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Solution-processed ternary alloy aluminum yttrium oxide dielectric for high performance indium zinc oxide thin-film transistors

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ABSTRACT

In this study, we evaluated the structural, chemical, and electrical properties of ternary alloy aluminum yttrium oxide ($Al_{2-x}Y_xO_3$) films prepared by employing a low-cost spin-cast technique. $Al_{2-x}Y_xO_3$ films annealed at 400 °C were found to possess smooth and excellent insulating characteristics compared to their binary Al_2O_3 or Y_2O_3 film counterparts. This superior performance of the $Al_{2-x}Y_xO_3$ films as a gate insulator can be explained based on structure stabilization from the cation alloying mixing effect. The amorphous indium zinc oxide (*a*-IZO) thin-film transistor (TFT) with the ternary alloy $Al_{0.45}Y_{1.55}O_3$ film exhibited a high mobility of 52.9 cm^2/Vs, a low subthreshold gate swing of 0.19 V/decade, a threshold voltage of -0.51 V, a high $I_{ON/OFF}$ ratio of 4×10^6, and good hysteresis-free stability, suggesting that the solution-based $Al_{0.45}Y_{1.55}O_3$ dielectric film is an attractive candidate as a gate dielectric for high-performance and low-cost *a*-IZO TFTs.

Keywords: Solution process; Aluminum yttrium oxide; Ternary alloy; Indium zinc oxide; Thin-film transistor

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