Flexible Thin Film MoS_2 Transistor embedded on Polyimide substrate using 2D Silver Nanowire Random Network

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Recently, 2D materials specially Transition Metal Dichalcogenides (TMDs) based Molybdenum disulfide (MoS_2) have emerged a lot attraction in flexible and stretchable electronics devices due to its high physical and mechanical properties such as high deformability, high mechanical stability and good electrical performance. Ultrahigh mobility thin film transistor (TFT) based on TMDs materials generally exhibits excellent electrical properties on the rigid substrate in contrary to the flexible and stretchable substrates. To obtain high performance flexible transistor, we suggested a laser-welded adhesion method of silver nanowires (Ag NWs) random network into the solution-based polyimide (PI) and fabricated a multilayer MoS_2 transistor followed by the conventional methods of fabrication. The mechanical and electrical characteristics of the flexible MoS_2 TFT have been analyzed under static and cyclic bending conditions (bending radius: 5 & 10 mm) and the consequences of this work elaborates the high electrical performance showing the current On/Off ratio (>10^6) and the charge carrier mobility greater than 100 $cm^2V^{-1}s^{-1}$ under static and cyclic bending conditions. The results show unchangeable behavior under various mechanical tests by introducing Al_2O_3 and Su-8 hybrid structure during the fabrication of flexible MoS_2 TFT. We believe that the presented work may extend the numerous new opportunities in the field of flexible and stretchable electronics applications such as memory, display and healthcare devices.

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