NEWELY

NEXT GENERATION ALKALINE MEMBRANE WATER ELECTROLYSERS WITH IMPROVED COMPONENTS AND MATERIALS

Project ID	875118
PRR 2024	Pillar 1 – Renewable hydrogen production
Call topic	FCH-02-4-2019: New anion exchange membrane electrolysers
Project total costs	EUR 2 597 413.75
Clean H_2 JU max. contribution	EUR 2 204 846.25
Project period	1.1.2020–29.6.2023
Coordinator	Deutsches Zentrum für Luft- und Raumfahrt EV, Germany
Beneficiaries	Air Liquide Forschung und Entwicklung GmbH, Commissariat à l'énergie atomique et aux énergies alternatives, Cutting-Edge Nanomaterials UG Haftungsbeschränkt, DLR-Institut für Vernetzte Energiesysteme EV, Fondazione Bruno Kessler, Korea Institute of Science and Technology, L'Air Liquide SA, Membrasenz SARL, ProPuls GmbH, Ústav Makromolekulární chemie AV ČR v.v.i., Vysoká škola chemicko-technologická v Praze, Westfälische Hochschule Gelsenkirchen, Bocholt, Recklinghausen

https://www.newely.eu

PROJECT AND GENERAL OBJECTIVES

This project aimed to redefine AEMWE surpassing the current state of alkaline water electrolysis and bringing it one step closer to proton-exchange membrane WE in terms of efficiency, but at a lower cost. The three main challenges of AEMWE – membrane, catalyst and stack – were addressed by three small and medium-sized enterprises and a large hydrogen company supported by seven renowned research and development centres.

NON-QUANTITATIVE OBJECTIVES

The techno-economic assessment and life-cycle assessment demonstrated a reduction in CAPEX and OPEX for AEMWE relative to proton-exchange membrane WE and alkaline WE. Life-cycle assessment identified electricity as having the highest environmental impact of all water electrolyser technologies. Of the stack materials, PEEK and steel are identified as drivers of global warming potential and damage to resources, and their use should be reduced as much as possible or they should be replaced by alternatives with lower impacts.

PROGRESS AND MAIN ACHIEVEMENTS

- The membrane electrode assembly with OXYGN-N anode, H2GEN-M cathode and commercial AEM / ionomer achieves 2 V at 2 A/cm^2 in 0.1 M KOH. No irreversible degradation was seen in a 400-hour test.
- An AEM with conductivity of 62 mS/cm and area-specific resistance of 0.065 ohm/cm^2 was achieved.
- The project created a new method for AEM membrane reinforcement with covalent bonds between the matrix and ionomer, with conductivity of 62 mS/cm.
- A novel and innovative high-pressure AEMWE stack technology was designed and assembled for 200 cm^2 cells. Tests of a five-cell stack achieved 1.244 kW at 100 A.

FUTURE STEPS AND PLANS

The project has finished.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SOA result achieved to date (by others)	Year for reported SOA result
Maximum AEMWE stack size realised in the project							
Project's own objectives and MAWP addendum (2018–2020)	Stack power	kW	2	0.075		2.4	2021
	Cell area	cm^2	200	25		N/A	2021
	Pressure	bar (relative)	≤ 40	N/A	⚙	≤ 35	2021
	Energy consumption @ power	kWh/kg @ W/cm^2	53.6 @ 2	53.6 @ 3.6		53.6 @ 2.4	2021
	Corresponding to cell voltage @ current	Corresponding to V @ A/cm^2	Corresponding to 2 @ 1	Corresponding to 2 @ 1.8		Corresponding to 2 @ 1.2	2021
Non-PGM catalysts							
Project's own objectives and MAWP addendum (2018–2020)	Added overpotentials (anode and cathode)	mV	415	232	✓	250	2020
	Current density	mA/cm^2	1	1	✓	1	2020
MAWP addendum (2018–2020)	Stable operation for 2 000 hours, cell voltage gap after 2 000 hours of operation	mV	50	No 2 000-hour test yet	⚙	N/A	2021
	Extrapolated to efficiency degradation @ rated power and considering 8 000 hours of operations per year	Extrapolated to %/year	Extrapolated to 7.2	No test yet	⚙	N/A	2021
	Chemically, thermally and mechanically stable AEM ionomer and membrane with conductivity	mS/cm	≥ 50	62	✓	80	2021
	Area-specific resistance	ohm/cm^2	≤ 0.07	0.065	✓	0.045	2021

Clean Hydrogen Partnership
Co-funded by the European Union