

# Formation of MoS<sub>2</sub> layer underneath graphene grown on SiC(0001)

**P.Knyps<sup>1</sup>**

P. P.Michalowski<sup>1</sup>, P.Ciepielewski<sup>1</sup>, P.A.Caban<sup>1</sup>, E.Dumiszewska<sup>1</sup>, J.M.Baranowski<sup>1</sup>, G.Kowalski<sup>2</sup>, and M.Tokarczyk<sup>2</sup>

<sup>1</sup>Institute of Electronic Materials Technology, Warsaw, Poland

<sup>2</sup>Physics Faculty, University of Warsaw, Poland

[Piotr.Knyps@itme.edu.pl](mailto:Piotr.Knyps@itme.edu.pl)

The process of formation of MoS<sub>2</sub> layers underneath the graphene grown on SiC(0001) is reported for the first time. The process of intercalation of hydrogen into the graphene layer grown on SiC(0001) is well known [1]. The intercalation of other atoms such as oxygen, iron, gold and cobalt [2] was also reported. However, the process of intercalation of Mo and formation of a high quality MoS<sub>2</sub> underneath of graphene grown on SiC(0001) was not known up till now.

Successful growth of MoS<sub>2</sub> underneath of graphene layer grown on 6H-SiC(0001) was implemented in two steps. The first step was realized with deposition of Mo layer into graphene/SiC substrate. Next, sample with Mo layer was heated up to 7500C in the H<sub>2</sub> flow. SIMS measurements have shown that Intercalation of Mo under graphene layer took place in this process. After that, sulfurization with H<sub>2</sub>S for 15 minutes was done. This process leads to formation of MoS<sub>2</sub> underneath graphene layer.

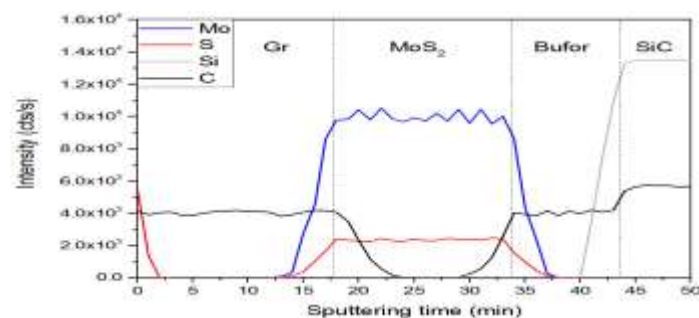
Characterization of the obtained Gr/MoS<sub>2</sub>/SiC heterostructures have been done by SIMS, X-ray diffraction, and by Raman spectroscopy. SIMS measurements have disclosed that MoS<sub>2</sub> layers are formed below the graphene layer. Raman measurements have identified peaks A<sub>1g</sub> and E<sub>2g</sub> connected with MoS<sub>2</sub> lattice and the G and 2D peaks connected with graphene. The X-ray diffraction confirmed the presence of MoS<sub>2</sub> in the system as

monocrystalline thin (4nm) layer parallel to the underlying SiC substrate surface.

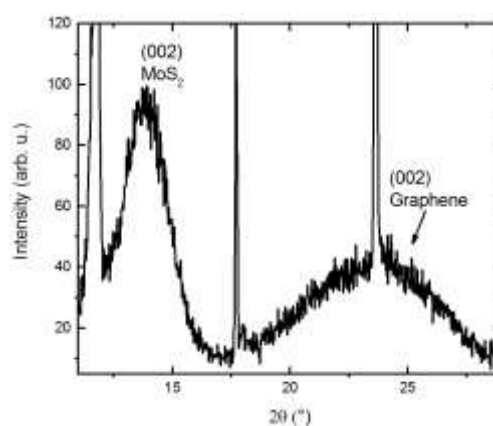
## References

- [1] C. Riedl, C. Coletti, T. Iwasaki, A. A. Zakharov, and U. Starke, Phys. Rev. Lett. 103 (2009), 246804
- [2] R.Honig, P.Roese, K.Shamout, U.Berges and C.Westphal, Nanotechnology 30 (2019) 025702

## Figures



a



b

**Figure 1:** a) SIMS profile and b) X-ray diffraction (in-plane XRD) patterns of the Gr/MoS<sub>2</sub>/SiC heterostructure