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High Powerfactor in single and few-layer MoS2 YING WANG, YU YE, KEDAR HIPPALGAONKAR, YUAN WANG, XIANG ZHANG, University of California, Berkeley — The thermoelectric effect enables conversion between thermal and electrical energy, and provides one way to extract energy from waste heat. The efficiency of a thermoelectric device can be defined by a dimensionless figure of merit given by $ZT = S^2\sigma\mathrm{T}/\kappa$. In order to achieve efficient thermoelectric devices, $S^2\sigma$ needs to be kept high by optimizing the interplay between the S and σ. The thin layered transition-metal dichalcogenide semiconductor $\mathrm{MoS_2}$ has attracted great interest because of two dimensional density of states and relatively high mobility, which could give a large S and σ. Here we study on pristine exfoliated 1L-, 2L- and 3L $\mathrm{MoS_2}$ samples by simultaneous measurement of the Seebeck coefficient(S) and two probe electrical conductivity using nano-fabricated heater and thermometer. It firstly shows that atomic thin MoS2 which has a large effective band masses ($m*$) as well as high mobilies (μ), increases the powerfactor $S^2\sigma$.to as high as $8.5\, mWm^{-1}K^{-2}$at room temperature (twice as high as commercially used $\mathrm{Bi_2Te_3}$). Further, we show for the first time that the confined two-dimensional density of states of the conduction band can be studied in monolayer $\mathrm{MoS_2}$ by measuring the gate-dependent Seebeck voltage.

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