Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Thermoelectric Powerfactor and Density of States in 2D MoS_2

KEDAR HIPPALGAONKAR, Institute of Materials Research and Engineering, YING WANG, YU YE, HANYU ZHU, YUAN WANG, JOEL MOORE, XIANG ZHANG, University of California, Berkeley — Efficient thermoelectric devices require high voltage generation from a temperature gradient and a large electrical conductivity, while maintaining a low thermal conductivity. For a given thermal conductivity and temperature, thermoelectric powerfactor is determined by the electronic structure of the material. Low dimensionality (1D and 2D) opens new routes to high powerfactor due to unique density of states (DOS) of confined electrons and holes. Emerging 2D transition metal dichalcogenide (TMDC) semiconductors represent a new class of thermoelectric materials not only because of their discretized density of states, but also due to their large effective masses and high carrier mobilities. We report a measured powerfactor of MoS2 as large as 8.5 $mWm^{-1}K^{-2}$ at room temperature, which is amongst the highest among all thermoelectric materials and we show that the powerfactor scales with mobility for 1L and 2L samples. Moreover, measurement of thermoelectric properties of monolayer MoS_2 allows us to determine the confined 2D DOS near the conduction band edge and in the insulating state, which cannot be measured by electrical conductivity alone. The demonstrated record high electronically tunable powerfactor in 2D TMDCs holds promise for efficient thermoelectric energy conversion.

Kedar Hippalgaonkar
Institute of Materials Research and Engineering

Date submitted: 05 Nov 2015 Electronic form version 1.4