(Invited) Stability Issues in P-Channel Tin Monoxide Thin-Film Transistors

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P-type oxide thin-film transistrors (TFTs) have the potential to initiate a new era of oxide TFT-based electronics by allowing the implementation of complementary logic circuits with high-performance n-type oxide TFTs including amorphous indium-gallium-zinc oixde (a-IGZO) TFTs. Since Ogo et al. [1], tin monoxide (SnO) has attracted special attention as a channel material for p-type oxide TFTs due to the potential for high hole mobilities. To date, various researches have been conducted to fabricate high-performance p-type SnO TFTs. In this presentation, we will summarize the present status of p-type SnO TFTs, and will report our recent research results on the stability issues in p-type SnO TFTs. The electrical stability of oxide TFTs generally depend on the ambient atmospheric condition, subgap states in oxide semiconductors, and gate dielectric/channel interface properties [2]. In our work, we investigate the effects of environmental water and oxygen on the electrical performance and stability of p-type SnO TFTs, and present the effective method for the passivation of SnO TFTs using a SU-8 organic layer. The SnO TFTs without a passivation layer suffer from the electrical performance degradation especially under humid environments, but the passivated device exhibits much improved long-term durability and bias stress stability compared to the SnO TFTs without a passivation layer. We also extract the subgap density of states in fabricated SnO TFTs using the temperature-dependent field-effect method, and compare the obtained results with those from the conventional n-type a-IGZO TFTs. Finally, we examine the effects of gate dielectric on the electrical performance and stability in p-type SnO TFTs.

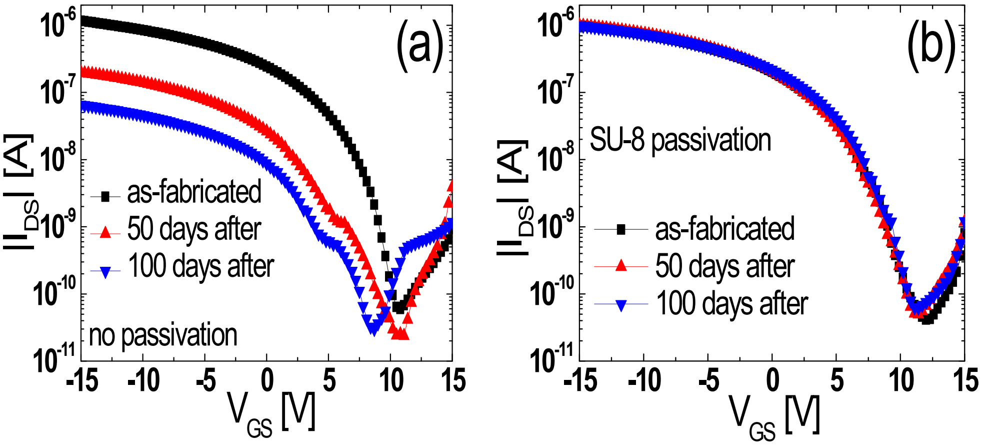

Fig. 1. Long term durability of the SnO TFTs (a) without and (b) with a SU-8 passivation layer. During the experiments, the devices were stored in a room, exposed to air ambient [3].

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References

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