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Manufacture and characteristic evaluation of Amorphous Indium-Gallium-Zinc-Oxide (IGZO) Thin Film Transistors

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Recently, TFTs based on amorphous oxide semiconductors (AOSs) such as ZnO, InZnO, ZnSnO, GaZnO, TiOx, InGaZnO(IGZO), SnGaZnO, etc. have been attracting a grate deal of attention as potential alternatives to existing TFT technology to meet emerging technological demands where Si-based or organic electronics cannot provide a solution. Since, in 2003, Masuda et al. and Nomura et al. have reported on transparent TFTs using ZnO and IGZO as active layers, respectively, much efforts have been devoted to develop oxide TFTs using aforementioned amorphous oxide semiconductors as their active layers.

In this thesis, I report on the performance of thin-film transistors using amorphous indium gallium zinc oxides for an active channel layer at room temperature. SiO_2 was employed as the gate dielectric oxide. The amorphous indium gallium zinc oxides were deposited by RF magnetron sputtering. The carrier concentration of amorphous indium gallium zinc oxide was controlled by oxygen pressure in the sputtering ambient.

Devices are realized that display a threshold voltage of 1.5V and an on/off ration of $>10^9$ operated as an n-type enhancement mode with saturation mobility with 9.06 $cm^2/V{\cdot}s$. The devices show optical transmittance above 80% in the visible range.

In conclusion, the fabrication and characterization of thin-film transistors using amorphous indium gallium zinc oxides for an active channel layer were reported. The operation of the devices was an n-type enhancement mode with good saturation characteristics.