18p-A12-6

Suppression of hump effect in *a*-InGaZnO thin-film transistors passivated by novel photosensitive passivation layer

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Current technological trends calls for devices that have high performance and low power consumption. Amorphous InGaZnO (*a*-IGZO) conform to these requirements because of its high electron mobility and large on-off current ratio [1]. Furthermore, *a*-IGZO will also have a large role in the development of emerging technologies such as flexible and transparent electronics because of low temperature processability and wide band gap [1]. Nevertheless, passivation layers are still necessary for *a*-IGZO thin-film transistors (TFT) because of several ambient effects that lead to degradation of reliability [2]. Both inorganic and organic passivation layers have been used to inhibit these effects. However, inorganic passivation requires complicated fabrication. On the other hand, fabrication of organic passivation is simpler but performance is worse compared to their inorganic counterparts such as larger threshold voltage shift and subthreshold degradation. We have previously presented hybrid inorganic-organic passivation layers based on polysilsesquioxane [3]. These passivation layers were easy to fabricate and greatly improved the reliability of *a*-IGZO. However, etching was required to form contact holes which affected the transfer characteristics.

In this work, we present a novel photosensitive polysilsesquioxane passivation layer. This passivation is even easier to fabricate than the previous polysilsesquioxane passivation, and promotes excellent reliability in *a*-IGZO TFT. It is also more effective in suppressing the hump effect observed in *a*-IGZO TFT after negative bias stress (NBS, V_{gs} = -20 V at 10000 s; see Fig. 1). We found that the suppression depended on the annealing temperature. The same trend was also observed during positive bias stress.

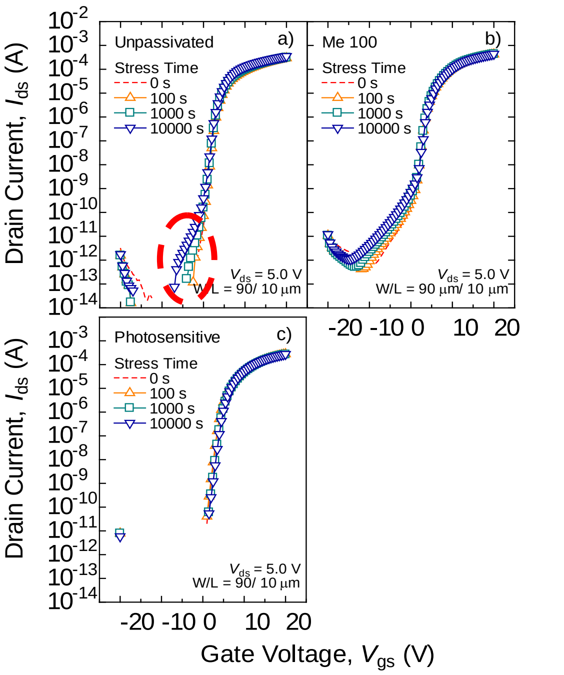

Fig. 1. Variation of transfer characteristics after NBS (V_{gs} = -20V) for a) unpassivated TFT, b) methylsilsesquioxane passivated TFT, c) photosensitive passivated TFT. Hump effect is highlighted by the red circle.

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