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Abstract
The study aims to amend the sheet resistance of indium tin oxide (ITO) transparent conductive film by the etched-area-ratio (EAR)approach. A high sheet resistance of ITO film of 500 Ω/□, commonly used for touch panel applications, is employed in this study. Three major experiments are conducted. (1) Obtain the optimal DC magnetron sputter process parameters for the desired ITO optic-electrical properties. (2) Change the thickness of ITO film to observe the dependence of sheet resistance on the ITO film thickness. (3) Etch ITO film in various area ratios to investigate the change in the sheet resistance and the influence on the film transparency.

In part 1, the results show that with the sputter process conditions of Ar = 12 sccm, Pressure = 7.8x10-3 torr, Ts = 100 °C, DC POWER=150 W, ITO with sheet resistance of 500 Ω/□ and optical transmittance of 91.5% are obtained. In part 2, it is found that the ITO sheet resistance is strongly dependent on the film thickness for the film thickness less than 300 nm. The thicker the ITO film the lower the ITO sheet resistance is. For film thickness larger than 300 nm, the sheet resistance remains unchanged. It has to be noted that the ITO film thickness can not be unlimitedly reduced for the increase in sheet resistance and transparency due to the problems in the variations of film stress, surface roughness, light absorb coefficient and surface reflex coefficient.

In part 3, it is demonstrated that the ITO sheet resistance performs high dependence on the etched-area-ratio of the ITO film for EAR > 20%. This is believed due to the increased impedance when the carriers travel through the narrower paths. It is also found that the optical transmittance and the accuracy of the touch pane device are not affected by the etched patterns. On the other hand, the power consumption is improved by 46 %, thus providing good features for the applications in portable flat panel displays that the power consumption is critical.
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