Charge transfer in 1T-TaS_2/graphene hybrid structures studied by spatially resolved Raman spectroscopy

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1T-TaS_2 belongs to the family of layered transition metals dichalcogenides (TMDs). It is characterized by four successive temperature-dependent phase transitions associated with charge density wave (CDW) phases and structural changes of the crystal lattice. At high temperatures the material is metallic, whereas at low temperatures (below around 200 K) periodic lattice distortion occurs, leading to superlattice formation and a bandgap opening. Moreover, 1T-TaS_2 has a relatively high value of spin-orbit interaction. The aim of the presented research is to obtain TaS_2 and graphene hybrid structures in order to combine the astonishing properties of these two materials, especially to obtain hybrid structures with strong spin-orbit coupling induced in graphene.

In this communication we present results of Raman scattering mapping of a 1T-TaS_2/graphene hybrid structure, obtained by mechanical exfoliation of thin TaS_2 flakes in vacuum onto epitaxial graphene grown on a SiC substrate. Figure 1 a) shows the effective Raman shift of G-band changes measured on and next to a TaS_2 flake. An effective G-band shift is calculated with respect to the 2D band position, to subtract effects of the strain in graphene. The observed effective G-band shift (Figure 1 a) is spatially correlated with the Raman signal corresponding to TaS_2 (Figure 1 b) and strongly suggests effective charge transfer from TaS_2 to graphene.

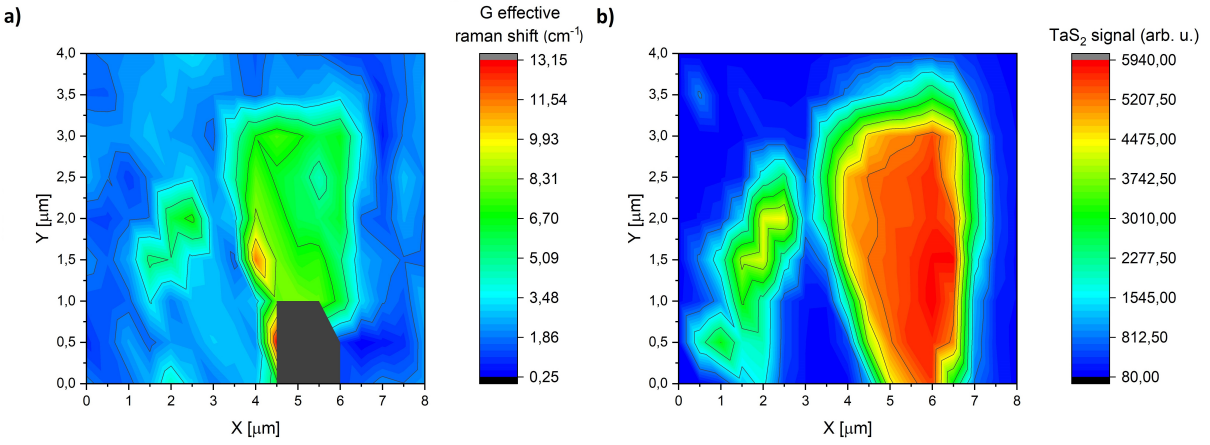

Figure 1. a) Effective Raman shift of the G band measured on and next to a TaS_2 flake. b) Raman signal from TaS_2.

Thus, the obtained results confirm that TaS_2 flakes are strongly coupled with the grapheneand hold great promise to obtain hybrid structures with enhanced spin-orbit coupling induced in graphene.

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