NEWSOC

NEXT GENERATION SOLID OXIDE FUEL CELL AND ELECTROLYSIS TECHNOLOGY

Project ID	874577
PRR 2024	Pillar 1 – Renewable hydrogen production
Call topic	FCH-02-6-2019: New materials, architectures and manufacturing processes for solid oxide cells
Project total costs	EUR 4 999 726.25
Clean H_2 JU max. contribution	EUR 4 999 726.25
Project period	1.1.2020–30.6.2023
Coordinator	Danmarks Tekniske Universitet, Denmark
Beneficiaries	Aktsiaselts Elcogen, Ceres Power Limited, Commissariat à l'énergie atomique et aux énergies alternatives, École polytechnique fédérale de Lausanne, Ethniko Kentro Erevnas Kai Technologikis Anaptyxis, Fundació Institut de Recerca de l'Energia de Catalunya, Hexis AG, Idryma Technologias Kai Erevnas, Instytut Energetyki, Nederlandse Organisatie voor toegepast natuurwetenschappelijk onderzoek, Politecnico di Torino, SolydEra SpA, Sunfire GmbH, Teknologian tutkimuskeskus VTT Oy, Università degli Studi di Salerno

http://www.newsoc.eu/

PROJECT AND GENERAL OBJECTIVES

Newsoc aimed to significantly improve the performance, durability and cost competitiveness of solid oxide cells and stacks compared with the state of the art, focusing on (i) structural optimisation and innovative architectures, (ii) alternative materials and (iii) innovative manufacturing. Newsoc succeeded in improving the cells, yielding a 25 % increase in applicable current density and a 25 % lower area-specific resistance, which marked the first milestone. Progress was achieved for all proposed concepts, and specific plans were agreed with the industry partners for integration into their commercial platforms.

NON-QUANTITATIVE OBJECTIVES

The Newsoc project provided a path on how to increase the technology readiness level, beyond the project period, towards level 6. Furthermore, the Newsoc project evaluated the new solid oxide cell materials and fabrication processes through a life-cycle impact assessment and cost assessment, including interpretation through the eco-efficiency framework.

A life-cycle assessment was carried out for six selected Newsoc concepts.

PROGRESS AND MAIN ACHIEVEMENTS

Newsoc succeeded in improving state-of-the-art (SOA) solid oxide cells and stacks and in developing promising concepts for further improvement beyond the project.

- **SOA materials improved.** These include the Ni/YSZ fuel electrode, LSCF/CGO air electrode and CGO barrier layer. The microstructural optimisation of the electrodes and the development of thin-film barrier layer technology (atomic layer deposition and room temperature sputtering) led to the improvement of performance and durability.
- **Alternative electrode materials improved specific durability parameters.** The parameters were (i) sulphur tolerance through an Ni/CGO-infiltrated, titanate-based fuel electrode, (ii) carbon tolerance through a bimetallic/trimetallic (Fe, Mo, Au) modified Ni/CGO fuel electrode, (iii) redox tolerance through an La-doped, chromite-based fuel electrode and (iv) reversible operation through (a) a Ni/CGO-infiltrated, titanate-based (La, Sr, Fe, Ni) fuel electrode and (b) a bimetallic/trimetallic (Fe, Mo, Au) modified Ni/CGO fuel electrode.
- **Reduction of toxic material use in the cells/stacks and during manufacturing.** This involved creation of a Co-free, LSF-based air electrode, the partial substitution of Co in Mn-Co-Cu-O spinel interconnect coatings and sealant deposition without toxic solvents.

All improved Newsoc concepts employ a scalable/well-established methodology, which eases adoption by industry. The Newsoc concepts can be exploited individually or in combinations (e.g. combining thinner barrier layers with improved electrodes). The results were validated in industrial cell and stack platforms in the Newsoc project, enabling fast uptake into industrial processes.

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)
Project's own objectives	Electrolysis current for operation with a degradation rate below 1 %/1 000 h	A/cm²	1	0.75–1	✓	0.75
	Area-specific resistance	ohm cm²	0.4	0.39		0.52
	Degradation rate under reversible operation	%/1 000 h	13	10		17
	Cost per cell	€/kW	5–10	5–10		N/A

Clean Hydrogen Partnership
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