Low-Voltage, Room Temperature Fabricated ZnO Thin Film Transistor using High-K
(Bi$_{1.5}$Zn$_{1.0}$Nb$_{1.5}$O$_7$)$_{0.9}$((MgO)$_{0.3}$ Gate Insulator

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Abstract: Low voltage organic TFTs (OTFTs) and ZnO based TFTs (<5V), utilizing room temperature deposited Bi$_{1.5}$Zn$_{1.0}$Nb$_{1.5}$O$_7$ (BZN) thin films were recently reported, pointing to high-k gate insulators as a promising route for realizing low voltage operating flexible electronics. Bi$_{1.5}$Zn$_{1.0}$Nb$_{1.5}$O$_7$ (BZN) thin film is one of the most promising materials for gate insulator because of its large dielectric constant (~60) at room temperature. However their tendency to suffer from relatively high leakage current at low electric field (>0.3MV/cm) hinder the application of BZN thin films for gate insulator. In order to improve leakage current characteristics of BZN thin film, we mixed 30mol% MgO with 70mol% BZN and their dielectric and electric properties were characterized. We fabricated field-effect transistors with transparent oxide semiconductor ZnO serving as the electron channel and high-k (Bi$_{1.5}$Zn$_{1.0}$Nb$_{1.5}$O$_7$)$_{0.9}$((MgO)$_{0.3}$ as the gate insulator. The devices exhibited low operation voltages (<4V) due to high capacitance of the (Bi$_{1.5}$Zn$_{1.0}$Nb$_{1.5}$O$_7$)$_{0.9}$((MgO)$_{0.3}$ dielectric.

Key Words: High-K, TFT, Gate Insulator, ZnO