

ON PERMANENT DISPLAYS

Low-power, low-cost liquid crystals move to market

The failings of conventional flat-panel display technology are familiar to anyone who has used—or priced—laptop computers. Inexpensive models are limited to shades of gray or dim colors. More advanced versions capable of bright, fast-changing hues carry dizzying price tags. And all liquid-crystal screens suffer from a voracious appetite for power, sucking batteries dry within a few hours.

Researchers at the Liquid Crystal Institute of Kent State University have recently demonstrated a new kind of inexpensive liquid-crystal display (LCD) that can produce clearer images using much less energy. Commercial production of a high-resolution gray-scale version has already begun at Kent Display Systems. The researchers are now engineering a similar color device.

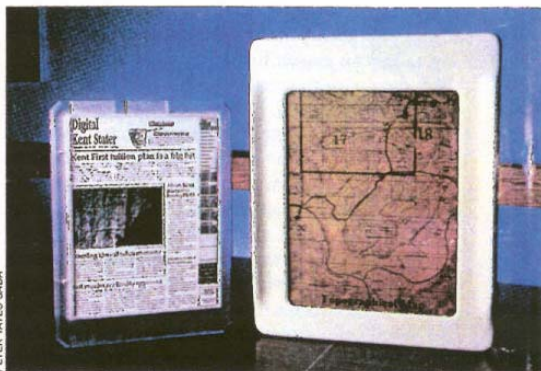
The displays do more with less because they affect light in a different way than conventional LCDs do. A standard liquid-crystal panel filters the light both going in and coming out. Dots, or pixels, of liquid crystal inside the panel naturally twist the light so that it can pass through the second filter. But when a pixel is turned on, it untwists, and the

dot goes dark. Unfortunately, such polarized filters cut the light going in by half; changing bright pixels into colored ones requires yet another filter. LCDs are consequently too dim to use as computer displays unless lit by a lamp from behind. And lamps devour power.

Liang-Chy Chien and his colleagues got around this problem using a so-called cholesteric liquid-crystal material. Rather than twisting light, this material breaks incoming rays into two parts. One ray is reflected; the other is transmitted. Electrifying the chemical turns it clear. Because cholesteric LCDs reflect light without the need for polarizing filters, they can be as bright and legible in ambient light as conventional LCDs are when backlit.

Early cholesteric LCDs were limited to single colors, but Chien found that if he added small amounts of a second material, he could tune the color to anything from deep red to brilliant blue by shining various amounts of bright ultraviolet light on the panel. Mixing in a bit of polymer then locks in the chosen color. The engineers are now adapting masks such as those used to etch microscopic patterns onto computer chips to create millions of red, blue and green pixels on a cholesteric LCD panel.

At present, cholesteric LCDs are about 20 percent more expensive than conventional "passive matrix" displays, but



PETER VATES/SABA

NEW LIQUID-CRYSTAL DISPLAYS
reflect rather than polarize light.

their effects are worth far more. Pixels in the new displays stay on once they are turned on, eliminating the need to redraw the display several times each second, thus saving power. These panels should run more than 10 times longer on batteries than present displays can.

The stability also allows pixels to be much smaller—one prototype boasts 200 dots per inch—and it eliminates the flicker that makes laptop screens wearisome to read. But the biggest advantage of the new LCDs is that they do not require the "active matrix" electronics that triple the price of conventional panels in order to maintain high contrast and resolution. A wide range of electronics makers, including IBM, Sony and Toshiba, have reportedly expressed interest in licensing the technology.

—W. Wayt Gibbs in San Francisco