

# SUSTAINABLE MATERIALS, PROCESSES AND SYSTEMS FOR ENERGY TRANSITION

## DM 630/HYTER - Anion Exchange Membrane for hydrogen production: characterization, durability and IEC improvement

<b>Funded By</b>	Ministero dell'Università e della Ricerca - MUR [P.iva/CF:96446770586] Politecnico di TORINO [P.iva/CF:00518460019] HYTER S.R.L. [P.iva/CF:04023260237]
<b>Supervisor</b>	BIANCO STEFANO - stefano.bianco@polito.it
<b>Contact</b>	
<b>Context of the research activity</b>	<p>Green hydrogen production and utilization play a vital role in the decarbonization efforts of key sectors to achieve net-zero CO<sub>2</sub> emissions. Green hydrogen is produced by water electrolysis and electricity obtained from renewable sources.</p> <p>Among low temperature electrolysis technologies, Anion Exchange Membrane Water Electrolysis (AEMWE) is an emerging technology that offers significant advantages over other hydrogen technologies, such as the use of low-cost and abundant materials, moderate temperatures, and high efficiency.</p> <p>However, there is still the lack of a comprehensive analysis of membrane performance and degradation mechanisms, and, consequently, a stable and durable anion exchange membrane.</p> <p>Progetto finanziato dal PNRR a valere sul DM 630/2024 – CUP: E14D24002340004</p>
<b>Objectives</b>	<p>The main research objectives of this PhD project include:</p> <ul style="list-style-type: none"><li>o The physical, chemical and mechanical characterization of commercial anion exchange membranes, using analytical techniques such as FT-IR, TGA, SEM, NMR, and by performing electrochemical measurements.</li><li>o The physical, chemical and mechanical characterization of the actual Hyter membrane, using analytical techniques such as FT-IR, TGA, SEM, NMR, and by performing electrochemical measurements.</li><li>o Investigation of different methods to perform membrane production (i.e. slot die coating, dip coating, doctor blade) and the effects of the production method on membrane performance and durability.</li></ul>

o Investigation of membrane behaviour in the electrolysis cell using in operando techniques to evaluate modifications of physical, chemical and ionic properties in relation to the specific coating technique.

o Improvement of the performance of Hyter anion exchange membrane by modification of the ionomer synthesis.

**Skills and  
competencies  
for the  
development of  
the activity**

Candidates should have a solid chemical engineering and chemistry background, as well as a strong motivation to learn through advanced and innovative research.

Expertise in chemical analytical techniques, such as UV-Vis, FT-IR and NMR, and in organic synthesis are preferred.

Expertise in physics and electrochemistry 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.