Thin Film Transistor Backplanes on Flexible Foils

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Abstract
Several laboratories worldwide have demonstrated the feasibility of producing amorphous silicon thin film transistor (TFT) arrays at temperatures that are sufficiently low to be compatible with flexible foils such as stainless steel or high temperature polyester. These arrays can be used to fabricate flexible high information content display prototypes using a variety of different display technologies. However, several questions must be addressed before this technology can be used for the economic commercial production of displays. These include process optimization and scale-up to address intrinsic electrical instabilities exhibited by these kinds of transistor device, and the development of appropriate techniques for the handling of flexible substrate materials with large coefficients of thermal expansion. The Flexible Display Center at Arizona State University was established in 2004 as a collaboration among industry, a number of Universities, and US Government research laboratories to focus on these issues. The goal of the FDC is to investigate the manufacturing of flexible TFT technology in order to accelerate the commercialization of flexible displays. This presentation will give a brief outline of the FDC's organization and capabilities, and review the status of efforts to fabricate amorphous silicon TFT arrays on flexible foils using a low temperature process. Together with industrial partners, these arrays are being integrated with cholesteric liquid crystal panels, electrophoretic inks, or organic electroluminescent devices to make flexible display prototypes. In addition to an overview of device stability issues, the presentation will include a discussion of challenges peculiar to the use of flexible substrates. A technique has been developed for temporarily bonding flexible substrates to rigid carrier plates so that they may be processed using conventional flat panel display manufacturing equipment. In addition, custom photolithographic equipment has been developed which permits the dynamic compensation of substrate distortions which accumulate at various process steps.