"New synthesis and applications of graphene based photocatalytic nanocomposites for Healthier Cities"

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Abstract Environmental pollution, especially toxic gases and organics in air and water, caused by anthropic activities, severely threaten ecological balance and human health. To face this problem, during the last decade, the scientific community made lots of efforts in producing compounds (mostly based on semiconductors, e.g.TiO_2) that exploit sun light photon energy to photodegradate organic and inorganic pollutants. Recently it has been demonstrated that photocatalytic performances can be enhanced when TiO_2 is combined to carbon nanomaterials, Fig.1, e.g. graphene(G) or carbon nanotubes in suitable composite.[1] In this work we synthesized a wide range of G-TiO_2 nanomaterials starting from different carbon sources (Graphite, graphene oxide, reduced graphene oxide, CO_2 expanded graphite and Graphene water-paste) and using different synthetic pathway (Ultrasonication, ball milling and shearing exfoliation) to promote the interaction between the carbon and the commercial titanium dioxide.
Moreover, we developed a method to test the photocatalytic performance of our graphene based nanocomposites under light irradiation taking two ionic dyes, rhodamine B and fluoresceine, as model targets of organic pollutants. The most promising material, obtained from commercial graphite and TiO_2, showed an efficiency increase of Δ%P=+20% after 10 min irradiation with respect to bare TiO_2.
In order to understand the interaction between the two components as well as the morphology of the sample, we performed TEM microscopy in dry and wet state (FIB-TEM and cryo-TEM), SEM and Raman spectroscopy. In conclusion, exploiting photon energy as well as the interaction with metal oxides and graphene to photodegradate organic and inorganic pollutants, we tried the real application of TiO_2-G photocatalytic compounds opening the possibility to have cleaner air.

References

[1] N. Zhang, Y. Zhanga and Y. Xu, Nanoscale, 2012, 4, 5792-5813

Figures

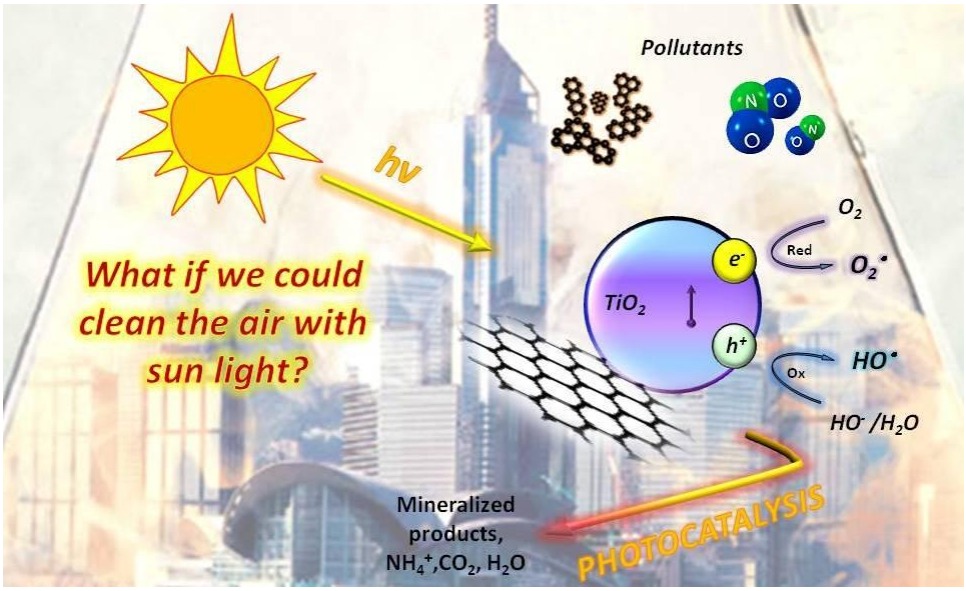

Fig. 1. Scheme of the photocatalytic process of TiO_2-G nanocomposite in photodegradation of volatile pollutants