# Graphene Oxide nanosheets by laser irradiation in liquid for environment, health and energy applications

**Simona Filice**[1]
Viviana Scuderi[1], Damiano Ricciarelli[1], Antonino La Magna[1], Stefano Boscarino[2], and Silvia Scalese[1]
[1]*ConsiglioNazionale delle Ricerche (CNR), Istituto per la Microelettronica e Microsistemi (IMM), Ottava Strada n°5, Catania 95121, Italy.*
[2]*Dipartimento di Fisica e Astronomia "Ettore Majorana" Università di Catania, Via Santa Sofia 64, Catania, 95123, Italy*

simona.filice@cnr.it

In this work, laser irradiation in liquid (PLIL) has been used as simple, tunable, highly scalable and low-cost procedure for the selective modifications of nanostructured material and in particular for the production of graphene oxide nanosheets (GO-n)[1-2].
We have prepared GO-n by PLIL using GO as precursor, different dispersing media (i.e. water, alcohol) and different energy doses, achieving flakes size reduction, as observed by Scanning Electron Microscopy, and modifications of surface functional groups, as shown by XPS spectroscopy. By tuning the laser process parameters selective modifications can be induced on the GO, for example, low energy densities promote pore and vacancies formation, while higher energy densities lead to internal quantum confinement. PLIL process determines also changes in the electrochemical properties of GO, as evidenced by the performed voltammetric analysis, and optical properties in terms of light absorption and emission, as shown by Uv-Visible and Photoluminescence spectroscopies. Experimental analyses were supported by theoretical investigations.
The above-mentioned physico-chemical changes confer to GO-n different functionalities suitable for different applications, from health to energy fields. In particular, here we report our recent studies concerning their use as (i) antimicrobial agents against *Escherichia coli*, (ii) optically active nanomaterials for bioimaging and, finally as (iii) active nanostructures for electrochemical devices (sensing and water splitting) will be shown.

## References

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[2] D. Ricciarelli, S. Filice, G. Calogero, V. Scuderi, S. Boscarino, V. Iacono, F. Ruffino, I. Deretzis, G. Fisicaro, S. Scalese, A. La Magna, ACS Applied Nano Materials, 7, 21, 24969–24977, (2024).

## Figures

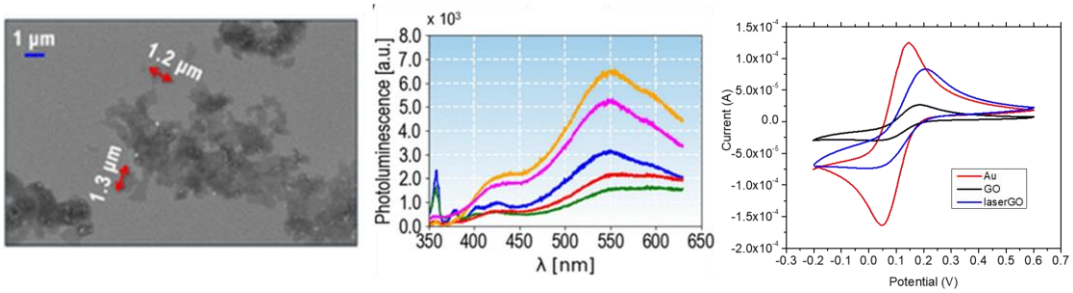


**Figure 1:** SEM micrographs of irradiated GO (on the left), photolumiscence spectra of pristine and irradiated GO at different fluences (on the center) and Cyclic voltammetry (CV) curves of pristine and laser modified GO in PBS with 10 mM $K_3Fe(CN)_6$ (on the right).

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