

비정질 IZTO기반의 투명 박막 트랜지스터 특성

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Characteristics of amorphous IZTO-based transparent thin film transistors

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Abstract : Recently, there has been increasing interest in amorphous oxide semiconductors to find alternative materials for an amorphous silicon or organic semiconductor layer as a channel in thin film transistors(TFTs) for transparent electronic devices owing to their high mobility and low photo-sensitivity. The fabrication of amorphous oxide-based TFTs at room temperature on plastic substrates is a key technology to realize transparent flexible electronics. Amorphous oxides allows for controllable conductivity, which permits it to be used both as a transparent semiconductor or conductor, and so to be used both as active and source/drain layers in TFTs. One of the materials that is being responsible for this revolution in the electronics is indium-zinc-tin oxide(IZTO). Since this is relatively new material, it is important to study the properties of room-temperature deposited IZTO thin films and exploration in a possible integration of the material in flexible TFT devices.

In this research, we deposited IZTO thin films on polyethylene naphthalate substrate at room temperature by using magnetron sputtering system and investigated their properties. Furthermore, we revealed the fabrication and characteristics of top-gate-type transparent TFTs with IZTO layers, seen in Fig. 1.

The experimental results show that by varying the oxygen flow rate during deposition, it can be prepared the IZTO thin films of two-types; One a conductive film that exhibits a resistivity of 2×10^{-4} ohm \cdot cm; the other, semiconductor film with a resistivity of 9 ohm \cdot cm. The TFT devices with IZTO layers are optically transparent in visible region and operate in enhancement mode. The threshold voltage, field effect mobility, on-off current ratio, and sub-threshold slope of the TFT are -0.5 V, 7.2 cm^2/Vs , $\sim 10^7$ and 0.2 V/decade, respectively. These results will contribute to applications of select TFT to transparent flexible electronics.

Key Words : Transparent TFT, IZTO, Plastic Substrate, room-temperature fabrication



Figure 1. Structure(a) and optical micrograph(b) of IZTO-based Transparent TFT prepared on a plastic substrate.