# Analysis of hump characteristics induced self-heating and charge trapping in bottom-gate etch-stopper a-IGZO TFTs after simultaneous positive gate and drain bias stress

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Simultaneous positive gate and drain bias stress (SPGDBS) is the most important instability in active-matrix organic light-emitting diode (AMOLED) displays. Under SPGDBS, both the self-heating and the charge trapping are important instability mechanisms in amorphous oxide thin-film transistors (TFTs) with low thermal conductivity on a glass substrate [1-2]. The hump effect was observed after SPGDBS because the instability mechanisms occur in different regions, respectively. Therefore, it was observed that the reverse $V_{GS}$ sweep condition is dominated by a local potential barrier modulated by the variations of the channel width ($W_{ch}$) and stress time.

In this work, SPGDBS ($V_{GS}$/$V_{DS}$= 25 V/25 V) induced degradation is investigated in the bottom-gate (BG) etch-stopper (ES) amorphous indium-gallium-zinc-oxide (a-IGZO) TFTs. After SPGDBS, both the positive shift and the hump of transfer curve were observed. In addition, it was observed that the magnitude of hump threshold voltage shift at reverse sweep increased with the increase in $W_{ch}$ [Fig. 1(a), (b)]. The results are attributed to the combination of donor creation near the drain by the increase in self-heating [1] and the electron trapping into the gate insulator [3] [Fig. 1(c), (d)]. To investigate the donor creation, the subgap density-of-states ($g$(E)) were extracted with stress time by using the multifrequency C-V method [4]. The increase in $W_{ch}$ affects the increase in the donor creation bacause self-heating dissipation will be insufficient with an increase in $W_{ch}$ [5] [Fig. 1(e), (f)]. The mechanisms discussed in our study are expected to be useful in characterizing the long-term instability of the BG ES a-IGZO TFT-driven AMOLED display backplanes.

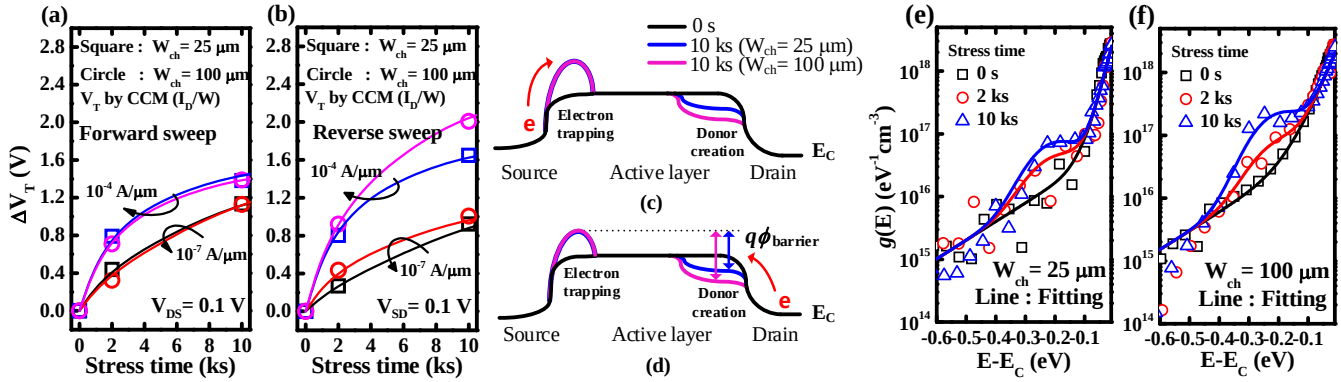


**Fig. 1. (a) and (b) $\Delta V_T$ curves. The read-out energy band diagram in (c) the forward sweep and (d) the reverse sweep conditions. The $g$(E) of a-IGZO channel with different stress time was extracted at various (e) $W_{ch}$= 25 μm and (f) $W_{ch}$= 100 μm.**

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