# CHEMICAL ENGINEERING

## MUR DM 117/Solvay - Next-generation of membranes for PEMEL and AEMEL electrolysis

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| **Funded By** | MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584]<br>SOLVAY SPECIALTY POLYMERS ITALY S.P.A. [P.iva/CF:03521920961]<br>Politecnico di TORINO [P.iva/CF:00518460019] |
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| **Context of the research activity** | Energy and the environment are two key factors to EU sustainable economic and social development. As global economies aim to become carbon neutral by 2050, hydrogen has gained great attention as an ideal clean energy carrier, while water electrolysis powered with renewables-generated electricity is a highly promising way for large scale green hydrogen production.<br>There are currently industrial electrochemical systems capable of producing hydrogen through various technologies (AEL and PEMEL). Mainly they suffer from different problems:<br>-high investment cost (CAPEX);<br>-low efficiency;<br>-use of critical raw materials (2.5 mg/W);<br>-fast degradation rate especially when coupled with RES (0.2 % every 1000 h);<br>it is for these reasons that this Ph.D. aims to mainly solve the limitation of current electrolyzers and develop the next generation of high-performance systems, ensuring its spread by guaranteeing european decarbonization.<br><br>Progetto finanziato nell'ambito del PNRR - DM 117/2023 - CUP E14D23001980004 |
| | The state-of-the-art electrolysis cells, based on low-temperature water electrolyzer is characterized by low current density, high electricity consumption (50 kWh/kgH2), use of CRM, low stability and high CAPEX; especially for PEMEL electrolysis. This project aims to develop anion exchange membrane electrolysis cell (AEL) and PEMEL components to reach SRIA targets and reduce the dependence of CRM materials while maintaining high efficiencies. |

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| **Objectives** | The specific objectives include (1) to develop advanced methods for testing the next-generation of membranes in semi-cell arrangement evaluating HER and OER reactions distinctively; (2) to develop and optimize an assembly deposition method for single cells that is industrially scalable; (3) to design, evaluate, and optimize AEMEL and PEMEL for maximizing cell performance (referred to single cells and short stacks); (4) to study and understand the degradation mechanism and develop strategies for improved durability of AEMEL and PEMEL.<br>The doctoral program includes periods at the company, both in Italian and foreign locations. It will also encourage the candidate to participate in conferences and periods abroad to refine his or her technical skills. |

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| **Skills and competencies for the development of the activity** | We are looking for a talented, motivated and enthusiastic PhD student with a background in chemical engineering, material engineering or applied physics. We're searching for an excellent candidate with proven capacities who recently finished his/her master (MSc) or will obtain his/her MSc soon.<br>• A master's degree in chemical engineering, material engineering, materials science, chemistry, physics or similar is required<br>• Be excellent in establishing an overview and take responsibility<br>• Ability to work independently, to plan and carry out complicated tasks.<br>• Good communication skills in English, both written and spoken.<br>• Knowledge/experience on the subjects of fabrication of electrochemical cells and electrochemical characterization is further advantageous.<br>You must have a two-year master's degree (120 ECTS points) or a similar degree with an academic level equivalent to a two-year master's degree. |