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Effects of High-Energy X-Ray Radiation on MoS2 FETs AMRITESH RAI, Univ of Texas, Austin, LAXMAN THOUTAM, WEI ZHANG, Materials Science Division, Argonne National Laboratory, Argonne, IL, KIRAN KOVI, Center for Nanoscale Materials, Argonne National Laboratory, Argonne, IL, SANJAY BANERJEE, Univ of Texas, Austin, SAPTARSHI DAS, Center for Nanoscale Materials, Argonne National Laboratory, Argonne, IL — FETs based on semiconducting MoS_2 nanosheets are currently being extensively explored for various nanoelectronic device applications. In real-life, several of these applications mandate the exposure of devices to X-ray radiation. In this study, we investigate the effects of high-energy X-ray radiation on few-layer MoS_2 transistors. Back-gated MoS_2 FETs on SiO_2 substrates were fabricated and exposed to X-ray radiation in an enclosed X-ray tube utilizing tungsten as the X-ray source. The devices were exposed to successive radiation doses up to a cumulative dose of 1500 kilorads (Krads). Even after high radiation doses, the devices maintained acceptable electrical performance with high I_{ON}/I_{OFF} ratios and good current saturation. The subthreshold swing remained similar to initial values. There was, however, a slight reduction in the ON-currents after each successive radiation, concomitant with a positive threshold voltage shift that can be attributed to the formation of negative-fixed charges in the substrate. Moreover, the maximum transconductance (g_m) of the devices decreased slightly with increasing radiation dose. Finally, Raman spectroscopy revealed practically no change in the in-plane and out-of-plane Raman modes of MoS_2 after radiation.

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