In-plane and Cross-plane Thermoelectric Transport in 2D materials

M.Zebarjadi[1,2]

[1] *Electrical and Computer Engineering Dept., and*
[2] *Materials Science and Engineering Dept., University of Virginia, Charlottesville, Va, USA*

Thermoelectric materials are used for power generation and refrigeration (pumping of heat from cold side to hot side). They could also be used for electronic cooling combining active and passive cooling to efficiently cool down the hot spots. 2D materials could be used for all three modes. In the in-plane direction, usually their thermal conductivity is large and therefore they could be used for electronic cooling. In a recent work we have shown that graphene on hBN demonstrates record high thermoelectric power factor (more than 10 W/mK). In the cross-plane direction, layered 2D materials are weakly bonded and form van-der-Waals bonds and therefore they could have extremely low thermal conductivity values, making them potentially good candidates for traditional thermoelectric applications. We have shown such layered van-der-Waals structures could serve as efficient thermionic coolers/ power generators.