

Effects of Al-doping on IZO Thin Film for Transparent TFT

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Amorphous transparent oxide semiconductors (a-TOS) have been widely studied for many optoelectronic devices such as AM-OLED (active-matrix organic light emitting diodes). Recently, Nomura et al. demonstrated high performance amorphous IGZO (In-Ga-Zn-O) TFTs.¹ Despite the amorphous structure, due to the conduction band minimum (CBM) that made of spherically extended s-orbitals of the constituent metals, an a-IGZO TFT shows high mobility.^{2,3} But IGZO films contain high cost rare metals. Therefore, we need to investigate the alternatives. Because Aluminum has a high bond enthalpy with oxygen atom and Alumina has a high lattice energy, we try to replace Gallium with Aluminum that is high reserve low cost material.

In this study, we focused on the electrical properties of IZO:Al thin films as a channel layer of TFTs. IZO:Al were deposited on unheated non-alkali glass substrates (5 cm × 5 cm) by magnetron co-sputtering system with two cathodes equipped with IZO target and Al target, respectively. The sintered ceramic IZO disc (3 inch ø, 5 mm t) and metal Al target (3 inch ø, 5 mm t) are used for deposition. The O₂ gas was used as the reactive gas to control carrier concentration and mobility. Deposition was carried out under various sputtering conditions to investigate the effect of sputtering process on the characteristics of IZO:Al thin films. Correlation between sputtering factors and electronic properties of the film will be discussed in detail.

Keywords: Transparent oxide semiconductor, Transparent-TFT, Sputtering, IZO:Al, Co-sputtering