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Large thermoelectric figure of merit in graphene layered devices at low temperature

Nanostructured materials have emerged as an alternative to enhance the figure of merit (ZT) of thermoelectric (TE) devices. Graphene exhibits a high electrical conductivity (in-plane) that is necessary for a high ZT ; however, this effect is countered by its impressive thermal conductivity. In this work TE layered devices composed of electrochemically exfoliated graphene (EEG) and a phonon blocking material such as poly (3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS), polyaniline (PANI) and gold nanoparticles (AuNPs) at the interface were prepared. The figure of merit, ZT , of each device was measured in the cross-plane direction using the Transient Harman Method (THM) and complemented with AFM-based measurements. The results show remarkable high ZT values ($0.81 < ZT < 2.45$) that are directly related with the topography, surface potential, capacitance gradient and resistance of the devices at the nanoscale.

References

[1] Daniel Olaya, Mikel Hurtado-Morales, Daniel Gómez, Octavio Alejandro Castañeda-Uribe, Zhen-Yu Juang and Yenny Hernández. 2D Materials 5, 011004, 2018.

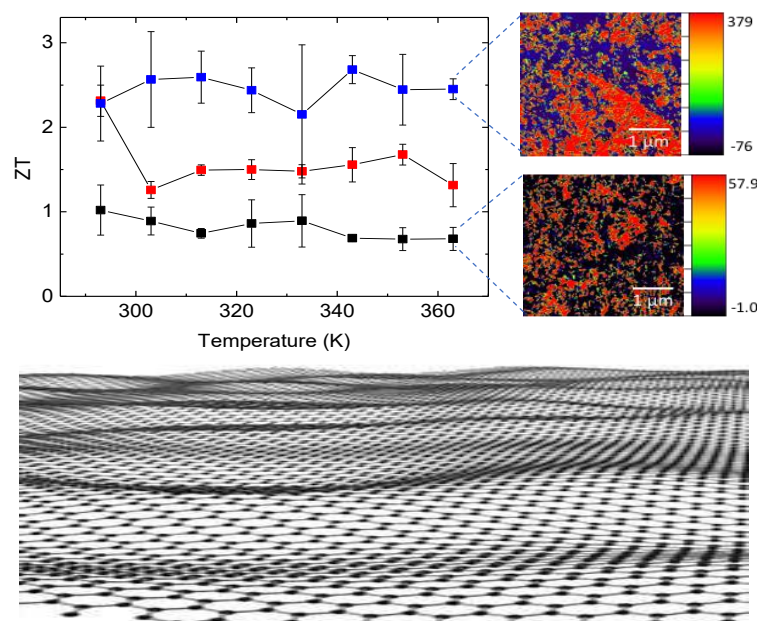


Figure 1: Thermoelectric figure of Merit of Graphene-based heterostructures.