

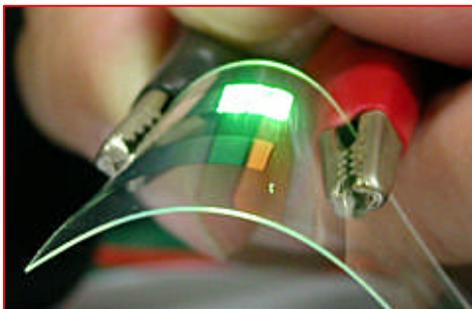
FLAT PANEL DISPLAYS - PHOTONICS NEWSLETTER

July 2007 - Ken Gilleo - www.Trends.com

MARKET & BUSINESS INFORMATION

 **The Apple Touch?** - Taiwan-based United Radiant Technology (URT), a small- to medium-size panel module maker, has said the company recently **restarted its touch screen panel production** line amid strong demand. The company entered the touch screen market 5-years ago, but as it saw its customer base decline and demand from applications such as PDA drop, the company decided to withdraw from the market. Recently however, demand for smart phones has picked up rapidly leading to a significant increase in demand for touch panels, the company noted. Source: DigiTimes.

e-Paper is Wrapping Up Some Business - Electronic paper (e-paper) has recently moved up as a new display technology that matches the characteristics of paper in terms of flexibility and readability, but adds the ability for constant updating from a network. The first applications for e-paper have been found in book readers and novelty products, such as flexible clocks. But e-paper is a serious product with sizeable addressable markets, especially in signage and smart shelving and in roll-up mobile displays. Major electronics and materials firms, as well as the usual slew of start-ups are already investing heavily in this technology. Nonetheless, many uncertainties and challenges beset the e-paper market. There are competing technologies -- electrophoretic inks and cholesteric LCDs, for example. Many of the products being designed with e-paper are entirely novel and have no established markets. E-paper-based book readers may be the next consumer electronics hit or the whole concept could very well crash and burn. Similarly, there are no established supply chains for e-paper products which have left technology developers to try and create them while at the same time attempting to manufacture their own products. Applications sectors for e-paper that will be discussed and forecast include smart-shelves, smart cards, smart packaging, book-readers, cell-phone displays, computer displays, information displays, clocks and other novelty products. Source: Research & Markets.



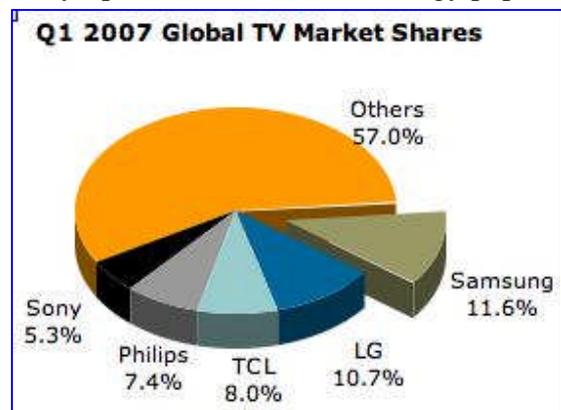
OLED Display Forecasts - DisplaySearch forecast shipments of organic EL TV panels would reach around 3-million units in 2011. The company assumed entry to the market from a number of manufacturers including Samsung Electronics Co. Ltd. of Korea in 2008 and Toshiba Matsushita Display Technology Co. Ltd. (TMD) in 2009, following Sony Corp. launching an organic EL TV onto the market in late 2007. Full-scale volume production of organic EL TVs is "still at a stage where we should solve a lot of

challenges," according to DisplaySearch's analysis. The company projected a cost of Sony's 11-inch organic EL panel will be around \$700 (USD). That is equivalent to the cost of a 40-inch class LCD panel, while the costs of current 10-inch class LCD panels are about \$100 per panel. Cost needs to be lowered toward the diffusion of organic EL TVs. Furthermore, manufacturers must establish a volume production technology and introduce large lines to enlarge organic EL panel size, DisplaySearch said. The large organic EL TV market will grow "in or after 2012, when demand for

LCD TVs slows down." This is because it involves a huge risk to invest in new facilities for organic EL panel manufacturing using large substrates or to convert existing manufacturing lines of LCD TV panels to organic EL panels. Shipments of organic EL panels are expected to grow about 35% from 2006 to 97.3 million units in 2007. This growth, however, represents increased shipments of passive matrix panels employed for sub displays of mobile phones. To expand the TV panel market, "First of all, we expect medium and small panel manufacturers to establish a volume production technology for active matrix OLED panels and a cost reduction technology as well," DisplaySearch said. Source: Tech On.



