Flexible Displays at low cost via roll-to-roll manufacturing

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We will describe our efforts to fabricate arrays of thin film transistors (TFTs) into complex integrated circuits, such as active matrix display backplanes, on low-cost, flexible substrates in a roll-to-roll format. Our transistors are based on zinc oxide (ZnO) and have shown carrier mobilities in excess of 5 cm^2/V-sec, deposited at room temperature. These high mobilities open up the possibility of integrating peripheral driver circuitry directly onto the active matrix backplanes, similar to the use of polysilicon in some current commercial displays. Our transistors exhibit excellent electrical stability when exposed to ambient atmosphere and current stressing, and excellent mechanical robustness. Our materials set lends itself to traditional TFT fabrication processes: the layers can be deposited via well-established vacuum deposition techniques and can be patterned via extensions of traditional photolithographic patterning technologies. These characteristics combined permit roll-to-roll manufacturing. Our current roll-to-roll yields are poor mostly due to the use of development level coaters not yet optimized for this effort. We suggest that roll-to-roll manufacturing may prove to be a crucial success factor, given that roll-to-roll fabrication appears to be the only way to reduce production costs to levels that could compete with the already well-established amorphous silicon industry, especially for low cost applications. A fully depreciated Gen 5 (1.1 m x 1.25 m) amorphous silicon facility can produce display backplanes for an extremely low cost per unit area.