Constant current stress-induced instability of the top-gate IZO TFTs for AMOLED displays

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Motivated by that a real mass production of oxide thin-film transistor (TFT)-driven active-matrix organic light-emitting diode (AMOLED) displays began very recently [1], the instabilities of *n*-channel oxide TFTs induced by applying the positive gate/drain voltage (V_{GS}/V_{DS}) need to be understood. On the other hand, the top-gate structure showed potential for high performance [2-4]. However, details on positive V_{GS}/V_{DS} stress-induced degradations of the oxide TFTs driving AMOLED displays have been seldom investigated. Here we investigated the constant current stress (CCS)-induced long-term instability of indium-zinc-oxide (IZO) TFTs not only by consolidating all of the experimental *I-V*, *C-V*, and device simulation but by paying a special attention to the difference between forward and reverse read-out (*I-V* sweep with switching source and drain). It was found that the CCS-induced degradation of threshold voltage (ΔV_T) and subthreshold swing (ΔSS) was larger in reverse rather than in forward read-out. Related mechanism was most likely to be the hot carrier generation followed by the electron trapping localized in drain edge. The difference between top-gate and bottom-gate structure was also addressed in perspective of CCS instability. Our results are expected to be useful for optimizing TFT structure for AMOLED era.

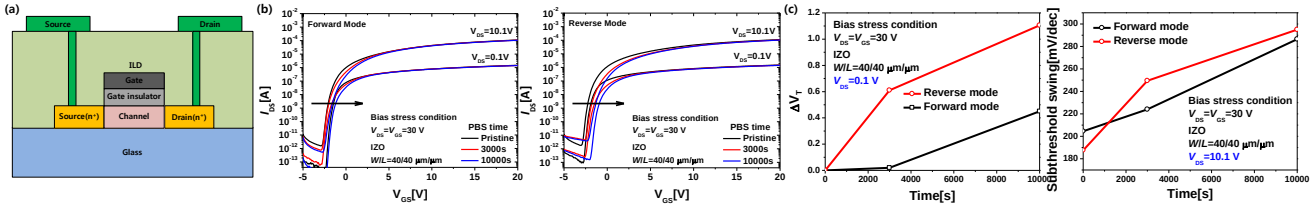

Fig 1. (a) Schematic of top gate a-IZO structure, (b) The forward and reverse transfer curves according to stress time, and (c) ΔV_T, *SS* vs. time characteristics of a-IZO TFTs.

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