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

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Abstract

Molybdenum disulfide (MoS₂) 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 cm²/V·s).

The bias-stress-induced instability of MoS₂ is one of the importance factors for further applications and several research have been reported. The surface passivation effect on the performance such as mobility and threshold voltage of MoS₂ transistor was reported, however, the effect on the instability has not been reported. Here, we report the effect of surface passivation with Al₂O₃ on the instability including the threshold voltage shift and fitting parameters of MoS₂ field-effect transistor under a gate bias stress. We used bi-layer MoS₂ synthesized by CVD technique using solid sources (MoO₃ and sulfur) at 700 °C and the Al₂O₃ 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