter Fischer, director of engineering for Plastic Logic GmbH, discussed "Challenges on the Way from Lab to Large Area Volume Manufacturing of OTFT Backplanes and a First Application in Flexible Displays."

“It is difficult to scale up,” Dr. Fischer said. “The equipment was different than the pilot line set up, and we had to test new materials. Process differences had consequences on the equipment.”

Dr. Edzer Huitema, CTO of Polymer Vision, discussed "Flexible Displays Development and Commercialization Efforts." Polymer Vision has developed flexible, rollable displays that can be used in areas ranging from eReaders and smart cards to eTickets and smart phones.

“The key ingredients for rollable displays are a thin display and optimized adhesive,” Dr. Huitema said. “Going down to a 4 mm radius is possible. We are at the forefront of the ‘era of flexible displays.’”

David Lussey, CTO of Peratech Ltd., showcased "Quantum Tunnelling Composites in Printable Electronics." A composite of nickel and silicon, printed Quantum Tunnelling Composites (QTC) have found opportunities for keypads and switches for fields such as robotics and textiles, and are ideal for touch screens.

Plastic Electronic GmbH CEO Philipp Weissel presented a talk on “Storeskin - the Smarter Shelf.” He noted that store shelves have not changed over the decades, even though online buying has changed the way retailers collect information on customers’ preferences.

Plastic Electronic has developed Storeskin, a sensor system that detects all movements on the shelf and collects real-time information while providing specific product information for customers. It can also provide inventory information and deter theft.

“The shelf is the hero,” Weissel said. “It is the place of buying decisions, the place of stock values and the place of thefts.”

The final talk of the afternoon, "Inorganic LED Lighting using Innovative Transparent Conductors," was presented by Dr. William J. Ray, chief scientist of Nth Degree Technologies. Nth Degree has successfully printed LED lighting, and the

results are impressive, to say the least. Dr. Ray noted that the company has orders for its systems, and has the capacity to print the equivalent of 250 million A-19 light bulbs per year on its flexo web press.

“We print LEDs,” Dr. Ray said. “We use 27 micron LEDs, the size of a white blood cell, release it into the ink and print it in a series of layers. We print using high speed screen presses, and will be converting to flexo in the next quarter.”

The products that were showcased during the first day of Printed Electronics USA 2011 show the potential for printed electronics designers and manufacturers to develop new solutions for the marketplace, and these products offer the promise of more to come for the field of printed electronics in the coming years.