Extraction of Intrinsic Mobility Values of Oxide Thin Film Transistor by Ultra-fast Pulsed I-V Measurements

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Conventional DC characterization method involving fast transient charging effect in oxide thin film transistor (TFT) leads to the underestimation of actual performance of oxide TFT. In order to extract the intrinsic mobility value and evaluate the impact of fast transient charge trapping on the mobility of oxide TFT, we introduced ultra-fast pulsed current-voltage (I–V) and transient current methodology. The ultra-fast pulsed I–V method allows to determine the intrinsic mobility of oxide TFT in charge trap-free environment. The field effect mobility values of tested devices, for instance, HfInZnO TFTs with low and high Hf contents are measured to 14.2 and 4.1 cm^2/v-s, respectively. The mobility values extracted from pulsed I–V curves were increased by 18 and 70 % as compared to conventional DC technique, respectively, mainly due to negligible charge trapping effect. We observed the same trends for other oxide TFTs such as GIZO, IZO and ZnON TFTs. Also the modelling on transient characteristics provides understanding on the dynamic nature of charge trapping in oxide TFT. This result present that the pulse I-V measurement is a very important technique for evaluating the performance of oxide thin film devices.

Fig. 1. A sample line graph

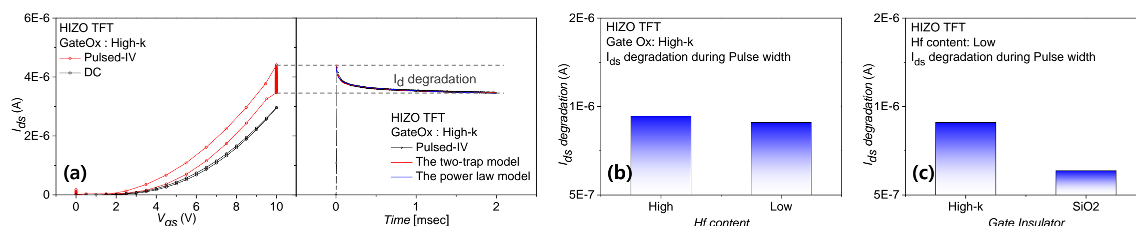

Figure 1. (a) Pulsed IV & DC IV curves and its transient IV curve in time domain (b),(c) Id degradation during pulse width with Hf content & Gate Insulator

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References

References

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