Toward instability-aware design of oxide TFTs

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Despite the fact that oxide thin-film transistors (TFTs) have exhibited strong potential as promising devices driving the next generation display backplanes, there have been unremitting drawbacks in commercialization of the oxide TFT technology due to insufficient understanding of instability issues and the design technique.

This work would be providing the deployed techniques in extracting the subgap density-of-states (DOS) of oxide TFTs and simulating the electrical characteristics with the DOS, material, process, and geometrical parameters. The proposed techniques are also validated and discussed in the perspective of material- and structure-dependences of TFT I-V and C-V characteristics. Finally, the techniques are even further extended to the modeling and simulation of the long-term instability under real circuit operation. It was identified the quantitative findings are very consistent either with the oxygen vacancy ionization1 or with the peroxide-induced meta-stability2. Our results have demonstrated the potential of playing a powerful role in the instability-aware design of oxide TFTs without a long-term stress and/or reliability test.

Fig. 1. DOS-based I-V model of oxide TFTs

Fig. 2. The concept of instability-aware design

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