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Thickness-dependent Electrical and Thermoelectric Transport in few-layer MoS_2 MORTEZA KAYYALHA, Purdue Univ, LI SHI, University of Texas at Austin, YONG CHEN, Purdue Univ — Layered semiconducting Transition Metal Dichalcogenides such as MoS_2 have recently gained a lot of attention as promising 2D materials for electronic and optoelectronic device applications. Here, we present a systematic study of thickness-dependent electrical and thermoelectric transport in few-layer MoS_2. MoS_2 flakes with various thicknesses ranging from 1-23 layers are prepared using the standard scotch-taped exfoliation technique and are then transferred onto a SiO_2/Si substrate. Electrical and thermoelectric measurements are carried out using AC and DC techniques with samples in vacuum. We observe five-fold enhancement in the electrical conductivity of two-layer MoS_2 compared to the bulk. However, the thermopower (TEP) exhibits less change except for monolayer where TEP is twice smaller. We also observe six times larger power factor in two-layer MoS_2 compared to the bulk. Additionally, we used a back gate to modulate the Fermi energy inside MoS_2 where an enhancement in TEP is observed close to the off state. Our results give insight into future prospects of MoS_2-based devices in thermoelectric applications.

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