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Influence of Oxygen Partial Pressure on ZnO Thin Films for Thin Film Transistors

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Recently, zinc oxide (ZnO) thin films have attracted great attention as a promising candidate for various electronic applications such as transparent electrodes, thin film transistors, and optoelectronic devices. ZnO thin films have a wide band gap energy of 3.37 eV and transparency in visible region. Moreover, ZnO thin films can be deposited in a poly-crystalline form even at room temperature, extending the choice of substrates including even plastics. Therefore, it is possible to realize thin film transistors by using ZnO thin films as the active channel layer.

In this work, we investigated influence of oxygen partial pressure on ZnO thin films and fabricated ZnO-based thin film transistors. ZnO thin films were deposited on glass substrates by using a pulsed laser deposition technique in various oxygen partial pressures from 20 to 100 mTorr at room temperature. X-ray diffraction (XRD), transmission line method (TLM), and UV-Vis spectroscopy were employed to study the structural, electrical, and optical properties of the ZnO thin films. As a result, 80 mTorr was optimal condition for active layer of thin film transistors, since the active layer of thin film transistors needs high resistivity to achieve low off-current and high on-off ratio. The fabricated ZnO-based thin film transistors operated in the enhancement mode with high field effect mobility and low threshold voltage.

Keywords: ZnO, Zinc Oxide, ZnO TFT, Thin film transistor, TFT