TV Market - Samsung is leveraging its flat-panel advanced TV technology while still shipping large numbers off CRT products to developing nations. Samsung was also #1 in LCD TV shipments with a 16.8% market share in Q1-07. Global TV unit shipments rose by 7% in Q1-07 to 45.9-million units. LCD and plasma TVs enjoyed positive growth with a 90% increase and a 41% increase respectively compared to 2006. Market drivers: aggressive pricing among flat-panel televisions that is pushing LCD TVs toward comparable price points with CRTs. CRT TVs continue to drop from a distinct lack of consumer, retailer and OEM interest. Large-size TVs are increasing and digital television is becoming a reality and consumers will spend to get the technology. Big TVs are thinner, lighter and easier to place in a smaller abode. New innovations may boost the rear-projection TV (RPTV) market. New lighting technologies, including electrodeless lamps, LEDs, and by 2008, lasers, are addressing concerns regarding lamp lifetime and improving image quality. On the microdisplay front, liquid crystal on silicon (LCOS) technology is seeing a boost because of Sony's push to make the technology popular in the 50-inch and larger range. OEM commitment to LCOS is not far behind. Other companies, such as JVC, are also joining the LCOS movement in the hopes that the technology will be able to extend the life of rear-projection televisions. Time will tell if LCOS will be able to make any notable impact in the television market. The push to continually reduce LCD TV prices almost certainly will make that technology the indisputable champ in the television market, regardless of the technological innovations being developed by other companies. Source: iSuppli



Samsung accounted for an 11.6% share of global TV sales in the first quarter, followed by LG Electronics at 10.7%, TCL with 8.0 %, Philips with 7.4% and Sony at 5.3%.

TECHNOLOGY

Future of Flexible Displays - The ideal technologies for **flex FPD** include electrophoretic, cholesteric LCD and OLED. Several companies are now involved in electrophoretic development: E-Ink (UA), Plastic Logic (UK), Polymer Vision (Netherlands), Bridgestone (Japan), Hitachi (Japan), Seiko Epson (Japan), Samsung/LG.Philips LCD (Korea). Kodak, Fujitsu and Taiwan's Industrial Economics and Knowledge Center (IEK) are developing cholesteric LCD displays while Sony and LG.Philips LCD are involved in OLED technology. E-



ink has been the leader for electronic paper display (e-paper) technologies and solutions. E-paper displays featuring E Ink's electronic ink technology are being made available in a wide variety of

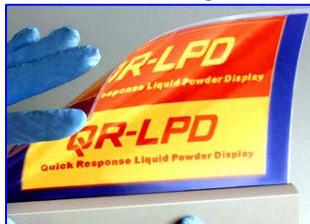
Comparison of flexible displays by technology			
Technology	Electrophoretic display	Cholesteric LCD	OLED
Contrast ratio	10:1	10:1	>10,000:1
Colors	4,096	4,096	16m
Pricing	low	low	high
Technology barrier	low	low	high

applications in the market. Citizen Watch and Citizen T.I.C (subsidiary) demonstrated the world's first flexible clock using E Ink imaging film. iRex Technologies BV (Philips spin-off) announced the launch of their iLiad, a first generation electronic reader product using E Ink imaging film all the way back in 2005.

Source: IEK, compiled by Digitimes, July 2007

Jinke Electronics, a leading eBook device developer and manufacturer in China launch of their Hanlin eBook V series (E Ink imaging film) also in 2006. Seiko Epson, and Seiko Watch announced their next generation watch that uses an electronic paper display in 2007. Sony's eBook, the Reader, has been available in the market since 2006. Polymer Vision who mainly develops printed electronics for e-paper displays and flexible color displays, is also active. In January 2007, the company announced its cooperation with Innos (UK) to establish a production facility for organic semiconductor-based rollable displays. Manufacturing will start this year to meet the increasing commercial demands for flexible displays, according to the company. The company co-developed a mobile device with rollable displays for reaching personal information, newspaper and books with Telecom Italia in February. Plastic Logic expects to establish a flexible active-matrix display plant in Germany with the company planning to volume produce 10-inch 150ppi flexible displays in 2008.

