PLASTIC ELECTRONICS UPDATE

Introduction of organic light-emitting diode television sets by Electronics. These 55-inch OLED TV sets will hit the market later this year, offering consumers a thinner, higher-resolution alternative to liquid crystal display-based TVs.
OLED technology is seeing wider implementation this year, in displays, lighting and organic electronics, according to NPD DisplaySearch. The market research firm estimates that OLED displays had sales of more than $4 billion in 2011 and forecasts that the market will exceed $20 billion by 2018. OLED lighting is forecast to generate $6 billion in annual sales by 2018.

“OLED displays operate through direct emission, as opposed to transmissive LCD or reflective displays, which enables area lighting,” said Jennifer Colegrove, Vice President of Emerging Display Technologies for NPD DisplaySearch. “The technology has made good progress and is ready to enter large-size applications, but low-cost manufacturing for large sizes is still a challenge.”

Market forecasts for OLEDs and other plastic electronics (also known as flexible electronics) vary widely, with some research reports putting compound annual growth rates for such products at 30 percent.

The Plastic Electronics Exhibition and Conference will be held concurrently. SEMI acquired the conference in February of 2012 and has formed a special interest group devoted to plastic electronics.

Thomas Morrow, SEMI's Executive Vice President of Emerging Markets and CMO is enthusiastic about the subject of plastic electronics, saying some market forecasts put the market growing to something between $45 billion and $100 billion by 2020. There has been "… a lot of speculative hyping over the years" about plastic or flexible electronics, he acknowledges.

One segment that is "clearly emerging" and "very promising" is OLED displays, Morrow says. That segment will drive $5 billion in capital expenditures this year by other display manufacturers. The growth in OLED display capital spending will be "significant for the next seven years," he adds, increasing to $35 billion a year by 2020, a tantalizing opportunity for equipment suppliers.

OLED is "the driver of a lot of capital investment," Morrow notes. "It's a 'killer app' in flexible electronics."

Introduced the first LED TV in 2009, and active-matrix organic LEDs are the coming wave in television technology. The next few years will witness the "turnover of the television market from LCD to LED," Morrow predicts.

OLED TVs are thinner and lighter than LCD TVs, he says, and they consume less power than their LCD predecessors, as well. "OLED has all these qualities," Morrow says. "People clearly want the best resolution, picture performance, and picture quality," which sums up the attributes of OLED TVs.

On a smaller scale than flat-screen TVs, dual high-brightness OLED backlights are behind the acclaimed Retina display on the latest iPad tablet computer. Those OLEDs are "responsible for the thinness" of the new Apple tablet, says Morrow. OLEDs also offer more energy efficiency than other display technology, and they have greater color clarity to boot, he adds.

In addition to displays for tablets and TVs, plastic electronics are making progress in batteries, logic and memory devices, and photovoltaic solar cells, according to Morrow. Applied Materials is doing "really exciting things in batteries," he says. "Solid-state batteries have broad applications in consumer electronics and distributed-sensor networks. We're at the vanguard of saying, 'We can do this now.' " Energy harvesting and thin-film batteries are leading-edge developments in the energy area, Morrow adds.

Organic photovoltaics are "recognized as a promising technology," Morrow states. Manufacturing such solar cells remains a challenge, however.

“Building a production system around is an overwhelming investment,” Morrow says. Organic PV is “still in the lab, primarily,” he adds.

The Holy Grail in plastic electronics is roll-to-roll manufacturing – essentially putting a flexible sheet of substrate material into a machine and having a roll of plastic electronic products come out of the other end. For now, roll-to-roll is “a leap for logic, memory and display manufacturing,” Morrow says. “Everybody’s been building their own equipment, solving their own problems with jerry-rigged platforms.” Making true roll-to-roll manufacturing a reality depends on “solving point problems,” such as coming up with fab-line tools for characterization, metrology and other steps, he notes.

One application where roll-to-roll manufacturing could prove feasible and useful in the near future is making touch-screen displays for the iPhone and other smartphones, added Morrow.

But what of the long-fabled “electronic newspaper,” a flexible display you could roll up and put in your pocket, which would be regularly refreshed with breaking-news content? “Exotic form factors are attractive and appealing,” Morrow admits, but the electronic newspaper may have become an obsolete concept with the advent of smartphones and tablets.

These Internet-connected mobile devices access the latest news and other important information with a few clicks on a Web browser, diminishing the need for a new and different platform.

Although plastic electronics will be found in a number of areas, such as energy generation, optoelectronics, radio-frequency devices and sensors, it appears that OLEDs for displays and lighting are the big-growth segment for the near future. “OLEDs will be on a rapid penetration rate over the next five years,” Morrow predicts.

One of the highest-profile companies in plastic electronics, Plastic Logic, has retrenched its operations this year. This company has given up plans to market an e-reader based on its technology, and has now become a technology licensing firm. The company was formed in 2000 to commercialize technology developed at the University of Cambridge’s Cavendish Laboratory. Pilot production of its flexible displays began in 2003, followed by volume production in 2008. At the 2010 International Consumer Electronics Show exhibition, Plastic Logic introduced the QUE proReader, its entry in the e-reader market. Unfortunately for the company, Apple brought out the first iPad tablet computer three weeks later. At release, the iPad included a library of e-books that could be read on the new and attractive slate. Plastic Logic killed the QUE proReader later that year.

In early 2011 the company received $280 million in venture capital from Rusnano and Oak Investment Partners, and it made plans to offer another e-reader, the Plastic Logic 100, to schools in Russia. That effort didn't pan out, either, leading to the company closing its U.S. office in May and scaling back operations elsewhere.

Plastic electronics may have its own boom-and-bust stories to tell in the future. The market verdict on OLED TVs has yet to come, and much work remains in widening the use of flexible electronics.

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