

Roll-to-Roll Manufacturing of Liquid Crystal Panels

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Abstract

Every development on display panels advances visual entertainment and changes the way we obtain information. Whilst flat panels dominate the current industry, displays of the future generation are expected to contour natural patterns of curved objects, such as human bodies, vehicles, and/or modern designed buildings. This urban trend demands displays to be lightweight, flexible and wearable. Today, roll-to-roll (R2R) manufacturing is taking a promising role in the fabrication of displays of the sort. We hereby present an R2R lamination framework of our own design that allows for continuous production of sandwich-structured flexible liquid crystal (LC) panels.

In the manufacturing process two Indium Tin Oxide (ITO)-coated plastic sheets are fed into the system as the upper and the bottom substrates, in between of which a chosen smectic A (SmA) LC material is coated by a slot die. Tension control and line speed are finely tuned in order to avoid film slippage. To test the optical effect of the final product, an electric field is applied in between the two conductive sheets, where the SmA LC layer can be tuned between the optical clear and scattering/opaque state by adjusting the driving voltage. Such panels can be used as smart windows that can shield or let through sunlight. Fabrication of higher functioning displays such as pixelated screens of different sizes are highly anticipated under the roll-to-roll manufacturing technique.

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