Surface passivation effect on the bias-stress-induced instability of CVD-grown molybdenum disulfide transistor

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Abstract

Molybdenum disulfide (MoS_2) is a promising transition metal dichalcogenide (TMD) material for the application as a channel material of field-effect transistor due to the existence of band-gap (1.8 eV for monolayer) and the high mobility (~150 $cm^2V^{-1}s^{-1}$).[1] The bias-stress-induced instability of MoS_2 is one of the importance factors for further applications and several research have been reported.[2],[3] The surface passivation effect on the performance such as a mobility and threshold voltage of MoS_2 transistor was reported,[4] however, the effect on the instability has not been reported. Here, we report the effect of surface passivation with Al_2O_3 on the instability including the threshold voltage shift and fitting parameters of MoS_2 field-effect transistor under a gate bias stress. We used bi-layer MoS_2 synthesized by CVD technique using solid sources (MoO_3 and sulfur) at 700 °C and the Al_2O_3 passivation layer was deposited using ALD. The threshold voltage shift was reduced using the surface passivation and the fitting parameters (characteristic time constant and stretched-exponential exponent) also indicated the decrease of trap density.

References

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