The breakthrough for color e-paper took place in May 2007 when Samsung Electronics exhibited



the world's largest (A4-sized/14.3-inch diagonal) color e-paper, a plastic, flexible display that can deliver undistorted color images even when the surface is bent. The display also continues to show a static image after power has been shut off. Around the same time, LG.Philips LCD announced it has developed the world's first 14.1-inch flexible color e-paper display, equivalent in size to an A4 sheet of paper. This is a second



breakthrough in e-paper for LG.Philips LCD, which introduced the world's first 14.1-inch black and white flexible e-paper display in May 2006, the company said. In May, Taiwan-based Prime View International (PVI) showed its flexible active matrix (AM) electrophoretic display made in volume at a TFT fab. At that time, PVI demonstrated 1.9-, 6- and 9.7-inch AM electrophoretic displays. These flexible displays are based on PVI's proprietary MagicMirror Reflective Technology as well as the EPLaR process, developed by Philips



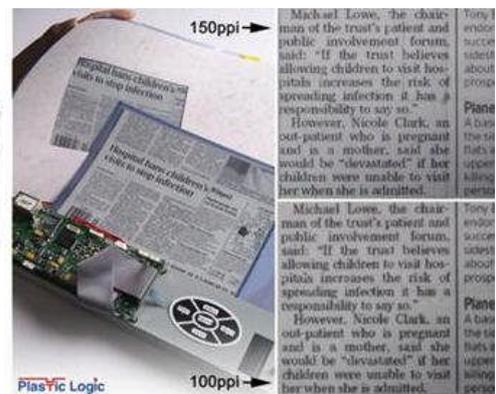
Research, and for which PVI currently has an exclusive license. Kent Display US), a specialist for cholesteric display technology has developed cholesteric display technologies for military purposes. The company will have new products that will use in application such as military uniforms, said sources. Taiwan's Industrial Technology Research Institute (ITRI) recently showcased its 10.4-inch bistable name card with a flexible Ch-LC display. The flexible bistable Ch-LC display, as well as

flexible Ch-LC driving system design and bonding technologies, the 10.4-inch bistable meeting name card enables meeting information editing via notebooks and bi-side displaying the VGA text or graphic content without extra power.

ITRI recently showcased its 10.4-inch bistable name card with a flexible cholesteric display. The 10.4-inch bistable meeting name card can be used, for example, to display meeting information through a notebook connection. Once any text or graphic content is displayed, the bi-side VGA display maintains the image even if the power is turned off. In April 2007, Fujitsu Frontech started limited sales of its portable information terminal "FLEPia" that was the first to adopt color electronic paper. This product has a large display 12mm thick, weighs 320g (A5-size model). It can run 50 hours continuously with a fully charged battery. A large amount of information (a year of newspapers, two years of weekly magazines or 5,000 volumes of books) can be stored in this terminal by using 4GB SD card (option), according to the company. In May, Sony unveiled its colorful 2.5-inch OLED flexible displays, according to the company. During the same month, LG.Philips LCD also announced that it has developed a 4-inch full-color flexible active matrix (AM) OLED (organic light emitting diode) display that uses amorphous silicon (a-Si) technology. LG.Philips LCD has developed this display in cooperation with Universal Display Corporation (UDC), which holds the original patents for phosphorescent OLED (PH OLED) technology. The 4-inch full-color flexible AM OLED display features 320×240 QVGA resolution and can reproduce 16.77 million colors. Source: DIGITIMES



Polymer Vision mobile device with rollable display
Source: Company



US-based Plastic Logic 150ppi flexible displays



Sony 2.5-inch OLED flexible display



LG.Philips LCD showed a 4-inch full-color flexible active matrix (AM) OLED display

