



PhD in INGEGNERIA DEI MATERIALI / MATERIALS ENGINEERING - 38th cycle

INTERDISCIPLINARY Research Field: SELF-ASSEMBLING COMPOSITE MATERIALS FOR INDUSTRIAL AND CIVIL WASTEWATER TREATMENT VIA PHOTOCATALYTIC PROCESSES

Monthly net income of PhDscholarship (max 36 months)

€ 1325.0

In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

Interdisciplinary PhD Grant

The PhD research will be carried out in collaboration with research groups of the PhD programme in "**INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING**".

See <https://www.dottorato.polimi.it/?id=422&L=1> for further information.

The management of water resources, in terms of rational use, purification treatments and recycling, is a long-standing and crucial issue that is increasingly considered to be the basis of sustainable global development. In particular, reduction of the level of inorganic and organic contaminants in water streams for industrial, domestic or agricultural use, has a paramount importance for reasons primarily related to human health, but also to environmental, technical and regulatory issues. It is therefore necessary to implement technological solutions aimed at reducing the content of undesirable species in wastewater coming from various processes in order to reusing such streams within the original process or disposing of them in a safe and sustainable way. There are two main methods used today: liquid-liquid processes (e.g., extraction with organic solvents) and solid-liquid processes (filtration and adsorption). The selection of the most appropriate technique depends on the correct evaluation of different parameters, such as, for example, reliability, flexibility, cost, environmental sustainability, process scalability and efficiency in contaminant removal.



	<p>In this scenario, the research proposes to address two urgent problems such as metal accumulation and pollution caused by pesticides and herbicides, by employing adsorbent materials in the form of self-assembling reduced graphene oxide (rGO) membranes and TiO₂-based photocatalysts. The final goal is to develop a composite filter to be used in photocatalytic reactors able to adsorb hybrid contaminants degrading the organic fraction. At the same time, it has to reduce the content of heavy metals, synergistically exploiting the well-known properties of TiO₂ and the innovative capabilities, demonstrated by the proponents, of rGO.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The activity will be carried out by integrating chemical and materials science knowledge with catalysis and photocatalysis knowledge. In particular, a method for GO reduction will be refined using reagents that are neither dangerous to humans nor harmful to the environment, such as, for example, ascorbic acid instead of hydrazine, still widely used as a reducing agent in the scientific literature. Self-assembling composite membranes will be produced by adopting TiO₂-containing formulations, and morphological and photocatalytic properties of the membranes will be investigated. All of them will be tested in photocatalytic reactors in order to evaluate the correlations between their morphological properties and performance in removing target pollutant species.</p>
<p>Educational objectives</p>	<p>The research activity will strengthen the following skills:- materials selection in several operating conditions;- design of experiments to fulfil pre-defined targets;- team-working and human interactions in research and industrial environments</p>
<p>Job opportunities</p>	<p>The research activity will strengthen the following skills:- materials selection in several operating conditions;- design of experiments to fulfil pre-defined targets;- team-working and human interactions in research and industrial environments</p>
<p>Composition of the research group</p>	<p>2 Full Professors 3 Associated Professors 3 Assistant Professors</p>



	5 PhD Students
Name of the research directors	Prof. Dotelli - Prof.ssa Nova

Contacts	
Telephone: +39 0223993232 (prof. Dotelli); +39 0223993228 (prof. Nova)	
Email: giovanni.dotelli@polimi.it; isabella.nova@polimi.it	
Web-pages of the research group: Mat4En ² group: https://mat4en2.cmic.polimi.it/ - LCCP group: https://www.lccp.polimi.it/	

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	662.5 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information	
<p>Educational activities (funding for participation in courses, summer schools, workshops and conferences) - financial aid per PhD student 5.500 euros.</p> <p>Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD student: There are various forms of financial support for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities within the limits allowed by the regulation.</p>	