Innovative solid oxide electrolyzers to produce hydrogen will be developed in the Hy-SPIRE project

Warsaw, 9 February 2024

The kick-off meeting of the Horizon Europe project Hy-SPIRE "Hydrogen production by innovative solid oxide cell for flexible operation at intermediate temperature" was held in Warsaw on 8-9 February 2024, hosted by coordinator – the Institute of Power Engineering – National Research Institute (IPE-NRI).

According to long-term goals of EU, green hydrogen produced using renewable energy sources will become an energy vector for decarbonisation of the EU economy, in particular the hard-to-abate industry and transport sectors.

Water electrolysis is the most well-known technique used for zero-emission production of hydrogen and the technology of solid oxide electrolysers (SOEL) can become a key technological advantage for EU to become a world leader in hydrogen economy.

What is the aim of the Hy-SPIRE project?

The overarching objective of Hy-SPIRE project is to further boost the potential of SOEL by lowering the operating temperature below 700°C and increasing its flexibility in order to match the profiles of electricity generation in renewable energy sources (RES).

Through the development and application of new materials, advanced manufacturing techniques and optimized cell as well as compact stack designs, the project focuses on the creation of novel oxygen ion- and proton-conducting cells (O-SOE and P-SOE, respectively) on both, ceramic and metallic supports. Among the key goals of the Hy-SPIRE a low degradation equal to or lower than 0.75% per 1,000 h, operation at high current densities ca. 1.2 A/cm^2 and ability to operate dynamically and fast ramping, can be listed.

Furthermore, the technoeconomic analysis with the support of life cycle assessment (LCA) will be used for the evaluation of project novelties and the market potential, as well as the definition of barriers and research directions to achieve the objectives of the Strategic Research and Innovation Agenda. This, among others, includes the reduction of hydrogen production cost to 3 €/kg by 2030, reduction of CAPEX 520 €/(kg/kW) and OPEX 45 €/(kg/kW).

These goals will be reached thanks to the collaboration of the consortium coordinated by the Institute of Power Engineering – National Research Institute (Poland). The partners of the project are prominent research institutes such as Ecole Polytechnique Fédérale De Lausanne (Switzerland), German Aerospace Center (Germany), Fondazione Bruno Kessler through the Centre for Sustainable Energy (Italy), Fundació Institut de Recerca en Energia de Catalunya a (Spain), Technical University of Denmark (Denmark), and one of the key European supplier of solid oxide cell electrolysers SolydEra (Italy).

"*All of the partners have extensive experience in R&D related to SOEL, confirmed by numerous publications, patents and, most importantly, implementations. The project's aims are ambitious, however, they will accelerate the implementation of SOEL to the market and at the same time they will position European entities as leaders in this technology"* reports the Project Coordinator Jakub Kupecki. "*Institute of Power Engineering – National Research Institute, beside the role of the project coordinator, will actively participate in all Work Packages. The Institute will perform comprehensive cell and stack testing, as well as will be involved in investigation of corrosion of metal-supported cell and the key stack components. Among IPE-NRI*

responsibilities will be the development of the testing protocols and procedure, which will be in line with European standards and other EU's projects".

IREC will be actively involved in the preparation and development of thin functional layers for P-SOE and O-SOE cells, on both ceramic and metal supports. Our laboratories are equipped with large area pulsed laser deposition (PLD) systems and ultra-fast high-temperature sintering (UHS) setup, as well as equipment for SOC cell preparation and tests benches. IREC will also carry out morphological, structural, and chemical composition analysis using its world-class characterization facilities. This action is led by ICREA Professor Albert Tarancón, head of the Nanoionics and Fuel Cells group at IREC and the researchers Kosova Kreka and Toni Maria.

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