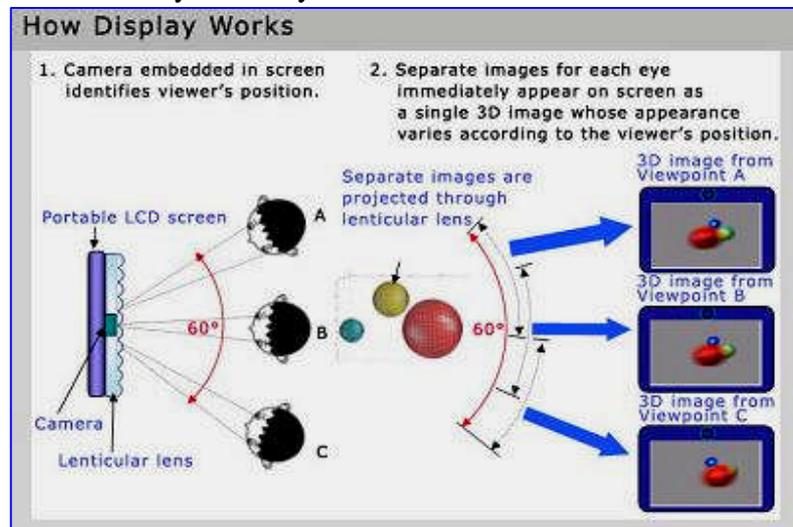
Photos: DigiTimes

Magnetic vs. Electrostatic - The University of California have developed a new display technology that uses a liquid filled with highly charged plastic-coated iron oxide particles, which by repelling one another form an ordered structure called colloidal photonic crystal. This substance can then be controlled with a magnet placed behind it. The microscopic spacing between the particles allows them to reflect light. Each particle is a pixel that represents a unique color. The scientists have managed to create a range of colors, and suppose this new technology could replace the LCD technology and make large displays much cheaper. *[Lower cost is very doubtful since methods for generating magnetic small and switchable fields are more complex and costly than those for electrostatic fields now in wide use for displays].*

3D Phones - About 4-yeras ago, DoCoMo introduced a mobile phone with a 3D display from Sharp. After selling about 2.8 million of them, they were discontinued in 2004 with no follow-on 3D product. No cell phone has had a 3D display since then. Interest in 3D for mobile phones and other portable devices has not gone away, however, it has just gone back to the research labs. Now it appears as if 3D may emerge from the labs again as a more viable product.



DoCoMo claims to have a new 3D display technology for mobile phones in their "Future Technologies" website, not a product announcement. The technology produces autostereoscopic 3D, viewable without special glasses. Autostereoscopic displays have a problem, a very limited viewer angle. The new display feature is head tracking where a camera in the mobile phone finds out where your eyes are and adjusts to match. DoCoMo isn't the only company working on 3D mobile phones. Samsung has announced a plan to sell a few hundred thousand 3D mobile phones at a premium. Samsung uses a switchable parallax barrier in its system, an autostereoscopic technology to the lenticular arrays used by DoCoMo and most others. NEC also has described a lenticular array display. NEC emphasized that, unlike many autostereoscopic displays, the 2D image quality did not suffer because of the 3D, and the display could easily show Asian type fonts. NEC provided market data that showed that consumers were interested in 3D mobile phone displays, at least young Japanese consumers. According to the study over half of the respondents were interested in 3D photo-mail and 3D movies on their mobile phones, and about 42% were interested in 3D games. So when can we expect 3D? No one is making promises yet.



Source: Display Daily.

Plasma vs. LCD - Matsushita (Panasonic brand) was one of the first of the Japanese majors to place its bet on plasma technology, and although it concedes some ground to LCD by selling smaller screen TVs using LCD, it is firmly committed to plasma in larger displays. Results suggest that while the LCD market is holding at Matsushita but not plasma. LCD sales rose 40% to 740,000 units, closing in on the 800,000 plasmas sold over the same period. But it's the revenue that counts and plasma income fell 1%, its first ever decline, while LCD rose 9%. Matsushita's mid-term

strategy is still heavily focused on plasma. The company is far too optimistic about future plasma sales, according analysis by outsiders, but it could meet targets by achieving a higher share than it expects. That's because Matsushita is likely to be one of only a couple of major companies selling the technology in a few years' time. The company must ask itself if it is losing out on potential sales by remaining wedded to plasma. Is plasma better? Plasma is seen as slightly better than LCD at 40" or larger, but at a price premium and it also suffers from extra power consumption. But plasma makers risk falling behind in the Full HD (1080p) race as they struggle to compete on price with LCD.

Is this the new IBM See-Thru Display Technology or hoax? Found on Flickr.



OLED TV - Sony is showing off working samples of its OLED flat panel TV at the Sony Experience More trade show in Australia. Sony made a big splash at CES in Las Vegas earlier this year when it demonstrated two working OLED TV samples. Now, the company has again rolled out the cutting-edge technology to wow Australian retailers at its trade-only event just held in Sydney.



Sony considers OLED as the most powerful technology for future displays, according to the Sony Australia senior product manager. Companies not typically associated with displays are also working on OLED, including Kodak and Hewlett Packard – such is the variety of products that will one day incorporate OLED displays. Sony said earlier this year it plans to release the first 11-inch OLED television in Japan in the fourth quarter 2007. Source: OLED TV News.

