Successful Kickoff Meeting of the PRETZEL Project

On January 24th, 2018, the Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR) hosted the official project Novel Modular Stack Design for High Pressure PEM Water electrolyzer technology with wide operation range and reduced cost (PRETZEL).

Start date: January 1st, 2018
End date: December 31st, 2020
Project funding: € 1,999,088.75

The overall goal of the project PRETZEL is to develop an innovative polymer electrolyte membrane electrolyzer (PEMEL) that provides significant improvements in efficiency and operability to satisfy emerging market requirements. Such electrolyzers are urgently needed for the increased demands of the grid balancing services. In this context, PRETZEL is offering breakthrough technologies for becoming game in the field of water electrolyzers.

The project PRETZEL has the following objectives:

1) Develop and manufacture a high pressure PEMEL stack based on the novel principle of hydraulic compression.
2) Produce innovative components for the high pressure PEMEL stack that can operate at high temperature and current density.
3) Setup and undertake continuous procedures to evaluate the component and stack development process through all phases against the project specifications.
4) Integrate the stack with the new components into a high pressure PEMEL test facility to validate the overall performance and operational criteria.
5) Disseminate and exploit the project results in order to prepare the market penetration of the new technology.

The principle of hydraulic compression and stack components have already proven in a small laboratory scale and can be considered being in the range of technology readiness level (TRL) 3. Hence, the overall goal of this project is to prove the functionality of these proven technologies in a realistic environment in order to advance them to TRL 5. In practice, this means integrating them into a fully functioning 25 kW, 100 bar electrolyzer system that reflects the realistic and highly dynamic conditions required by the market.
Therefore, the central objective of this project is the development of a novel PEMEL system with a maximum 25 kW electrical power consumption that generates 4.5 m³ H₂ per hour at rated power, at an output pressure of 100 bar and feed water temperature of maximum 90 ºC.

At the system level, the specific energy demand at rated production rate will below 25 kWh per kg H₂ referring to a system efficiency of above 70% on the basis of higher heating value (HHV). Furthermore, this system will be able to operate in overload mode referring to a production rate as high as 6.8 m³ H₂ per hour (1.5 times overload). Rapid response of 1 second for a host start and 10 seconds for a cold start are also operating targets of the system.

At the stack level, the project will implement a patented design approach based on hydraulic cell compression. This design allows for large planar cell components, which is required for future mass production, and effective cooling at very high production rates and temperature levels. Regarding sufficient stack conditioning, a cooling system will be developed for voltages of maximum 2.0 V per cell at rated power and of 2.3 V per cell in overload modus.

Additionally, the target of PRETZEL is the development of a high pressure PEMEL stack with innovative components having non-precious metal coatings and advanced ceramic aerogel catalyst supports, which opens a perspective for specific stack costs of below 500 €/kW. As for the hydrogen production at 100 bar an additional compressor is omitted, thus specific system cost are possible in the range of 750 €/kW.

The PRETZEL project will realize the next generation electrolyzer technology, whilst meeting the needs of industrial scale hydrogen production in the near future.

Beyond these challenges, a significant increase of lifetime and improved operability will be achieved to cope with intermittent electricity supply from renewable energy sources.

Over the coming three years, the PRETZEL project will be carried out by an experienced and well-rounded consortium represented by the following partners:

- Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) German Aerospace Center (coordinator, Germany).
- Westfalische Hochschule Gelsenkirchen, Bocholt, Recklinghausen (Germany).
- Association pour la recherche et le développement des méthodes et processus industriels (ARMINES, France).
- Universitatea Politehnica Timisoara (Romania).
- Adamant Composites Ltd. (Greece)
- GKN Sinter Metals Filters GmbH Radevormwald (Germany).
- Centre for Research and Technology – Hellas (Greece).
- Soluciones Catalíticas IBERCAT, S. L. (Spain).
- iGas Energy GmbH (Germany)