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High-Performance, Fully-Transparent and Top-Gated Oxide Thin-Film Transistor with High-k Gate Dielectric

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High-performance, fully-transparent, and top-gated oxide thin-film transistor (TFT) was successfully fabricated with Ta₂O₅ high-k gate dielectric on a glass substrate. Through a self-passivation with the gate dielectric and top electrode, the top-gated oxide TFT was not affected from H₂O and O₂ causing the electrical instability. Heat-treated InSnO (ITO) was used as the top and source/drain electrode with a low resistance and a transparent property in visible region. A InGaZnO (IGZO) thin-film was used as a active channel with a broad optical bandgap of 3.72 eV and transparent property. In addition, using a X-ray diffraction, amorphous phase of IGZO thin-film was observed until it was heat-treated at 500 oC. The fabricated device was demonstrated that an applied electric field efficiently controlled electron transfer in the IGZO active channel using the Ta₂O₅ gate dielectric. With the transparent ITO electrodes and IGZO active channel, the fabricated oxide TFT on a glass substrate showed optical transparency and high carrier mobility. These results expected that the top-gated oxide TFT with the high-k gate dielectric accelerates the realization of presence of fully-transparent electronics.

Keywords: Top-gated Oxide TFT, Transparent, High-k dielectric