LOW TEMPERATURE/UV-ASSISTED COMPOSITES AS GAS SENSORS FOR MEDICAL APPLICATIONS

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The sensing of gas molecules is of fundamental importance for environmental monitoring, control of chemical processes, medical applications, and so on [1]. Furthermore, recent success in non-invasive medical diagnostics, based on human breath analysis, is pushing forward the development of extremely sensitive gas sensors for ppb detection of specific analytes (*e.g.* acetone) in a complex gas mixture [1,2]. In recent years, graphene-based gas sensors have attracted much attention and different structures have been developed showing high sensing performances and room temperature working conditions [2]. However, they still suffer from several problems, which could be overcome by covering the graphene surface with metal oxide semiconductors. Furthermore, studies regarding the detection of Volatile Organic Compounds (VOCs) are still at the beginning [3].

Hence, the present work will be aimed at: *i*) optimizing the synthetic routes of *ad hoc* composite VOCs sensing materials (based on graphene oxide/SnO_2 hybrids); *ii)* engineering the gas sensor device; and *iii*) evaluating the sensing performances at both high and mild temperatures (also exploiting the UV light) towards gaseous ethanol, acetone and ethylbenzene.

Starting from pure graphite, graphene oxide (GO) powder was synthesized by adopting the Hummer's modified method, in which the synthetic route was deeply investigated, and several parameters (such as H_2O_2 concentration) were modulated. Once optimized this step, SnO_2 were grown on its surface by hydrothermal method, varying the starting salt precursor/GO weight ratio between 4 and 32. For comparison, pure commercial and home-made SnO_2 were also tested. Several physico-chemical analyses were performed to characterize all the as-prepared nanopowders. Subsequently, a homogeneous film was deposited by spraying technique onto Pt-Interdigitated Electrodes (Pt-IDEs).

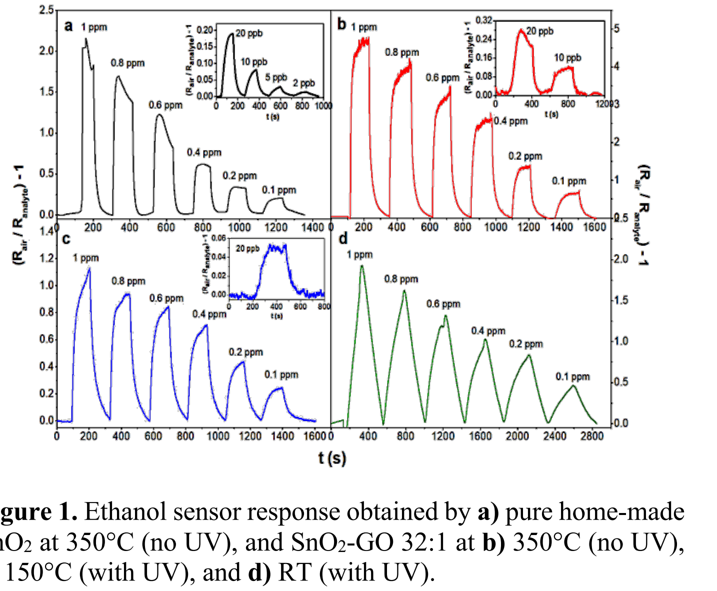

Figure 1. Ethanol sensor response obtained by **a)** pure home-made SnO_2 at 350°C (no UV), and SnO_2-GO 32:1 at **b)** 350°C (no UV), **c)** 150°C (with UV), and **d)** RT (with UV).

Then, gaseous ethanol (Figure 1) and acetone were sensed, obtaining very promising results for both pure and hybrid materials at 350°C, and at lower temperatures (150°C to 30°C, by exploiting the UV light) for the graphene-based samples.

References

[1] A. Tricoli, N. Nasiri, S. De, *Adv. Funct. Mater.* **2017**, *27*, 1605271.
[2] A. Tricoli, M. Righettoni, A. Teleki, *Angew. Chem. Int.* **2010**, *49*, 7632 – 7659.
[3] J. Chen, B. Yao, C. Li, G. Shi, *Carbon* **2013**, *64*, 225–229.