

The Future of e-Books and e-Newspaper: Flexible, Touchable and Colorful

By Jennifer Colegrove, PhD

The first e-book on the market with a paper-like bi-stable display was the **Sony** LIBRIe, which was released in Japan around 2004. It used the electrophoretic display technology from E Ink with a TFT backplane from Philips. Two years later, Sony released a new version of the e-book in the US market. However, the e-book didn't really become popular until late 2007 with **Amazon's** Kindle. Amazon reported it ran out of stock within six hours of its debut. In addition to Sony and Amazon, there are several other companies offer e-books as well—such as iRex Technology (iLid), Jinke (Hanlin), STARebook and iRiver.

Bi-Stable Display vs. TFT LCD

The e-books on the market all use E Ink's micro-encapsulation-type electrophoretic displays, but there are other kinds of bi-stable displays.

Recently, SiPix announced the launch of an e-book display by end of 2008, using its micro-cup-type electrophoretic display. The display module partners will be Wintek, ChiMei and CPT.

Other bi-stable display suppliers include Bridgestone (electrophoretic), Kent Displays (cholesteric liquid crystal) and Qualcomm (MEMS).

Comparing conventional TFT LCDs used in most mobile phones, PDAs, notebook and desktop PCs, we can see advantages and disadvantages:

- The advantages of using a bi-stable display are paper-like characters (good sunlight readability, easier on the eye when reading for long periods) and power saving.
- The disadvantages are the lack of color (currently, but color has been demonstrated) and longer response time when changing the whole page.

Table 1 Comparison of TFT LCDs with TFT Electrophoretic Displays (EPD)

	TFT LCD	TFT EPD
Device example	Mobile phone, PDA, NB PC	Amazon Kindle, Sony Reader
Sunlight readability	Poor for transmissive type; OK for transreflective type	Excellent
Viewing angle	Typically narrow, some can be up to 170°	Excellent, almost 180°
Color	Excellent, full color	Monochrome, color is demonstrated
Response time	Several ms	Hundreds of ms
Power consumption	High and constantly draw power	Low, zero power to maintain an image, only draw power when change image
Battery life	Several hours to tens of hours	7K page turns; If a person read 200 pages per day, the battery life is more than one month.

Source: DisplaySearch

Flexible e-Books, e-Newspapers and e-Magazines

All e-book displays on the market are produced on glass substrates. Several developers have demonstrated e-book, e-newspaper and e-magazine on plastic or metal-foil substrates. For example, **Polymer Vision** demonstrated a rollable e-book/mobile phone device—Readius—in 2007, and it will be on the market by the end of 2008. **Plastic Logic** recently demonstrated a plastic e-newspaper/e-magazine with about 10.7" display (the whole device is 8.5" × 11.0"). It will be available in 2009. *Esquire* used an electrophoretic display on its October magazine cover to celebrate its 75th anniversary.

(For more info, see "E Ink Display on the Esquire Magazine Cover" on page 6 of this issue.) LG Display, Samsung Electronics, Prime View International and Epson also have shown flexible electrophoretic displays.

Figure 1 Flexible e-Book, e-Newspaper and e-Magazine Demonstrations



Source: (left) Polymer Vision; (Right) Plastic Logic

I'd like to mention another large size e-paper devices demonstrated recently, but on glass substrates. Brother Industries in Japan recently demonstrated an e-paper devices at *Pan-Pacific Imaging Conference '08*. The device is 9.7" diagonal, with 1200 × 825 resolutions. The company plans to commercialize it in 2010.

Figure 2 Large e-paper demonstration



Source: Nikkei Electronics

Touchable, Writable, Colorful

Paper books, newspapers and magazines are writable and colorful. Their electronic versions are catching up on those characteristics. **iRex Technology's** iLid already has integrated an active digitizer-type touch screen. Recently, **E Ink** and **Wacom** (a big supplier of the active-digitizer touch screens used on most tablet PCs) teamed up to offer an electronic-pen writeable electrophoretic display solution. This will allow the user to write notes, highlight and save within the e-book devices.

Plastic Logic's recent demonstration integrates a touch screen. Users can turn pages with a finger stroke, instead of using buttons.

Full-color electrophoretic displays have been shown for several years. The typical method is to overlay a RGB or RGBW color filter on top of the black and white display to make color. This method is straight forward, but it reduces the reflectivity by about two-thirds and also reduces the resolution. Other methods, such as colored particles or colorful liquid, are under development. E Ink demonstrated a clever idea at *SID 2008*: a small colorful display window in a black and white display. This allows the text to be shown in the black and white area, providing good reflectivity, strong contrast ratio and high resolution. The colorful window in the top right corner is dedicated to pictures and figures.

Market Drivers and Forecast

Digital content—including books, textbooks, newspapers, magazines and journals—is increasing dramatically every year. On the other hand, the newspaper industry is losing subscribers each year, with more and more consumers reading on their computers or e-books to get these benefits:

- Saves paper—a good contribution to the environment
- Light weight—One device can hold tens or hundreds of books or content, decreasing the burden of students' backpacks, saving bookshelf space, reducing shipping costs and so on.
- Up-to-date—The e-version can be updated several times per day.
- Video will be possible soon, although speed will be limited.

Newspaper companies have been watching the bi-stable display technologies for years. Some are planning to launch their own e-newspapers in 2009 or 2010.

According to the *Flexible Displays and Electronics Report* by DisplaySearch and FlexTech Alliance, the flexible e-book/e-newspaper/e-magazine display market will see a dramatic volume increase in 2009. This market is forecast to reach \$5.7B by 2018.

For more information on this product, please view www.displaysearch.com/technology/ or contact Patrick Maki at patrick_maki@displaysearch.com.

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