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Air Stable Doping of MoS2 FETs Using TiOx Sol-Gel[1] AMRITESH RAI, RUDRESH GHOSH, ANUPAM ROY, AMITHRAJ VALSARAJ, HEMA CP MOVVA, SANGWOO KANG, EMANUEL TUTUC, LEONARD REGISTER, SANJAY BANERJEE, Univ of Texas, Austin — Field effect transistors based on ultra-thin transition metal dichalcogenides suffer from high contact resistances due to the Schottky barrier formed between the metal and the semiconducting channel. An effective way to overcome this issue is to dope the semiconducting channel in order to reduce the Schottky barrier width, thereby enabling efficient electron injection via tunneling. Previously used charge transfer doping techniques employed the use of potassium ions and PEI. However, these doping reagents are unstable in air. Here we report the use of an air stable, self encapsulating, spin on n-type doping technique on MoS2 utilizing TiOx sol-gel. The doping of the channel is confirmed by the broadening of the A1g Raman mode of MoS2. High performance field effect transistors are demonstrated which show three times improvement in the field effect mobility as well as a two-fold increase in the intrinsic mobility of the MoS2 channel. The enhancement of intrinsic mobility can be attributed to the suppression of the A1g phonon modes of MoS2 as well as screening of charged impurities by the TiOX layer. The devices show extended air stability over two to three weeks. The use of TiOx sol-gel can be a promising way to enhance the performance of TMD based transistors.

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