

# ANIONE

## ANION EXCHANGE MEMBRANE ELECTROLYSIS FOR RENEWABLE HYDROGEN PRODUCTION ON A WIDE-SCALE



<b>Project ID:</b>	875024
<b>PRD 2023:</b>	Panel 1 – H2 production
<b>Call topic:</b>	FCH-02-4-2019: New anion exchange membrane electrolyzers
<b>Project total costs:</b>	EUR 1 999 995
<b>Clean H<sub>2</sub> JU max. contribution:</b>	EUR 1 999 995
<b>Project period:</b>	1.1.2020–31.12.2022
<b>Coordinator:</b>	Consiglio Nazionale delle Ricerche, Italy
<b>Beneficiaries:</b>	Hydrolite Ltd, Université de Montpellier, TFP Hydrogen Products Ltd, Hydrogenics Europe NV, IRD Fuel Cells A/S, Uniresearch BV, Centre national de la recherche scientifique

<https://anione.eu/>

### PROJECT AND OBJECTIVES

ANIONE aims to develop a high-performance, cost-effective and durable anion-exchange membrane (AEM) water electrolysis technology. The approach taken involves using an AEM and ionomer dispersion in the catalytic layers for hydroxide ion conduction. The project aims to validate a 2 kW AEM electrolyser with a hydrogen production rate of about 0.4 Nm<sup>3</sup>/h (technology readiness level (TRL) 4). Advanced AEMs have been developed in conjunction with non-critical raw material non-CRM high-surface-area electrocatalysts and membrane electrode assemblies. These advanced AEMs have shown promising performance and stability.

### NON-QUANTITATIVE OBJECTIVES

- **Enhanced oxygen evolution catalyst.** ANIONE aims to develop an advanced non-CRM Ni- and Fe-based catalyst for the oxygen evolution reaction, providing reduced overpotential and enhanced stability.
- **Enhanced hydrogen evolution catalyst.** ANIONE aims to develop an advanced non-CRM Ni-based catalyst for the hydrogen evolution reaction, providing reduced overpotential and enhanced stability.
- **Advanced cost-effective membrane.** ANIONE aims to develop cost-effective advanced AEMs with proper hydroxide ion conductivity and stability.
- **Process implementation.** ANIONE aims to develop an AEM electrolysis operating mode providing enhanced stability.

- **AEM electrolysis hardware components.** ANIONE aims to implement advanced AEM electrolysis components in terms of diffusion layers and current collectors.

### PROGRESS AND MAIN ACHIEVEMENTS

- A highly conductive and chemically stable hydrocarbon ionomer/membrane for AEM water electrolysis.
- ANIONE has produced reinforced and composite AEM hydrocarbon membranes for water electrolysis showing the capability to operate at higher temperatures.
- It has also produced a high-performing and electrochemically stable NiFe oxide, oxygen evolution, anode electrocatalyst for AEM water electrolysis.
- Enhanced catalyst-coated electrode-based membrane electrode assemblies for AEM water electrolysis.
- It has also produced large-area membrane-electrode assemblies based on non-CRMs performing similarly to small-area membrane electrode assemblies.

### FUTURE STEPS AND PLANS

- Large area stack assembling and testing will be carried out.
- There will be full validation of functional materials at the stack level.

### QUANTITATIVE TARGETS AND STATUS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SoA result achieved to date (by others)	Year of SoA target
Project's own objectives and AWP 2019	Cell voltage at 1 A/cm <sup>2</sup> (cell performance at 45 °C)	V	2	1.75		1.67	2020
	Degradation rate: voltage increase at 1 A/cm <sup>2</sup>	mV/h	< 0.005	< 0.005	✓	2	
	Membrane conductivity	mS/cm	50	105	✓	80	
	Maximum operating temperature	°C	90	90	✓	60	2022
	Series resistance	ohm.cm <sup>2</sup>	< 0.07	0.06	✓	0.1	