Effects of indium concentration in the indium zinc oxide (IZO) channel layer on the electrical performance of IZO-based TFTs

ZnO has been studied as a semiconducting material and has attracted attention due to improvements in deposition techniques that have made it possible to make high-quality ZnO thin films. We report the fabrication and characteristics of thin film transistors with indium zinc oxide (IZO) channel layers having different indium concentrations. Also, we define the operation mechanism of IZO-based TFTs as the variation of indium concentration of the IZO channel layer. The IZO thin films were deposited on SiO2/Si substrate using indium oxide pellet and ZnO target by DC magnetron sputtering.

The structural, electrical, and chemi-physical properties of intrinsic IZO thin films were characterized using various analysis tools. A high-resolution X-ray diffractometer (HR-XRD, Bruker Discover) was used to investigate the crystallinity and crystal orientation. The electrical properties of films including carrier concentration, carrier mobility, and resistivity were measured using a Hall Effect system (Ecopia, HMS-3000). The elemental composition in the films was investigated by Rutherford back scattering (RBS, NEC 53DH-2).

Effects of indium concentration in the IZO thin films on the electrical performance of IZO-based TFTs with bottom gate structure were investigated using HP4145B semiconductor parameters analyzer. Our research implied that an attractive application for TFTs involves their use as select-transistors in individual pixels of an active-matrix liquid-crystal display.

Keywords: zinc oxide, thin film transistor