Flexible Display Manufacturing Technology

Establish an integrated pilot line and processes to manufacture affordable flexible full-color active matrix displays to improve yield and reduce manufacturing costs.

OBJECTIVE / SOLUTION

Enable a pilot-line compatible process to deliver 1000 flexible displays/year with a resolution of at least 320 x 240 pixels to meet the requirements of the Army transformation, and to improve the yield and reduce manufacturing costs. Reflective and emissive technologies implemented will be more rugged and efficient than current displays in use. The flexible attribute will enable new applications not possible with glass-based displays.

ACHIEVEMENTS

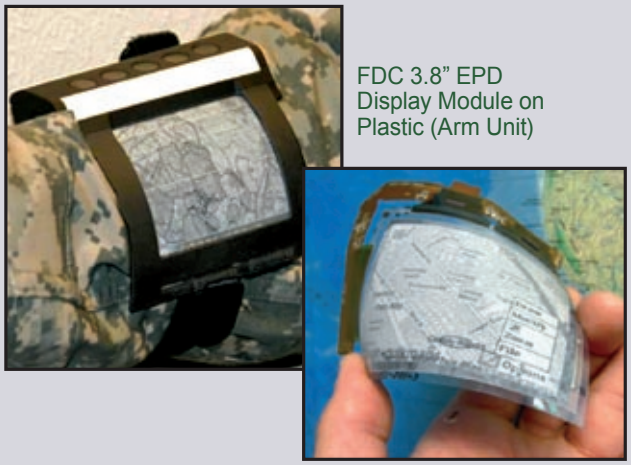
Process and tool development work has enabled fabrication of 4" diagonal reflective ultra low power displays at high transistor yield (approaching 100%) and display panel yield (75-80%) on stainless steel and plastic substrates. Demonstrated thin film transistor process on the GEN II pilot line. Transistor performance exceeds that of any results reported anywhere in the world using a low temperature amorphous silicon process.

Flexible reflective 4" diagonal displays produced at display yields exceeding (10-20%) have been produced. Integrated display quality matches that of any demonstration devices currently being produced anywhere in the world. In FY09, the Flexible Display Center (FDC) transitioned flexible displays to military integrators for Army system demonstrators. A fully automated bond-debond process has been developed and patented at the 6" wafer-scale. Currently, in discussions to license the bond-debond process and the thin film transistor process. These processes have been used to demonstrate 4" diagonal monochrome OLEDs as well as 4" diagonal color flexible reflective displays.

The GEN II manufacturing line is now fully installed and 100% qualified and has demonstrated functional transistors at the Army's Flexible Display Center in Tempe, AZ. Three industrial partner products developed under this program have been commercialized: (i) a high performance planarized polyester flexible substrate material has been commercialized by DuPont Teijin Films; (ii) novel organo-inorganic dielectricmaterials have been commercialized by Honeywell Electronic Materials; and (iii) a large-scale thin-film coating tool that achieves dramatic cost reductions has been commercialized by EV Group.

BENEFITS

- Lightweight, rugged, low-power flexible displays will enable situational awareness in daylight, night, and adverse weather conditions



FDC 3.8" EPD Display Module on Plastic (Arm Unit)

- Flexible display technologies will enable situational awareness from technology not commercially available with attributes that cannot be realized from glass-based displays. It provides affordable manufacturing capability, lower production costs, extended operation lifetime, and reduced life-cycle costs (environmental)
- $600/diagonal inch cost reduction per display unit, from $800/diagonal inch to $200/diagonal inch
- Possible 5X savings in life cycle costs

STATUS

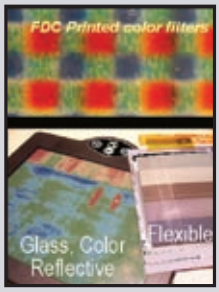
- GEN II tool set is installed and is 100% qualified
- Center has 25 industrial partners and three academic partners
- Demonstrated the first organic light emitting diodes on plastic substrates and color reflective displays
- Successfully developed and patented a manufacturable bond-debond process. Discussions on commercialization transition for process with partners

WEAPON SYSTEMS / SECONDARY ITEMS IMPACTED

- Two Transform the Army (TTAs) to transition flexible displays to PEO Soldier and PM Common Controller
- Transitioned flexible displays to Military integrator for Army system demonstrator

POTENTIAL COST AVOIDANCE

- Return on Investment of 4.3:1 with a cost benefit of $72M



Glass, Color Reflective

Flexible Display AKT Tool