A comparison of MoSe$_2$ field-effect transistors on SiO$_2$ and parylene-C substrates: possible surface polar phonon effects$^1$ BHIM CHAMLAGAIN, Wayne State University, QING LI, MINGHU PAN, Oak Ridge National Laboratory, TUGENG HONG, HSUEN-JEN CHUANG, MEEGHAGE PERERA, Wayne State University, YONG XU, Wayne State University, DI XAIO, Carnegie Mellon University, NIRMAL GHIMIRE, JIAQIANG YAN, DAVID MANDRUS, University of Tennessee, ZHIXIAN ZHOU, Wayne State University — We report the fabrication and electrical characterization of high quality MoSe$_2$ field-effect transistors fabricated on both SiO$_2$ and parylene-C substrates. Multilayer MoSe$_2$ on parylene-C shows a significantly higher room temperature mobility of 100 cm$^2$V$^{-1}$s$^{-1}$—160 cm$^2$V$^{-1}$s$^{-1}$ than that on SiO$_2$ ($\approx$50 cm$^2$V$^{-1}$s$^{-1}$). Our variable temperature transport measurements indicate that the mobility of MoSe$_2$ devices on both SiO$_2$ and parylene-C increases to $\approx$ 500 cm$^2$V$^{-1}$s$^{-1}$ as the temperature decreases to below 100 K, with the mobility of MoSe$_2$ on SiO$_2$ increasing more rapidly. We attribute the observed difference in mobility and its temperature dependence between MoSe$_2$ on SiO$_2$ and on parylene-C primarily to the surface polar optical phonon scattering in the SiO$_2$ substrate, which is absent in parylene-C.

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