SUSTAINABLE MATERIALS, PROCESSES AND SYSTEMS FOR ENERGY TRANSITION

Microporous polymer-based proton exchange membranes for electrochemical applications

Funded By	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA [P.iva/CF:09198791007]
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Context of the research activity	In the context of decarbonization, green hydrogen has great potential in the medium to long term for the replacement of fossil fuels and as a solution in the storage of renewable energy that is unfortunately produced discontinuously. However, hydrogen still has many challenges, including its current high cost compared to fossil fuels and heat engines. The production of more efficient electrolyzers and fuel cells requires much effort from both academia and industry. Technological innovations are needed to improve the performance of these devices. The development of new membranes that do not contain fluorine and are therefore more economical, resistant to high temperatures and corrosion, and their optimization is important to speed up the energy transition and thus counteract climate change.
Objectives	Scholarship funded by IIT. Main seat to carry out the research: CENTER FOR SUSTAINABLE FUTURE TECHNOLOGIES, ISTITUTO ITALIANO DI TECNOLOGIA, Torino Supervisors: Fabrizio Pirri (fabrizio.pirri@iit.it, fabrizio.pirri@polito.it) - Sergio Bocchini (sergio.bocchini@polito.it) The main research objectives of this PhD thesis include (not necessarily all): - Synthesis through scalable methods of intrinsically microporous polymers containing benzo-imidazole groups or similar functionalities - Study and development of membranes based on previously synthesized polymers for proton transport. Membranes will be fabricated through scalable methods, and tested at both laboratory and pilot scale. Electrochemical characterization. Study of gas diffusion through the membranes in case of fuel cells application. - Integration of the developed materials into electrochemical devices (e.g. fuel cells, electrolyzers and so on…)

Skills and competencies for the development of the activity	Candidates should have a solid engineering background and strong motivation to learn through advanced research. Expertise in chemistry, polymer synthesis, electrochemistry, advanced processes and nanotechnologies is preferred. In particular the knowledge of the main electrochemical characterization techniques is required. Problem solving ability and practical experience in laboratory activity is preferred.