European Commission

Hydrogen - A Competitive Energy Storage Medium To Enable the Large Scale Integration of Renewable Energies

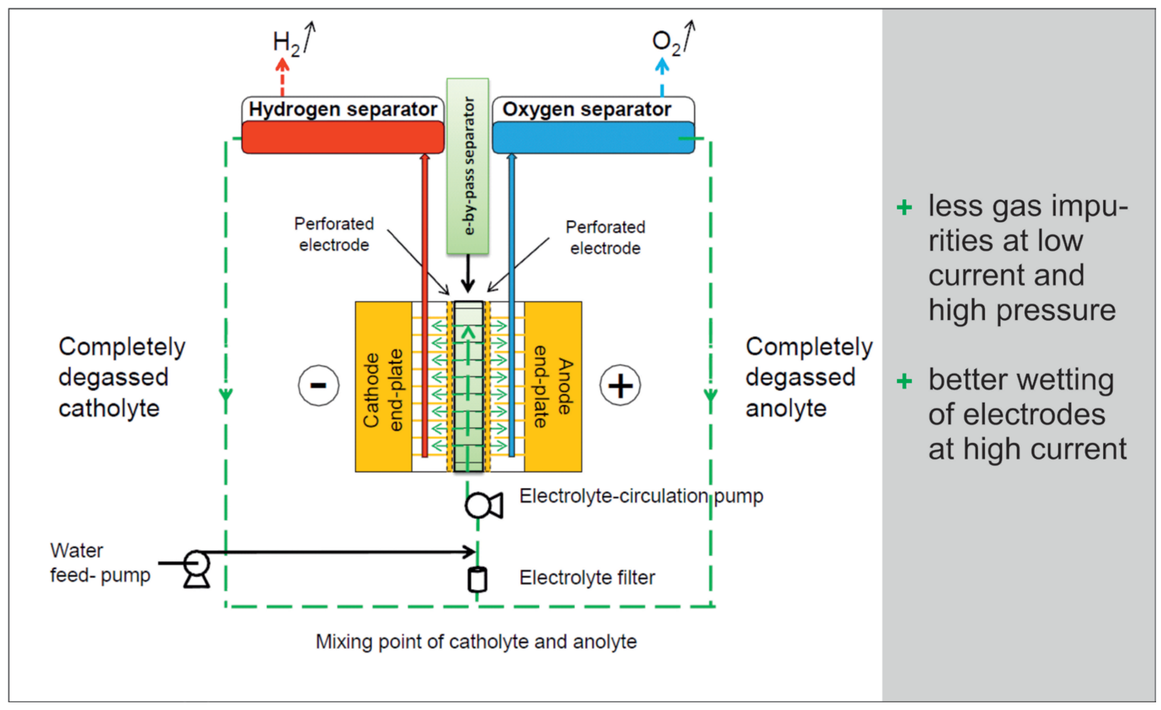
Seville, 15-16 November 2012

H_2 from RES: pressurised alk. electrolyser with high efficiency and wide operating range (REselyser)

Overall Objectives and Budget

The project REselyser develops high pressure, highly efficient, low cost alkaline water electrolysers that can be integrated with renewable energy power sources (RES) using an advanced membrane concept, highly efficient electrodes and a new cell design. The project is to develop a prototype of an improved electrolyser. Project Budget: 2.89 Mio. €.

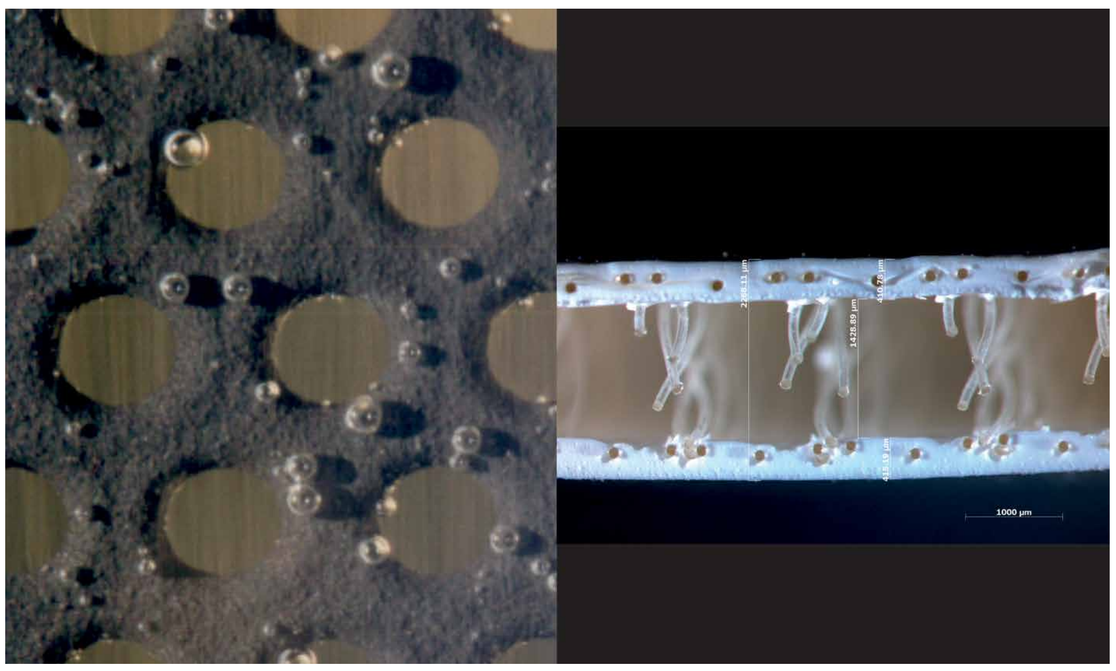
... to enhance the efficiency, reliability, durability and to reduce the costs of the electrolyser ...



New system concept for alkaline electrolyser using "E-bypass separator" with internal electrolyte channel.

Technical Barriers and Targets

The gas impurity at low current in high pressure operation as well as the poor wetting of electrodes at high current will be improved by a "E-bypass separator" with internal electrolyte channel thus allowing a wider current operating range for the electrolyser. High efficiency, i.e. small loss of energy when transforming electrical to chemical energy (hydrogen), will be demonstrated. A stability of this efficiency during long term operation in on/off cycles, as needed when operated with RES, will be demonstrated with an extrapolation to a lifetime of 10 years. In the same time low costs for the system are the target: System costs of 3.000 €/(Nm^3/h) plant capacity for the complete system.



Highly efficient long term stable electrode (left) and E-bypass separator with internal electrolyte channel (right)

Results

"E-bypass separator" diaphragms with internal electrolyte bypass and properties for maximum benefit of the cell were developed with a total thickness (including the internal electrolyte channel) between 1.4 and 3.4 mm at the size of a 300 cm^2 electrolyser. A cell concept was realised. Electrode coatings were demonstrated reducing the overpotential of a nickel electrode by 210 mV for the cathode and 161 mV for the cathode thus increasing the efficiency.

Future Work

The project will demonstrate the techniques in a 30 kW electrolyser stack with technical cell size at >25 bar. System designs to meet the needs of intermittent operation when coupled to Renewable Energy Sources will be developed and costs will be calculated.

Conclusions and major findings

First steps towards an alkaline water electrolyser better adapted to highly fluctuating current supply as when connected to RES were taken: Membranes for a new concept were developed, electrodes for higher efficiency were demonstrated and a new cell design is available.

Project Overview

- DLR German Aerospace Center, regine.reissner@dlr.de
- VITO, Hydrogenics Europe, DTU

- From 11/2011 to 10/2014
- www.reselyser.eu

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