NOVEL MODULAR STACK DESIGN FOR HIGH PRESSURE PEM WATER ELECTROLYZER TECHNOLOGY WITH WIDE OPERATION RANGE AND REDUCED COST (PRETZEL)

Goal of the project

Green hydrogen produced by electrolysis might become a key energy carrier for the implementation of renewable energy as a cross-sectional connection between the energy sector, industry and mobility. Proton exchange membrane electrolyzer (PEM) is the preferred technology for this purpose, still costs, efficiency, lifetime and operability need to be optimized. The aim of PRETZEL project is to develop a new PEMEL that provides significant improvements in efficiency and operability to satisfy emerging market requirements.

Short description of the project

The central objective of PRETZEL is to develop a new PEMEL for hydrogen production, upsaling a patented design approach based on hydraulic cell compression.

EU Partners:

- Westphalian University of Applied Sciences, Germany (WHS)
- Association for Research and Development of Industrial Methods and Processes, France (ARMINES)
- Politehnica University Timișoara, Romania (UPT)
- Adamant Composites Ltd., Greece
- GKN Sinter Metals Engineering GmbH, Germany (GKN)
- Centre for Research and Technology Hellas, Greece (CERTH)
- Soluciones Catalíticas IBERCAT, Spain
- iGas energy GmbH, Germany

Implementation period

01.01.2018 – 31.12.2020

Main activities

UPT’s main activities in PRETZEL are the investigation of newly developed bipolar plates (BPP), as cost-efficient alternative for the classical titanium BPP, consisting of highly corrosion resistant Nb-coatings deposited by vacuum plasma spraying (VPS) on copper pole plates in regard of:

Project implemented by:

Project Coordinator:
German Aerospace Center, Stuttgart, Germany (DLR)
• Corrosion resistance: evaluation in simulated PEMEL environment, at 90°C and O₂ saturated solution, including accelerated stress tests at constant potential of 2 V applied for 6 hours.

• Interfacial contact resistance (ICR) versus compaction force measurement.

• Structure and morphology of BPP before and after accelerated stress tests.

Results:

• A 30 µm thick Nb coating fully protects the copper substrate against corrosion in simulated PEMEL environment, showing excellent corrosion resistance properties, with \( i_{corr} \) lower than 0.1 µA cm⁻².

• Cross-section images show no signs of corrosion, nor the formation of pinholes beneath the coating.

Applicability and transferability of the results:

• System: Development and validation of a 25 kW PEM electrolyzer system with hydrogen output pressure of 100 bars or higher.

• Cell components: Reduction of Ir catalyst loading compared to the state-of-the-art, by the use of new aerogel supports.

• Protocols: development of complete protocols for BPP testing, including stress test, corrosion resistance and ICR.

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Research Centre

Research Institute for Renewable Energy (ICER-TM), UPT

Research team

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