7 - 11 JULY 2024
NANOSMAT Barcelona

15th International Conference on Surfaces, Coatings and Nanostructured Materials
www.nanosmat2024.com

ABSTRACT:

Graphene oxide as versatile tool to investigate low-dimensional systems on large-scale

Andrea Liscio
Institute for Microelectronics and Microsystems of
National Research Council of Italy (IMM-CNR)
email: andrea.liscio@cnr.it

GO is an oxygenated derivative of graphene produced at industrial-scale using liquid phase methods[1] and employed in the fabrication of a large number of materials spanning on different applications including energy harvesting, water treatment and structural composites. The key of its versatility is given by the chemical structure of these 2D sheets featuring aromatic carbon clusters surrounded by defects and holes, chemical functionalization as hydroxyl and epoxy groups on the basal plane along with carboxyl and carbonyl moieties lining the edges.
In this talk I will show how a material with such processing and manipulation versatility can become a useful tool for testing mathematical, statistical and physical models in low-dimensional materials. In particular, by breaking and assembling GO nanosheets it is possible to shed light on more general phenomena related to 2D systems.

- ✓ Breaking the single graphene oxide offers the unique opportunity to study the fragmentation mechanisms of purely 2D materials and to verify the various theoretical models. In particular, the intrinsic correlation between the morphological and mechanical properties is established. The use of a statistical approach allows defining new parameters necessary for the development of a correct metrology of 2D materials.[2]
- ✓ On the other side, the single GO nanosheet can be assembled to produce structures with tuned structural complexity in controlled way. In particular, we assemble single sheets with great precision into micrometric networks and macroscopic multi-layered films with tunable chemical and electrical properties by thermal reduction studying the mechanisms involved in the charge transport using dedicated self-consistent approaches.[3] Results clearly show that such thin films can be described using a topological point of view paving the way to a more general description of charge transport in van der Waals 2D thin films.

References

[1] Park, S. et al., Nature Nanotechnology, 4 (2009) 217
[2] Liscio A. et al., 2D Materials, 4 (2017) 025017; Kovtun A. et al., 2D Materials, 6 (2019) 025006
[3] Kovtun A. et al., ACS Nano, 15 (2021) 2654-2667; Çinar M.N., et al., Nano Letters, 22 (2022) 2202; Boschi A. et al., Small, 19 (2023) 2303238