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Band-like transport in high mobility single-layer MoS_2 FETs
DEEP JARIWALA, VINOD SANGWAN, JAMES JOHNS, DATTATRAY LATE, KEN EVERAERTS, JULIAN MCMORROW, LINCOLN LAUHON, VINAYAK DRAVID, Department of Materials Science and Engineering, Northwestern University, TOBIN MARKS, Department of Chemistry and Materials Science and Engineering, Northwestern University, MARK HERSAM, Department of Materials Science and Engineering, Chemistry and Medicine, Northwestern University — The recent realization of monolayered MoS_2 as a direct band gap two-dimensional semiconductor in contrast to zero gap graphene, has attracted significant attention for digital electronic applications. In most measurements to date, single-layer MoS_2 field-effect transistors (FETs) have shown low field-effect mobility values that have been explained by Mott variable range hopping (VRH) transport. In contrast, here we report variable temperature measurements on high mobility (greater than 50 cm^2/V.s at room temperature) single-layer MoS_2 FETs that show band-like transport with monotonic increase in mobility with decreasing temperature suggesting phonon quenching at low temperatures as also observed for graphene. The magnitude of the drain current remains constant across the range of temperatures (5.7 - 298 K), while the threshold voltage displays a positive shift. In this presentation we emphasize on high quality single-layer MoS_2 FETs with band-like transport and the highest reported field-effect mobility values (120 cm^2/V.s at 5.7 K) in devices without encapsulation in a high-κ dielectric.

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