

Cryogenic Measurement on the Electrical Properties of Sputter-deposited Indium Gallium Zinc Oxide Thin-film transistors

W.-H. Lu¹, C.-Y. Hsu², Y.-J. Lee^{2*}, Y.-H. Wang¹

¹*Inst. of Microelectronics, Natl. Cheng Kung University, Tainan, Taiwan,* ²*Inst. of Pioneer Semiconductor Innovation, National Yang Ming Chiao Tung University, Hsinchu, Taiwan*

* yjlee1976@nycu.edu.tw ** yhw@ee.ncku.edu.tw

Abstract

This work investigates the impact of cryogenic measurements on the performance of indium gallium zinc oxide (IGZO) thin-film transistors (TFTs). For IGZO TFTs, a double-gate configuration and low temperatures are necessary to achieve the normally-off operation of nFETs. We analyzed the on-current, threshold voltage (V_{th}), and subthreshold swing (S.S.) of IGZO TFTs at temperatures down to 10K. It was observed that although S.S. and V_{th} improve under these low-temperature conditions, the on-current significantly decreases. This can result in freeze-out, leading to a reduction in the carrier concentration of IGZO at low temperatures.

Keywords - Oxide semiconductor, Indium Gallium Zinc Oxide (IGZO), Cryogenic measurement, Sputter, Thin film transistors (TFTs), Freeze-out