LOWCOST-IC

LOWCOSTINTERCONNECTSWITHHIGHLYIMPROVEDCONTACT STRENGTH FOR SOC APPLICATIONS

Project ID:	826323
PRD 2023:	Panel 7 – supply chain
Call topic:	FCH-02-6-2018:Cost-effectivenovel architectures of interconnects
Project total costs:	EUR 2 335 997.50
Clean H_2 JU max. contribution:	EUR 2 335 997.50
Project period:	1.1.2019–30.9.2022
Coordinator:	Danmarks Tekniske Universitet (DTU), Denmark
Beneficiaries:	Sandvik Materials Technology AB, Aperam Stainless France SA, AVL List GmbH, Borit NV, Chalmers Tekniska Högskola AB, Forschungszentrum Jülich GmbH, SolydEra SpA, Sunfire GmbH, Tecno Italia SRL

http://www.lowcost-ic.eu/

PROJECT AND OBJECTIVES

The overall objective of LOWCOST-IC is to contribute to the successful upscaling of the widespread commercialisation of solid oxide cell (SOC) technologies by:

- increasing the robustness of the lifetime of SOC stacks by developing novel highly robust air electrode contact layers and testing new interconnect coatings in SOC stacks;
- minimising the interconnect development and production cost by introducing cheaper high-volume steel, applying state-of-the-art (SoA) large-scale roll-to-roll manufacturing methods for SOC manufacturing and developing a novel interconnect shape design process.

PROGRESS AND MAIN ACHIEVEMENTS

- Work package (WP) 2 aimed to reduce interconnect costs without affecting performance by exploring steel grades, coatings and manufacturing processes. The highlights are as follows:
- roll-to-roll manufacturing – feasibility demonstrated, including shaping with hydroforming;
- chromium evaporation – reduced by 30 times;
- low-cost steels – comparable performance to specialised steel in terms of corrosion rate, chromium evaporation and area-specific resistance (ASR);
- ASR of < 20 mΩcm² at 850 °C after 3 000 hours of operation achieved.
- In WP3, a new interconnect design with optimised flow distribution was developed, based on an efficient three-dimensional multiphysics model considering flow, heat transfer, mechanical stresses and electrochemical reactions.
- In WP4, novel contact layers were developed by DTU, based on *in situ* reactive bonding, using metallic powders as precursors to form strong bonds through oxidation and reaction.
- In WP5, four stack designs were produced using different materials to demonstrate developed materials. A stack with Sanergy 441 HT interconnect steel-coating solution was tested for 3 500 hours at 800–850 °C. Sanergy HT 441 with CeCo coating showed more ASR degradation than Crofer 22 APU with MCF coating but performed better at lower temperature. A stack with the new contact layers performed similarly to standard solutions without optimisation.
- In WP6, the technical improvements converted into monetary values showing that the mass manufacturing routes would be commercially competitive compared with in-house production because of the scalable processes of roll-to-roll and high-speed printing.
- In WP7, the work was disseminated through 12 published papers, with 4 more in preparation; 11 conference presentations; and 2 workshops, each with 32 participants comprising academics and most of the SOC stack manufacturers in Europe.

FUTURE STEPS AND PLANS

- Stack modelling will continue in national and EU projects, e.g. the AMON project.
- The material development for contact layers will be paused due to lack of funding.
- A recommendation will be made to Hydrogen Europe to put more effort back into material research.

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 for reported SoA result
Project's own objectives	Fracture energy of contact layer	J/m²	5.1	19.6	✓	1.7	2013
	ASR of contact layer at 750 °C	mΩcm²	15	18	✓	15	2019
	ASR of contact layer at 850 °C	mΩcm²	25	15	⚙	N/A	N/A

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Clean Hydrogen Partnership

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