Dielectric function of monolayer WS_2: a spectroscopic ellipsometry investigation

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Two-dimensional crystals, such as transition metal dichalcogenides (TMDs), have emerged as elementary components of new-generation nano-electronic and spintronic devices due to their unique properties [1]. The possibility to create so-called Van der Waals heterostructures exploiting appropriate stacks of 2D materials bulk counterpart peculiar ability of being exfoliated is an appealing topic which will permeate the thin interfaces science and technology in the next years [2]. As far as optics is concerned, the spectral response of heterostacks represents both a diagnostic tool of the system quality and, of course, a direct way to evaluate characteristics such as electronic band gaps, excitons and so on.
Here, we present a preliminary study by spectroscopic ellipsometry of the properties of CVD-grown monolayer tungsten disulphide (WS_2) on quasi-free standing monolayer graphene (QFMLG) on SiC (0001) [3].
Preliminarily, we characterized the morphological and structural properties of the sample through atomic force microscopy (AFM) and Raman spectroscopy, while we got the information about the stacking of layers through X-ray photoemission spectroscopy (XPS). Quick diagnostics of excitonic peaks can be obtained by difference spectra of ellipsometry data between our sample and an appropriate reference, whereas building a suitable model allows us to extract the dielectric properties (the complex index of refraction) of WS_2 in the optical spectral range 1.2-3.1 eV.
Our results substantially agree with the existing literature on the system and represent an excellent starting point for the investigation of increasingly complex heterostacks.

References

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Figure

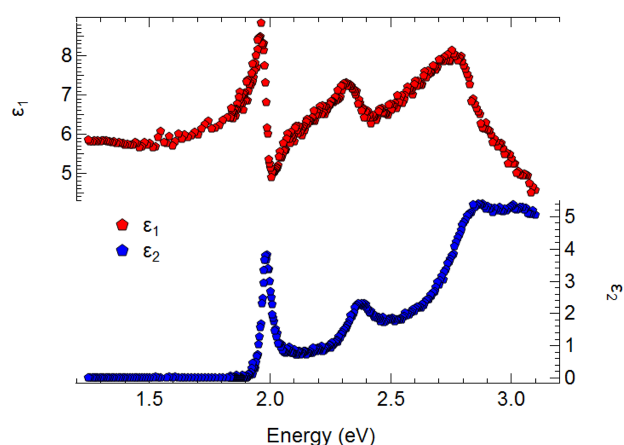

Figure 1: Real (red curve) and Imaginary (blue curve) parts of the dielectric function of WS_2.

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