Helium atom scattering: A unique tool to characterize layered van der Waals heterostructures

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The rapidly developing field of layered van der Waals heterostructures, in which atomically thin layers of compounds of different nature (graphene, h-BN, black phosphorus, metal dichalchogenides, iron pnictides, etc.) are stacked on top of one another [1], requires an arsenal of experimental techniques that can yield global and local characterization of the fascinating properties of these technologically relevant 2D materials. Specifically, we describe here how properties of the utmost importance, such as crystallographic structure, structural corrugation, interlayer bonding (covalent, ionic, van der Waals, etc), charge transfer or phonon spectrum can be determined by Helium Atom Scattering (HAS) [2] in layered systems (including insulating ones) with examples related mostly to graphene epitaxially grown on a number of single crystal metal surfaces.

References

[1] A. K. Geim and I. V. Grigorieva, Nature, 499 (2013) 419.
[2] D. Farías and K.-H. Rieder, Rep. Prog. Phys. 61 (1998) 1575

Figures

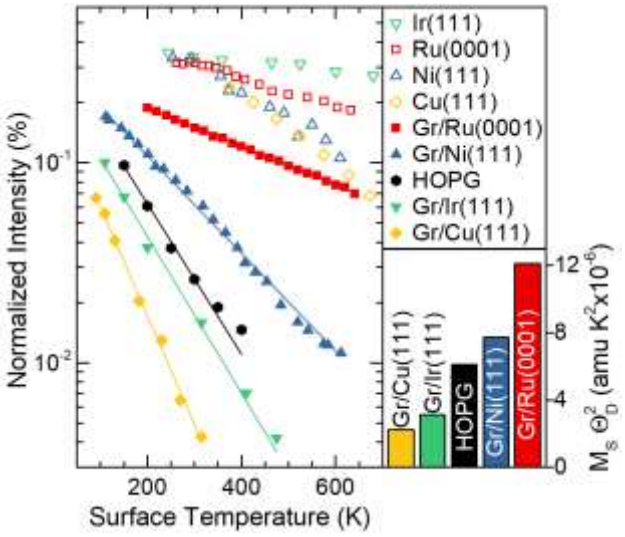

Figure 1: Thermal attenuation and derived effective mass of surface atoms of graphene on different metallic substrates

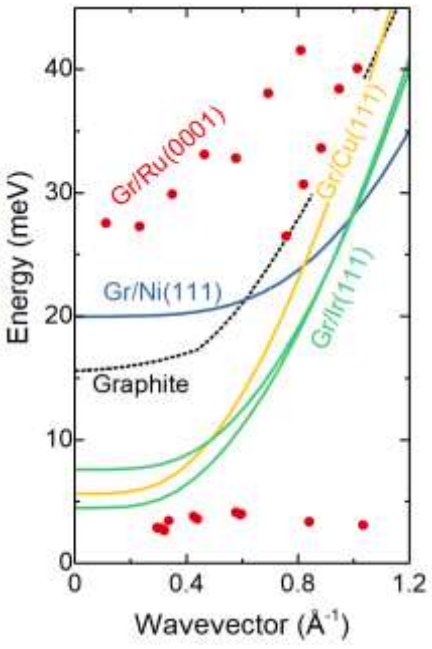

Figure 2: Flexural phonon mode of Graphene on different metallic substrates