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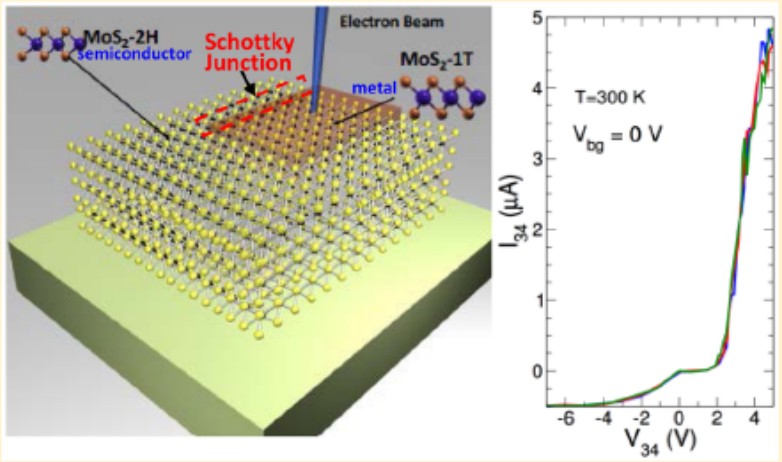
Gate-Tunable Atomically Thin Lateral MoS_2 Schottky Junction Patterned by Electron Beam

ABSTRACT: Among atomically thin two-dimensional (2D) materials, molybdenum disulfide (MoS_2) is attracting considerable attention because of its direct bandgap in the 2H-semiconducting phase. On the other hand, a 1T-metallic phase has been revealed, bringing complementary application. Recently, thanks to top-down fabrication using electron beam (EB) irradiation techniques, in-plane 1T-metal/2H-semiconductor lateral (Schottky) MoS_2 junctions were demonstrated, opening a path toward the cointegration of active and passive two-dimensional devices. Here, we report the first transport measurements evidencing the formation of a MoS_2 Schottky barrier (SB) junction with barrier height of 0.13−0.18 eV created at the interface between EB-irradiated (1T)/nonirradiated (2H) regions. Our experimental findings, supported by state-of-the-art simulation, reveal unique device fingerprint of SB-based field-effect transistors made from atom-thin 1T layers.



KEYWORDS: *Atomically thin layers, Schottky junction, semiconductor−metal transition, electron-beam irradiation, 1T phase*

単層・数層の二硫化モリブデンはグラフェンを凌ぐ次世代原子層半導体として期待が集まっています。これに電子線照射することで金属転移を発生させ、その半導体・金属界面に世界で最も薄い原子数層のショットキー接合が存在することを突き止めました。電子線照射のみで創製する原子層レベルの次世代集積回路の基盤技術として今後の発展が大いに期待されます（論文は下記リンク）。