Positive Bias Stress in Flowing Drain Current-Induced Degradations in Self-Aligned Top-Gate a-IZO TFTs

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Drain current-flowing stress is the most important instability of oxide thin-film transistor (TFT)-driven backplanes in active-matrix organic light-emitting diode (AMOLED) displays. It has been worthy of notice very recently and especially a deep understanding of instability in oxide TFTs under AMOLED operation condition has become a critical issue for commercializing the oxide TFTs technology. Moreover, the oxide TFTs with top-gate structures have indicated advantageious features, such as rather higher mobility and lower source/drain(S/D) resistance, than the features of bottom-gate structured oxide TFTs [1-2]. However, the positive bias stress in flowing drain current-induced instability in the top-gate structured oxide TFTs have been rarely investigated in the perspective of frequency-dispersion of C-V curve and self-heating effect.

In this work, the current-flowing stress-induced degradation in the self-aligned top-gate indium-zinc-oxide (IZO) TFTs is investigated and the related mechanisms are discussed with self-heating effect, *i.e.*, the positive bias stress condition(V_{DS}/V_{GS} = 13V/13V). The subgap density-of-states (g(E)) was traced with the stress time by using the multifrequency C-V method [3]. As the stress time increased, it was found that the frequency-dispersion of C-V characteristics, the negative shift of threshold voltage in forward mode(ΔV_{TF}) and in S/D interchange reverse mode(ΔV_{TR}) became prominently different due to the various temperature and width[Fig. 1(a), (b)] by local joule-heating[4]. In comparison with the various temperature and width, generation of both deep donor-like trap and the annihilation of shallow donor-like trap were clearly increased in the drain region under high temperature and wide width [Fig. 1(c)]. This finding was consistent not only with the current-flowint stress time-evolutions of I-V and C-V characteristics and local degradation near the drain region, but also with various temperature and width as well.

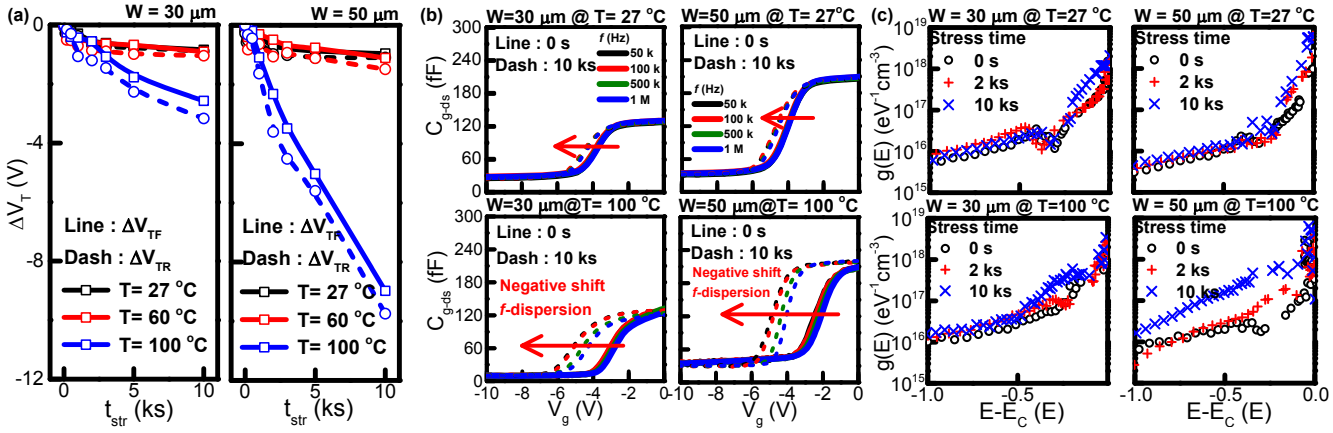

Fig. 1. (a) ΔV_T and (b) Capacitance-voltage curves. The stress time evolutions of DOS in (c) various temperature condition and width.

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