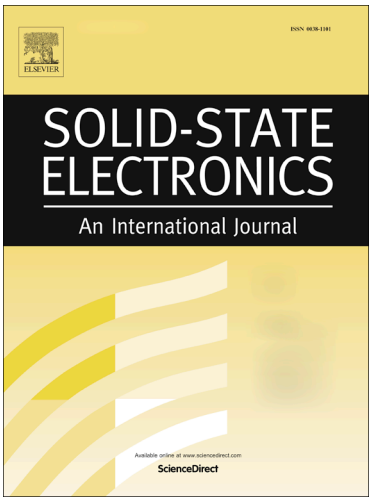

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Solution Processed Thin Film Transistor from Liquid Phase Exfoliated MoS_2 Flakes

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Abstract

Two dimensional layers of dichalcogenide materials have attracted a lot of interests due to their potential applications in optoelectronics and energy storage. Hence, there is a large interest in establishing cheap, scalable processes for the production of low dimensional semiconducting dichalcogenide based films. In this work, well exfoliated MoS_2 dispersions were prepared through a two-step liquid phase exfoliation process with N-methyl-pyrrolidone (NMP) and Isopropanol (IPA). The quality of the obtained MoS_2 flakes was characterized by transmission electron microscopy, scanning electron microscopy, UV-Vis spectroscopy and Raman spectroscopy. For charge transport analysis, bottom-gate thin film transistors (TFTs) based on exfoliated MoS_2 films were fabricated via spray coating technique. Electrical characterization of the obtained TFTs showed that adding a PMMA layer on top of the semiconductor lead to considerable improvements in the electrical performance. The analysis of the electrical characteristics suggests that the additional PMMA layer improves the charge transfer between adjacent flakes. Electrical measurements on TFTs with different channel length were used to separate the impact of the contact resistance and the channel resistance on the charge transport. The TFTs output curves showed non-linear current-voltage (I-V) characteristic. The non-linear behavior was attributed to the formation of Schottky barriers at the inter-flakes connection. In this work, we show a low-cost and scalable solution-based fabrication process that could boost the application of dichalcogenides in modern nanoelectronic devices.

Keywords*: Transition metal dichalcogenides, molybdenum disulfide, liquid phase exfoliation, thin film transistors*