

PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 40th cycle

THEMATIC Research Field: INNOVATIVE DIAGNOSTIC TECHNIQUES TO EVALUATE MASS TRANSPORT RESISTANCE IN POLYMER ELECTROLYTE MEMBRANE FUEL CELLS CATHODE CATALYST LAYER

Monthly net income of PhDscholarship (max 36 months)		
€ 1600.0		
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	Hydrogen produced from renewable resources is becoming a crucial asset to tackle the impact of climate change in those hard-to-abate sectors in which no competitive and scalable technology is currently available for decarbonization. These sectors are responsible for nearly one-third of global carbon emission, but projections clearly suggest that their share will increase significantly in the future. Hydrogen polymer electrolyte fuel cells (PEMFC) could be an efficient, scalable, reliable and climate neutral solution for end-use of green hydrogen in the transport and stationary energy sector. Research on PEMFC is focused on improved cathode catalyst layers with improved activity and durability. Specific intesest is focused on oxygen mass transport resistance that impacts power density at device level. The research project aims to develop innovative diagnostic techniques to investigate oxygen and proton transport properties in the cathode catalyst layer based on limiting current test. These techniques will be investigated to analyze different materials and specifically different ionomers and electrocatalyst supports, as well as material ageing. The following activities are identified: a) development of innovative diagnostic techniques and modelling tools; b) validation of the protocols on relevant cases; c) innovative solutions to exploit the findings of the research activity; c)	



	expansion of the technique to different applications and cases, considering improved spatial resolution.
Methods and techniques that will be developed and used to carry out the research	The experimental analysis will be carried out through the experimental facilities available at MRT Fuel Cell &Battery research group and Pro-e-Storage laboratory for manufacturing of materials, with a specific focus on electrochemical techniques (polarization curves, electrochemical impedance spectroscopy, voltammetry). Modeling tools will be developed starting from proprietary codes based on commercial software (Matlab or Simulink) to simulate material degradation and fuel cell performance/efficiency.
Educational objectives	The topic is interdisciplinary. The student will deepen his/her knowledge in thermodynamics, mass and heat transfer, electrochemistry. Theoretical and experimental activities are required.
Job opportunities	Placement in research companies operating in the energy sector, advanced materials, modelling of energy systems.
Composition of the research group	1 Full Professors 3 Associated Professors 0 Assistant Professors 9 PhD Students
Name of the research directors	Andrea Baricci, Andrea Casalegno

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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	800.0 €	
By number of months	6	

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

POLITECNICO DI MILANO



Educational activities: financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations and computer, etc. Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD student. There are various forms of financial aid 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 regulations. Computer availability: individual use. Desk availability: individual use.