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Improved Carrier Mobility in Few-Layer MoS_2 Field-Effect Transistors with Ionic-Liquid Gating[1] MEEGHAGE PERERA, MING-WEI LIN, HSUN-JEN CHUANG, BHIM CHAMLAGAIN, CHONGYU WANG, XUEBIN TAN, MARK CHENG, Wayne State University, DAVID TOMÁNEK, Michigan State University, ZHIXIAN ZHOU, Wayne State University — We report the fabrication of ionic liquid (IL) gated field-effect transistors (FETs) consisting of bilayer and few-layer MoS_2. Our transport measurements indicate that the electron mobility μ $\approx$60 $cm^2V^{-1}s^{-1}$ at 250 K in ionic liquid gated devices exceeds significantly that of comparable back-gated devices. IL-FETs display a mobility increase from $\approx$100 $cm^2V^{-1}s^{-1}$ at 180 K to $\approx$220 $cm^2V^{-1}s^{-1}$ at 77 K in good agreement with the true channel mobility determined from four-terminal measurements, ambipolar behavior with a high ON/OFF ratio $>10^7$ (10^4) for electrons (holes), and a near ideal sub-threshold swing of $\approx$50 mV/dec at 250 K. We attribute the observed performance enhancement, specifically the increased carrier mobility that is limited by phonons, to the reduction of the Schottky barrier at the source and drain electrode by band bending caused by the ultrathin ionic-liquid dielectric layer. In addition, graphene contacted MoS_2 FETs with IL-gating will also be discussed.

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