PROJECTORS



HD Projection Technology - JVC and Gennum are among the manufacturers making significant advancements in 4K x 2K display projection technology. Research and development of new

high-resolution video projection systems is in high gear. JVC has been previewing what it bills as the world's highest pixel density projection chip, one that could enable future projectors to be smaller, lighter, and more affordable. The chip can deliver images that are more than 4X the resolution of today's high-definition video. The newly developed 1.27-inch (43% smaller) D-ILA

device chip offers 4096 x 2400, or about 10-megapixels. The 20,000:1 contrast ratio sets a new standard. Gennum, another major player in the fast-paced HD projection market claims to have an image processing system for 4096 x 2160 pixel displays. While previous industry demonstrations of 4Kx2K have used custom processing solutions, often utilizing multiple field programmable gate arrays (FPGAs) to manage the complexity, Gennum's new 4Kx2K design incorporates two of its GF9450 image processors to power the display. The GF9450s provide full motion-adaptive deinterlacing, professional quality scaling up to 4Kx2K, frame rate conversion and various image enhancement technologies such as 3D noise reduction, compression artifact reduction and detail enhancement. The low power of the GF9450, under 3.5 watts, is also key to emerging 4Kx2K displays, as it will eliminate the need for a fan to cool the device. This makes it possible for Gennum's technology to be incorporated into the small footprint of flat panel display electronics while delivering the processing bandwidth and image quality expected of very high-resolution displays. Gennum said it will have a single chip solution for 4K displays by the fourth quarter of this year, which would enable new projection products based on the design to be available for sale by the second half of 2008. Source: Studio Daily.

Microvision announced that it has signed an agreement with Motorola to develop pico projector display solutions for mobile applications leveraging Microvision's ultra-miniature laser based display engine, called PicoP. Tiny laser-based projectors are expected to enable a "big screen" viewing experience from mobile devices.



By projecting content displayed on the device screen onto a wall, object or even a curved surface, mobile users could easily share Websites or multimedia applications such as movies, personal videos, mobile TV, photographs and presentations with friends or business colleagues. Motorola says it is committed to driving technology innovation that will enable the next generation of great consumer experiences. Motorola and Microvision are pursuing ways that projection technology can redefine how mobile consumers view and interact with the media they take with them. With its slim form factor and low power requirements, Microvision's PicoP projector is optimized for the mobile environment. Microvision believes that their unique display technology, combined with Motorola's focus on delivering cool experiences, will allow mobile users to enhance their viewing of information and entertainment. The companies revealed they will work together initially to integrate Microvision's latest PicoP projector inside a functioning mobile device for demonstration purposes. This prototype handset will utilize Microvision's new, WVGA (854 x 480 color pixels) wide-angle scanner, first demonstrated in May 2007 at the Society of Information Display annual conference. Source: the Unwired.

READERS

Newest E-Ink Reader - This new Sony reader, like the previous version, uses display technology from E-Ink - so called, e-paper. This may be the first e-reader that that looks like a book and can be read for hours without experiencing eyestrain. There's no backlight, its passive reflective, so forget about reading in the dark. There is also zero flicker; one the



pixels are set, nothing happens. It's small and lightweight too (.5 inches thick and smaller than a hardcover book). The reader accepts both Memory Stick and SD flash memory cards. It's got a USB plug, and could be used to download and read websites, JPEGs or PDF docs. The battery life is equivalent to 7,500 page turns, avid readers can devour a dozen bestsellers plus War and Peace without ever having to recharge. The books will be available through the Connect Store, and there is some Connect software for managing your books (so far, this is the only drawback). Random House, HarperCollins Publishers, Penguin-Putnam, Simon & Schuster and Time Warner Book Group are all on board with titles, along with Manga publisher Tokyopop. Sony is promising to deliver this reader by spring. *[But it still may be too chunky and gadget-like and that will turn off a bibliophile. The e-paper is the way to go, but let's get rid of some of the housing].*



Another e-Paper Powered Book - Bookeen (Paris, France) announces Generation 3 Cybook, based on the latest Vizplex™ epaper technology from E Ink. This ebook reader offers a 6" screen and 166 dpi resolution. Bookeen's product is the size of a paperback, the thickness of a magazine, for a weight of only 6.1 ounces (174 g). It boasts an impressive battery life of 8,000 page flips, allowing for an average reading time of 1 month without recharging. The device is compatible with all USB enabled computers, (compatible with Windows, Mac, Linux...) and also offers an SD slot for virtually unlimited library storage space. There are currently about 50,000 titles from the world's leading publishers available from dozens of online ebook stores. Price is about \$350. Bookeen is privately held company founded in 2003. Source: <http://www.bookeen.com>

