GROWTH AND CHARACTERIZATION OF THIN MoS_2 LAYERS ON EPITAXIAL GRAPHENE ON SiC(0001)

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The unique property of layered metal dichalcogenides such as MoS_2 to transform from an indirect to a direct semiconductor when reducing the thickness to one monolayer offers new possibilities for electronic devices. For applications, however, the availability of scaleable production methods is a prerequisite.

In the present work, we investigate the chemical vapor deposition (CVD) of thin layers of MoS_2 using sulfur powder and two different molybdenum precursors, MoO_3 [1] and $MoCl_5$ [2]. MoS_2 was deposited on monolayer graphene (MLG) epitaxially grown on SiC(0001). Alternatively, the so-called buffer layer (BL), which is a graphene-like layer strongly bound to SiC(0001) [3], was used as substrate. Both BL and MLG were prepared by sublimation growth in argon at atmospheric pressure as described elsewhere [4].

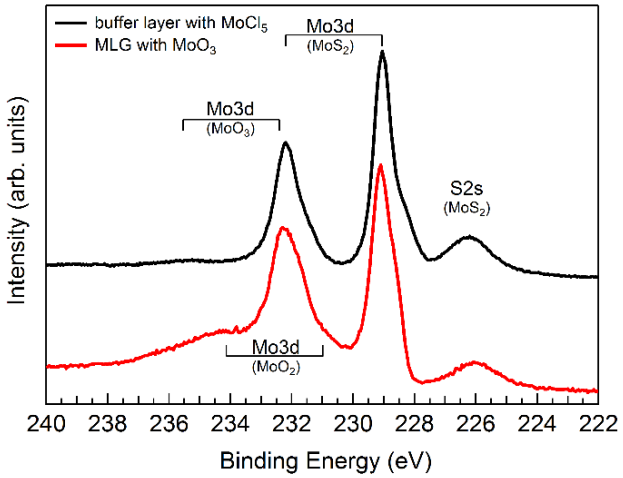

Fig. 1. Mo3d and S2s core-level spectra of CVD-MoS_2 films on buffer layer and monolayer graphene using $MoCl_5$ and MoO_3 precursors, respectively.

Samples were characterized using X-ray photoelectron spectroscopy (XPS) for the chemical composition of the samples, atomic force microscopy and low-energy electron diffraction for the structure and crystallinity of the deposited layers. For MoO_3 as precursor, a rather inhomogeneous MoS_2 growth is found which is accompanied by interface oxidation of the SiC due to oxygen intercalation. On the other hand, $MoCl_5$ as precursor results in an improved homogeneity of the deposited films and sulfur intercalation as suggested by XPS data. For the latter, a thickness of the deposited MoS_2 of approximately 1 to 3 monolayers is derived from analysis of core-level intensities.

Keywords: MoS_2; Graphene; CVD; XPS

References

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