

# MATERIALS SCIENCE AND TECHNOLOGY

## DISAT - Functional 2D material inks and nano-hybrids

<b>Funded By</b>	Dipartimento DISAT
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<b>Context of the research activity</b>	This research project aims at studying the production of 2D material inks through the use of the liquid-phase exfoliation methods and the formation of nano-hybrids with other nanomaterials for use in energy conversion applications, such as (photo)electrocatalysis and photovoltaics.
<b>Objectives</b>	<p>The PhD scholarship is in the framework of the European Research Council Starting Grant project titled "All-liquid phase JANUS Bldimensional materials for functional nano-architectures and assemblies" (acronym: JANUS BI), led by Prof. Teresa Gatti (Department of Applied Science and Technology - DISAT).</p> <p>The research activity concerns the optimization of the liquid-phase exfoliation process for different types of layered materials, including graphene, transition metal dichalcogenides and oxides, MXenes and graphitic carbon nitride. The thus obtained nano-inks have to be coupled through chemical and physical methods to other nanomaterials such as semiconducting nanocrystals and carbon dots for the preparation of functional nanohybrids with energy conversion activity. The target applications are (photo)electrocatalysis and photovoltaics.</p> <p>In particular, the research activities will regard:</p> <ul style="list-style-type: none"> <li>- the synthesis of the nanomaterials object of the research program in a chemical laboratory and their formulation into colloidal inks;</li> <li>- the physico-chemical, optical and electrochemical characterization of the synthesized nanomaterials and of their inks;</li> <li>- the production of thin films from direct deposition of the nanomaterials-based colloidal inks through solution processing techniques;</li> <li>- the fabrication of devices on a laboratory scale;</li> <li>- the interfacing with the other members of the research group to give continuity and synergy between the various parts of the project;</li> <li>- the autonomous development of ideas and the opportune analysis of the experimental data;</li> <li>- the preparation of monthly reports on the experimental activity;</li> <li>- the drafting of scientific articles, reviews and patents on the basis of the results obtained, as well as the participation to national and international conferences and meetings in the field to present the results to the scientific and technical community;</li> </ul>

	- the supervision of Bachelor and Master students carrying out thesis projects in the frame of the above described research
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<b>Skills and competencies for the development of the activity</b>	Knowledge of colloidal chemistry, of low-dimensional materials and of their (opto)electronic properties. Knowledge of synthetic methods for low-dimensional materials and of physico-chemical characterization techniques (electron microscopy, x-ray diffraction, x-ray photoelectron spectroscopy, Raman spectroscopy, electrochemical methods). Knowledge of applications of low-dimensional materials in energy and optoelectronics, particularly in solar and (photo)electrochemical cells.
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