

## O2 MAT

### GRAPHENE DERIVATIVES: SYNTHESIS, CHARACTERIZATION AND APPLICATION IN GAS SENSING DEVICES. RAMAN STUDY OF THE INTERACTIONS AMONG NO, NO<sub>2</sub> GASEOUS POLLUTANTS, AND THE GRAPHENE GAS SENSITIVE LAYERS

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In this work, the chemical synthesis of graphene derivatives have been performed with two different graphite, applied as graphene precursors, by using the modified Hummer's method [1]. Raman, FTIR and TEM characterization were carried out to identify the presence of high quality graphene materials. The highest quality of graphene sample, obtained working with the micro-metric graphite from Merck (as solid powder precursor), was applied for the subsequent functionalization with Triethanolamine (TEOA). FTIR study has been also performed to verify the functionalization of graphene nanosheets with TEOA. This aliphatic amine has been selected because it results highly sensitive [2] and selective toward the NO<sub>2</sub> uptake [3], present as primary pollutant in troposphere. Theoretical studies (based on Computational models) [4], reveal that the unmodified graphene (i.e. pristine graphene, as deposited) is not an ideal material for gas sensing and for this purpose graphene needs to be functionalized. Especially, FTIR reveals the presence of OH groups on graphene nano sheets and the First-principles calculations also demonstrate the main role of the hydroxyl groups [5] in NO<sub>2</sub> sensing (during the uptake of the gaseous pollutants and their release, especially when sensors are regenerated). Moreover, Raman spectroscopy clearly highlights the reversible molecular interactions between graphene derivative and NO<sub>2</sub> gaseous pollutant, in both cases: during the selective uptake/capturing and also during the gaseous pollutants desorbing step (this latter necessary for the regeneration of the sensor nanoplatform). Finally, derivatization of Graphene is the first step in designing air pollution sensors characterized by sufficiently moderate cost and ease of operation. These would be very suitable for "saturation monitoring" in which many sensors per unit surface may contribute to a better knowledge of the spatial distribution of atmospheric pollution and a better evaluation of its effects on population.

#### References

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***O2 MAT***

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