Thermoelectric properties of van der Waals heterostructures based of transition metal dichalcogenides

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The wold of the 2D materials offers the possibility to discover and exploit new properties and performances that have no counterpart in bulk structures. However, 2D materials does not have the same thermal and chemical stability as bulk materials. The idea that allows to use or even to improve bi-dimensional materials is to create a van der Waals heterostructure [1]. This allows for a protection of the central layer and, moreover, can produce properties that do not belong to any of the employed materials in the heterostructure.
In this poster, I will present the transfer technique employed to build the vdW heterostructures; I will show some preliminary electric transport measures in heterostructures fabricated with graphene, hexagonal boron nitride (hBN) and tungsten diselenide (WSe_2) [2]. Finally, I will show COMSOL simulation and implementation of a Seebeck measure set-up.
Transition metal dichalcogenides shows an electrical conductivity relatively high and a weak thermal conductivity. This makes them suitable materials for thermoelectric applications [3].

References

[1] A.K. Geim et al., Nature, 499 (2013) 419 - 425.
[2] G. Fiori et al., Nature Nanotechnology, 9 (2014), 768 – 779.
[3] M. Buscema et al., Nano Letter, 13 (2013) 358 - 363.

Figures

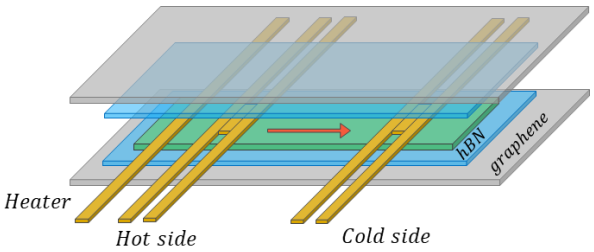

Figure 1: Van der Waals heterostructure with electrodes for Seebeck measure.

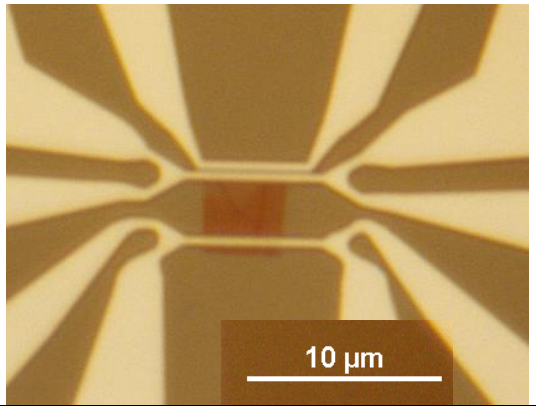

Figure 2: Graphene sample for Seebeck measure.