Subgap Density-of-States (DOS)-based Simulation for Instability-Aware Design of Oxide TFTs

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It has been widely accepted in the field that amorphous oxide semiconductor thin-film transistors (TFTs) are within executable possibility allowing to be commercially viable devices driving the next generation display backplanes with the cohesion of performance and cost-effectiveness. However, there have been unremitting drawbacks in successful commercialization of the oxide TFT technology due to insufficient understanding of instability issues and the design technique.

In order to ameliorate the long-term instability of oxide TFTs, we focus on the physical parameter-based model and simulation, which are based on the subgap density-of-states (DOS) and the DOS extraction technique in connection with the results of thin-film analysis. Also, the relationship between the simulation results and the measured negative bias illumination stress (NBIS) instabilities of oxide TFTs would be presented in a coherent manner. Besides, the NBIS time-evolutions of I-V characteristics, which were measured in various oxide TFTs, would be discussed confirming that they correspond well with the results of our simulation model [Fig.1 and 2]. Finally it was found that our NBIS model was consistent either with the oxygen vacancy ionization [1] or with the peroxide-induced meta-stability [2]. As a consequence, the work we discuss would be reflecting that our results demonstrate the potential of playing a powerful role in the instability-aware design of oxide TFTs without a long-term stress test.

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**Fig. 1** The I-V characteristics of various oxide TFTs.

**Fig. 2** The NBIS time-evolutions of I-V characteristics and DOS in various oxide TFTs.