Raman scattering from 1T-TaS_2 / graphene hybrid structures

E.M. Łacińska[1], J. Binder[1], I. Lutsyk [2], W. Strupiński[3,4], Z. Klusek[2], R. Stępniewski[1], A. Wysmołek[1]

[1] *Faculty of Physics, University of Warsaw, Pasteura 5, 02-093 Warsaw, Poland*
[2]*Faculty of Physics, University of Łódź, Pomorska 149/153, 90-236 Łódź, Poland*
[3]*Institute of Electronic Materials Technology, Wólczyńska 133, 01-919 Warsaw, Poland*
[4]*Faculty of Physics, Warsaw University of Technology (WUT), Koszykowa 75, 00-662 Warsaw, Poland*

Tantalum disulfide (TaS_2) belongs to very intensively studied family of layered transition metal dichalcogenides. It has attracted a lot of interest from many research groups because of its very rich phase diagram: it has four temperature-dependent charge density wave phases, from which high temperature phases are metallic, whereas at low temperature (below around 180 K) TaS_2 shows Mott insulator behaviour. Moreover, it has a 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 preliminary studies of 1T-TaS_2/graphene structures, obtained by mechanical exfoliation of bulk TaS_2 crystal onto epitaxial graphene grown on a SiC substrate. Samples prepared in such a way were measured using Raman spectroscopy. Figure 1 shows the intensity changes of Raman modes of graphene measured on and next to a TaS_2 flake. Considerable loss of the intensity of the G and 2D peaks correlates well with the integrated intensity of the TaS_2 Raman signal, which clearly indicates that an interaction between graphene and TaS_2 flake is present. However, no evident modification of the positions or widths of the G and 2D modes caused by the presence of the TaS_2 flake was observed. This suggests that no significant charge transfer between TaS_2 and graphene takes place and the effect most probably results from an excitation transfer between graphene and TaS_2. Possible mechanisms responsible for the observed effects are discussed.

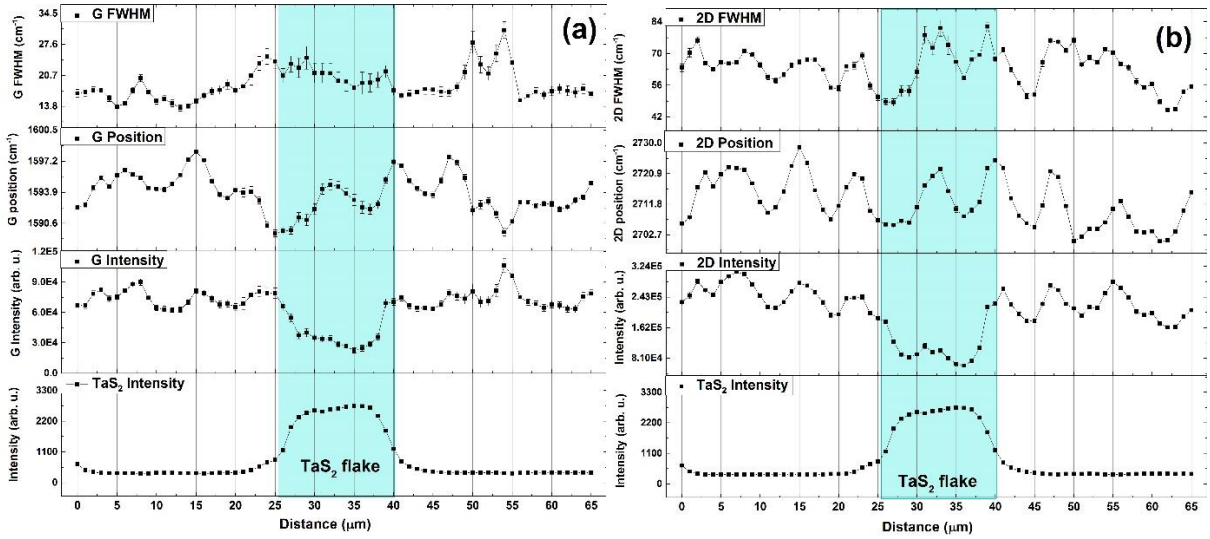

Figure 1. Graphene Raman (a) G and (b) 2D modes parameters obtained for graphene on and next to 1T-TaS_2 flake.

This work has been supported by the National Science Centre under grants no. 110104/501/66 GR-5296 and 2015/19/B/ST3/03142.