POLITECNICO DI MILANO

PhD in INGEGNERIA DEI MATERIALI / MATERIALS ENGINEERING - 39th cycle

THEMATIC Research Field: POWER-TO-GAS CONVERSION AND ENERGY TRANSITION: DEVELOPMENT OF ELECTRODES FOR ELECTROCHEMICAL AND BIOELECTROCHEMICAL SYSTEMS

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	In the global search for energy harvesting systems from sustainable power sources, great interest has been recently aroused by the (bio)electrochemical synthesis of hydrogen and methane, in a power-to-gas concept. The challenge for developing such a complex technology mostly focuses on materials, environmental conditions, and the microbial pool. In this context, the choice of materials for electrodes and their interactions with microorganisms remain critical issues. This thesis will focus on the synthesis of new electrodes to boost energy transition by means of performing electrochemical and bioelectrochemical systems.
Methods and techniques that will be developed and used to carry out the research	In order to carry out the research program it will be necessary to develop knowledge on the use of electrochemical equipment whose operation is based on Plasma electrolytic oxidation techniques for the synthesis of the electrodes (Laboratory of applied electrochemistry and surface engineering "Roberto Piontelli" of the CMIC Department) and of electrochemical techniques for in-situ characterization of the electrodes and the (bio)electrochemial systems (e.g. cyclic voltammetry, electrochemical impedance spectroscopy). Knowledge on the use of finite elements software (e.g. Comsol) will also be needed for the simulation of hydrodynamics in (bio)electrochemical systems and optimization of the cell

	design. The research work will require the use of investigation techniques such as optical and electronic microscopy, profilometry (laser and AFM), durometry, elemental composition spectroscopy (EDS,GDOES, XRF). Master of science level knowledge of metallurgy and surface engineering is required.The experimental part of the research will be carried out mostly at Politecnico (Laboratory of applied electrochemistry and surface engineering "Roberto Piontelli" of the CMIC Department). Some months (to be agreed) will be spent in RSE (Ricerca sul Sistema Energetico SpA - RSE) laboratories in Milano and Piacenza, and other research laboratories collaborating with RSE
Educational objectives	The candidate will learn to conduct a proper bibliographicresearch, to safely work in a specialized surface engineeringlaboratory, to carry out research activity on electrochemical materials and systems, and to work in an international multidisciplinary team (www.rse-web.it).
Job opportunities	The job opportunities fall into the electro-energy sector, for the use of renewable sources, materials and network infrastructures. RSE has a robust expansion plan, frequently announcing calls for recruitment of doctoral student (https://www.rse-web.it/processo-di-selezione/).
Composition of the research group	0 Full Professors 3 Associated Professors 2 Assistant Professors 3 PhD Students
Name of the research directors	Prof. Silvia Franz

Contacts
Telephone: +39 02 23993102 Email: silvia.franz@polimi.it Web-pages of the research group: https://www.cmic.polimi.it/en/ricerca/elenco-gruppi-di-ricerca/surfacelab/

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 funding company. Upon acceptance of the scholarship, the beneficiary must 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