



PhD in CHIMICA INDUSTRIALE E INGEGNERIA

CHIMICA / INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING - 40th cycle

THEMATIC Research Field: ADVANCED CHARACTERIZATION OF SINGLE-ATOM CATALYSTS

Monthly net income of PhDscholarship (max 36 months)

€ 1500.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

Single-atom catalysts (SACs) hold promise in revolutionizing heterogeneous catalysis, due to their unparalleled efficiency and selectivity and maximized metal utilization. However, elucidating the intricate mechanisms governing the performance of single-atom catalysts in liquid-phase reactions remains a formidable challenge. This Ph.D. project aims to bridge this gap by employing advanced characterization techniques to unravel the elusive reaction pathways of single-atom catalysts in liquid environments. By delving deep into the atomic-scale dynamics, the goal is to decipher the underlying principles governing SACs, paving the way for a more rational design of highly efficient and sustainable catalysts for various chemical transformations.

Methods and techniques that will be developed and used to carry out the research

Cutting-edge methodologies such as in-situ spectroscopy, high-resolution transmission electron microscopy (HRTEM), X-ray absorption spectroscopy (XAS), and X-ray photoelectron spectroscopy (XPS) will be utilized to probe the structure, electronic configuration, and catalytic activity of single-atom catalysts under operando conditions. The use of synchrotron-based techniques will be necessary for their exceptional sensitivity and resolution, enabling real-time monitoring of catalytic processes at the atomic level. The ultimate goal is to derive structure-function relationships to comprehensively



	understand the interplay between catalyst structure, performance, and dynamics.
Educational objectives	This research will provide a comprehensive training platform encompassing theoretical knowledge, experimental skills, and computational techniques. Through hands-on experience with advanced instrumentation and interdisciplinary collaboration, the PhD candidate will develop proficiency in advanced characterization methods, data analysis, and scientific communication, fostering critical thinking and problem-solving abilities essential for tackling complex scientific challenges. It is expected that the PhD candidate will publish multiple highly-cited papers in prestigious journals such as Angewandte Chemie International Edition, Journal of the American Chemical Society, Nature Catalysis, Nature Materials, and Nature Synthesis. Furthermore, the PhD candidate will actively present their work through several oral talks at prominent conferences such as the European Congress on Catalysis, North American Meeting, and other scientific gatherings.
Job opportunities	Graduates of this Ph.D. program will be highly sought after in both academia and industry. Opportunities abound in research institutions, national laboratories, and industrial R&D sectors, where their specialized skill set, and innovative mindset will be instrumental in driving forward the development of next-generation catalysts and sustainable chemical processes.
Composition of the research group	0 Full Professors 1 Associated Professors 5 Assistant Professors 7 PhD Students
Name of the research directors	Prof. Gianvito Vilé

Contacts

Telephone: +39 02 2399 3036

E-mail: gianvito.vile@polimi.it

Webpage: <https://www.vile-researchgroup.com/>



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)	1st year	2nd year	3rd year
	2000.0 € per student	2000.0 € per student	2000.0 € per student
	max number of financial aid available: 1, given in order of merit (only for students with scholarship)..		

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
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 per year:</p> <p>1st year: around 1.900 euros per student 2nd year: around 1.900 euros per student 3rd year: around 1.900 euros per student</p> <p>Teaching assistantship. There are various forms of financial of for activities of support to the teaching practice. The candidate is encouraged to take part in these activities within the limits allowed by the regulation.</p>