

SEAL-HYDROGEN

STABLE AND EFFICIENT ALKALINE WATER
ELECTROLYZERS WITH ZERO CRITICAL RAW
MATERIALS FOR PURE HYDROGEN PRODUCTION



Project ID	101137915
PRR 2025	Pillar 1 - H ₂ Production
Call Topic	HORIZON-JTI-CLEANH ₂ -2023-01-01
Project Total Costs	3 000 048.75
Clean H ₂ JU Max. Contribution	3 000 000.00
Project Period	01-01-2024 - 31-12-2026
Coordinator Beneficiary	UNIVERSITAT DE VALENCIA, ES
Beneficiaries	MATTECO TEAM SL, SIEMENS ENERGY GLOBAL GMBH and CO. KG, HORIBA FRANCE SAS, FORSCHUNGSZENTRUM JULICH GMBH

<https://seal-hydrogen.eu/>

PROJECT AND GENERAL OBJECTIVES

SEAL-HYDROGEN is an ambitious 36-month project aiming to develop laboratory-validated and scalable technology to boost the next generation of efficient, cost-effective, and durable electrolyzers. SEAL-HYDROGEN proposes a multidisciplinary approach to develop an efficient and highly durable alkaline water electrolysis (AWE) stack (six cells) able to compete at the highest level with classic anion-exchange membrane (AEM) and polymer electrolyte membrane (PEM) electrolyzers. A reliable method based on Raman spectroscopy, will be developed for the precise determination of electrode stability, offering appropriate quality control of great interest, both in research and industry.

NON-QUANTITATIVE OBJECTIVES

Key innovations include:

- Cost-effective layered double hydroxide (LDH) catalysts free of critical raw materials for the oxygen evolution reaction.
- Thermo-mechanical stable catalyst-support-ionomer electrodes.
- Advanced separator-electrode assemblies.
- Cutting-edge in-operando Raman spectroscopy for catalyst activity and stability testing.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

- Kick off Meeting held in Valencia, Spain, 1-2nd February 2024.

- Synthesis of various binary and ternary LDHs with different transition metals achieved. Chemical and morphological characterisation is ongoing and electrochemical tests will follow.
- Upscaling of NiFe LDH to Kg scale.
- Preparation of a large surface area electrode for testing.
- Definition of specifications for a new Raman cell to be developed.
- Study of the dissolution of NiFe LDHs through SFC coupled to ICP-MS, showing promising preliminary results on Mattec LDH stability.
- Construction of the stack test station initiated. Design finalised, holding specifications on Ni substrate properties for the constructed stack.

FUTURE STEPS AND PLANS

- Initial selection of active platinum group metal-free catalysts based on LDHs for the oxygen evolution reaction.
- Webpage, social media profiles and leaflets put in place and shared among stakeholders in various European events.
- Consortium engagement and deliverables up to date (next consortium meeting in Lille, France).
- In-operando Raman cell designed and being evaluated.
- Electrochemical tests of reference catalysts under realistic conditions for alkaline water electrolysis performed.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Interface resistance	-	1.9 V at 0.8 A/cm ² , 48 kWh/Kg	
	Electricity consumption in stacks	kWh/Kg	1.9 V at 0.8 A/cm ² , 48 kWh/Kg	
	Partial load operation	%	5	
	CRM	mg/W Pt	<0.3 mg/W	
	Stability - Current	A/cm ²	1	