



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 38th cycle

THEMATIC Research Field: IMPROVING UNDERSTANDING OF IONOMER AND CATALYST DEGRADATION IN POLYMER ELECTROLYTE MEMBRANE FUEL CELLS UNDER REAL WORLD OPERATING CONDITIONS WITH TAILORED MATERIALS

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

Hydrogen produced from renewable resources, universally known as green hydrogen, 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 indicate their share will increase significantly in the near future. Heavy-duty transport, i.e. road trucks, maritime and rail, is a hard-to-abate sector for which hydrogen fuel cells could be an efficient, scalable, reliable and climate neutral solution. Hydrogen fueled polymer electrolyte fuel cell (PEMFC) is a commercially available technology in the automotive sector that was already demonstrated for heavy duty transport applications, however the state-of-the-art technology requires yet an improvement in durability to overcome barriers in the commercialization. The research project aims to provide understanding to the performance and efficiency loss occurring in energy applications related to transport, aiming to identify innovative solutions and validate the results of the research. The following activities are identified: a) experimental analysis to identify the physical origin for the efficiency loss under real world operation; b) development of innovative solutions to mitigate the performance decay



	by means of experimental and theoretical analysis; c) analysis of tailored samples to validate the innovative solutions that were identified.
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 Lab 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 extremely interdisciplinary. The student will deepen his/her knowledge in thermodynamics, mass and heat transfer, electrochemistry, as well as on theoretical and experimental activities.
Job opportunities	Placement in companies operating in the field of automotive/transport sector, advanced materials, modelling of energy systems.
Composition of the research group	1 Full Professors 2 Associated Professors 1 Assistant Professors 7 PhD Students
Name of the research directors	Andrea Baricci; Andrea Casalegno

Contacts	
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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	750.0 €
By number of months	6



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

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.