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High-Performance n-type and p-type WSe_2 Field Effect Transistors with Ionic-Liquid Gated Graphene Electrodes HSUN JEN CHUANG, XUEBIN TAN, MARK MING-CHENG CHENG, Wayne State University, NIRMAL JEEVI GHIMIRE, JIAQIANG YAN, DAVID MANDRUS, University of Tennessee, BHIM CHAMLAGAIN, MEEGHAGE MADUSANKA PERERA, ZHIXIAN ZHOU, Wayne State University — We report the application of graphene as a work-function-tunable electrode material for few-layer WSe_2 field-effect transistors (FETs). By tuning the carrier density of graphene at the graphene/WSe_2 contacts using an extremely-large-capacitance ionic liquid gate, we have successfully achieved low resistance Ohmic contacts and high ON-current for both holes and electrons in WSe_2 FETs. The extrinsic electron and hole mobility values increase with decreasing temperature reaching $\approx$ 300 $cm^2V^{-1}s^{-1}$ at 77 K when the graphene contacts are highly n- and p-doped by large positive and negative ionic-liquid gate voltages, respectively, indicating that the intrinsic phonon-limited mobility is approached for both electrons and holes in graphene contacted few-layer WSe_2. We attribute the enhanced device performance to the drastic reduction of the Schottky barrier height via tuning the work function of graphene electrodes to align with the conduction and valence band edges of WSe_2 by an ionic liquid gate. This work was supported by NSF (DMR-1308436).

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