

PhD in CHIMICA INDUSTRIALE E INGEGNERIA CHIMICA / INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING - 40th cycle

THEMATIC Research Field: STUDY OF INTENSIFIED AND ELECTRIFIED REACTORS FOR LOW-CARBON HYDROGEN PRODUCTION

Monthly net income of PhDscholarship (max 36 months)		
€ 1400.0		
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	The research project aims at contributing to the progress of decarbonization of hydrogen production through the development of novel catalytic reactors characterized by improved heat and mass transfer properties and by the application of renewable electric energy as heat source. The future energy system will rely on distributed hydrogen production starting from renewable feedstocks and green H-vectors. Biomethane/biogas and green ammonia will be major resources. Their efficient conversion into H2-rich streams in highly energy efficient and compact reactors will be a key for the penetration of hydrogen in the energy system. The objective of this research will be the testing, modelling and scale-up of novel reactor configurations based on the combined use of structured catalysts and/or internals to impreove heat and mass transfer properties and the application of renewable sources (including electricity via Joule effect) as heating sources. The novel reactor configurations for low-C H2 processes (e.g. biogas reforming and green-NH3 decomposition) will be proved at laboratory scale and then scale-up towards the pilot- scale applications.	
Methods and techniques that will be developed and used to carry out the research	The research activity will focus on key processes that will play a role in the energy transition, e.g. H2 production from CH4/bio-gas and from H-vectors (e.g. green ammonia). The candidate will perform kinetic	

POLITECNICO DI MILANO



	investigations at the laboratory scale in order to characterize the performance of novel catalytic formulations and identify the best options for the scale-up of the reactor concept. Electrification of lab-scale reactors and development of autothermal processes will be studied to verify the reactor performances under industrially relevant conditions. A quantitative analysis of the results will be undertaken by modelling activities , that will include a full characterization of heat and mass transfer and catalyst kinetics to allow the analysis of the experimental output. Upon validation, the mathematical models will be used to design scaled-up units based on an optimized geometrical configuration. In a mature stage of the research, the candidate is expected to assist the building, operation and analysis of pilot-scale reactors where performances and models will be verified at a stringent level.
Educational objectives	The candidate will gain high-level knowledge of experimental testing and modelling of advanced catalytic reactors and catalytic processes for the production of key energy vectors.
Job opportunities	The skills acquired by the candidate during the PhD programme will be useful for possible jobs in R&D roles of companies active in chemical processes design, catalyst manufacturers, EPC, oil and gas.
Composition of the research group	6 Full Professors 4 Associated Professors 10 Assistant Professors 20 PhD Students
Name of the research directors	Proff. Tronconi, Groppi, Beretta

Contacts

Contacts Telephone: 02 23993264

Email: enrico.tronconi@polimi.it, gianpiero.groppi@polimi.it, alessandra.beretta@polimi.it Web-pages of the research group: 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	700.0 €	
By number of months	6	

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Confidentiality:

since this is a thematic scholarship, the management of Confidential Information, Results and their publication is subordinate to the restrictions agreed upon with the partner company. Upon acceptance of the scholarship, the beneficiary may have to sign a specific commitment.

Educational activities (funding for participation in courses, summer schools, workshops and conferences) - financial aid per PhD student per year:

1st year: around 1.900 euros per student

2nd year: around 1.900 euros per student

3rd year: around 1.900 euros per student

Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD student:

There are various forms of financial of 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.