Investigation of electronic properties and chemical interactions of graphene-MoSx composites

Labrini Sygellou [1#*], Iordanis Tzanidis[2] and Dimitrios Tasis[2]

[1] Foundation for Research and Technology, Institute of Chemical Engineering Sciences (FORTH/ICE-HT), Patras, GR-26504, Greece

[2] Department of Chemistry (Section of Physical Chemistry), University of Ioannina, 45110, Ioannina, Greece

* sygellou@iceht.forth.gr

ABSTRACT

Nanostructured transition metal dichalcogenide (TMDs) materials exhibit promising potential in next-generation optoelectronic devices and catalysts. TMDs possess chemically inert basal planes and catalytically active edge sites, with the relative population of the latter being a decisive factor for tailoring the structural, chemical and electronic properties of such nanostructures. In virtually all applications, TMD based assemblies must be interfaced with other materials (such as graphitic domains in an electrode). During the in situ growth of MoS_2 nanostructures in the presence of oxygen-doped graphitic materials, the formation of amorphous and/or crystalline Mo based species could influence the chemical environment and electronic properties of the composites.

Herein, a combined in situ X-ray and Ultra-Violet photoelectron spectroscopies (XPS/UPS) study has been carried out to follow the evolution of atomic composition, the surface chemical species and the electronic properties (Work Function and Ionization Potential) during the thermal decomposition in Ultra High Vacuum conditions of (a) neat $(NH_4)_2MoS_4$ salt, (b) $(NH_4)_2MoS_4$-GO and (c) $(NH_4)_2MoS_4$-rGO composites. The composites were in the form of thin films on ITO substrates reduced upon step-wise heating in ultrahigh vacuum (UHV) and XPS/UPS recorded in each reduction step. It was found that, up to 400C, thermal conversion of $(NH_4)_2MoS_4$ salt to transient intermediates, across amorphous MoSx phase have been performed towards to MoS2 out of significant percent of suphur active sites. [1]. In the case of $(NH_4)_2MoS_4$-GO and $(NH_4)_2MoS_4$-rGO composites Mo^{6+}, Mo^{a+} ($5 \leq a < 6$), MoS_2 and sulphur oxides were formed. An accurate assessment of the chemical environment of the component interfaces along with its electronic properties was performed [2]. These findings have implications for electronic transport and the understanding of behavior of such hybrid assemblies in many applications.

REFERENCES

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