INN-BALANCE

INNOVATIVE COST IMPROVEMENTS FOR BALANCE OF PLANT COMPONENTS OF AUTOMOTIVE PEMFC SYSTEMS

PROJECT AND OBJECTIVES

The aim of INN-BALANCE was to develop a novel and integrated development platform for developing advanced balance-of-plant components in current fuel-cell-based vehicles in order to improve their efficiency and reliability, reducing costs and presenting a stable supply chain to European car manufacturers and system integrators.

PROGRESS AND MAIN ACHIEVEMENTS

- INN-BALANCE has created an optimised ejector for the automotive fuel cell stack.
- The project has created a high-speed air compressor for the automotive fuel cell.
- It has created an antifreeze module for the automotive fuel cell.

FUTURE STEPS AND PLANS

The project has finished.

QUANTITATIVE TARGETS AND STATUS

| Target source          | Parameter                          | Unit | Target       | Target achieved?
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Project's own objectives</td>
<td>Power: air turbo compressor</td>
<td>kW</td>
<td>10–12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermal management system</td>
<td>°C</td>
<td>- 40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuel cell system's efficiency and lifetime</td>
<td>%</td>
<td>5 (efficiency), 10 (lifetime)</td>
<td></td>
</tr>
</tbody>
</table>
LOWCOST-IC
LOW COST INTERCONNECTS WITH HIGHLY IMPROVED CONTACT STRENGTH FOR SOC APPLICATIONS

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 high-robustness 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 route.

PROGRESS AND MAIN ACHIEVEMENTS
Robust contact layers were developed.

FUTURE STEPS AND PLANS
LOWCOST-IC will perform postmortem analysis of the contact layers tested in the stacks. Samples have been cut out from commercial stacks being tested with the new contact material. Postmortem analysis under a microscope will be undertaken shortly.

QUANTITATIVE TARGETS AND STATUS

<table>
<thead>
<tr>
<th>Target source</th>
<th>Parameter</th>
<th>Unit</th>
<th>Target</th>
<th>Achieved to date by the project</th>
<th>Target achieved?</th>
<th>SoA result achieved to date (by others)</th>
<th>Year of SoA target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project’s own objectives</td>
<td>Fracture energy of contact layer</td>
<td>J/m²</td>
<td>5.1</td>
<td>10</td>
<td>✓</td>
<td>1.7</td>
<td>2013</td>
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<tr>
<td></td>
<td>Area-specific resistance of contact layer at 750 °C</td>
<td>mohm.cm²</td>
<td>15</td>
<td>60</td>
<td>✗</td>
<td>15</td>
<td>2019</td>
</tr>
<tr>
<td></td>
<td>Area-specific resistance of contact layer at 850 °C</td>
<td>mohm.cm²</td>
<td>25</td>
<td>21</td>
<td>✓</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

https://www.lowcost-ic.eu
MAMA-MEA

MASS MANUFACTURE OF MEAS USING HIGH SPEED DEPOSITION PROCESSES

PROJECT AND OBJECTIVES
The task of MAMA-MEA was to develop an innovative additive layer deposition process integrating all main catalyst-coated membrane components (membrane, catalyst layers, sealing) using a single, continuous roll-to-roll manufacturing process for the proton-exchange membrane fuel cell industry. This will enable a more than 10-fold increase in the volume manufacturing rate compared with state-of-the-art processes, while also increasing key material utilisation, and reducing the quantity of materials and their costs. The project was successfully completed by 30 June 2021.

PROGRESS AND MAIN ACHIEVEMENTS
• MAMA-MEA completed the engineering design.
• The project evaluated deposition techniques.
• It performed experimental validation.

FUTURE STEPS AND PLANS
The project is finished. The target manufacturing speed was reached; however, additional process optimisation is required to increase the lifetime.

Project ID 779591
PRD 2022 Panel 7 – Supply chain
Call topic FCH-02-8-2017: Step-change in manufacturing of fuel cell stack components
Project total costs EUR 3 189 816
Clean H₂ max. contribution EUR 3 189 816
Project period 1/1/2018 – 30/6/2021
Coordinator Technische Universität Chemnitz, Germany
Beneficiaries System SpA, Johnson Matthey Fuel Cells Limited, Inea Informatizacija Energetika Avtomatizacija Doo, Nedstack Fuel Cell Technology BV, Università degli Studi di Modena e Reggio Emilia, Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung EV

https://www.mama-mea.eu

QUANTITATIVE TARGETS AND STATUS

<table>
<thead>
<tr>
<th>Target source</th>
<th>Parameter</th>
<th>Unit</th>
<th>Target</th>
<th>Target achieved?</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWP 2017</td>
<td>CAPEX</td>
<td>€/kW</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lifetime</td>
<td>hours</td>
<td>20 000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Degradation rate</td>
<td>%/1 000 h</td>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>Project’s own objectives</td>
<td>Production/web speed</td>
<td>lm/s</td>
<td>0.84</td>
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