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Amorphous Indium-Tin-Zinc-Oxide (ITZO) Thin Film Transistors

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Thin-film transistors (TFT) have become the key components of electronic and optoelectronic devices. Most conventional thin-film field-effect transistors in display applications use an amorphous or polycrystal Si:H layer as the channel. This silicon layers are opaque in the visible range and severely restrict the amount of light detected by the observer due to its bandgap energy smaller than the visible light. Therefore, Si:H TFT devices reduce the efficiency of light transmittance and brightness. One method to increase the efficiency is to use the transparent oxides for the channel, electrode, and gate insulator. The development of transparent oxides for the components of thin-film field-effect transistors and the room-temperature fabrication with low voltage operations of the devices can offer the flexibility in designing the devices and contribute to the progress of next generation display technologies based on transparent displays and flexible displays.

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

Devices are realized that display a threshold voltage of 4.17V and an on/off ration of $\sim 10^9$ operated as an n-type enhancement mode with saturation mobility with 15.8 cm^2/Vs.

In conclusion, the fabrication and characterization of thin-film transistors using amorphous indium tin zinc oxides for an active layer were reported. The devices were fabricated at room temperature by RF magnetron sputtering. The operation of the devices was an n-type enhancement mode with good saturation characteristics.