

Pressurized alkaline electrolyser with high efficiency and wide operating range – the project RESelyser

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Introduction

For wide-spread use of electrolysers for energy storage by converting surplus renewable electrical energy to hydrogen the main obstacles are the costs of the device and the limited adaptation to fluctuating power supply. To address these points the project RESelyser has developed concepts and materials for 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 three-compartment cell design. A new separator membrane with internal electrolyte feeding and an adapted design of the cell to improve mass transfer, especially gas evacuation has been investigated and demonstrated. Intermittent and varying load operation with RES has been addressed by improved electrode stability and a cell concept for increasing the gas purity of hydrogen and oxygen especially at partial load and high pressure operation.

Discussion

High performance electrodes with a plasma sprayed coating layer give an overpotential reduction of 330 mV compared to uncoated electrodes thus showing high performance and stability with lowcost material. Detailed investigation of the electrode pore structure and microstructure at beginning of life and after operation shows possible degradation mechanisms. It was found that by feeding KOH solution from inside the internal compartment of a double layer diaphragm towards both the anolyte and catholyte compartments improves the gas purities of the cell significantly. The novel three-compartment cell concept using this double layer diaphragm (E-bypass separator) was realized in single cells of 300 cm² area and in a 10 kW stack.

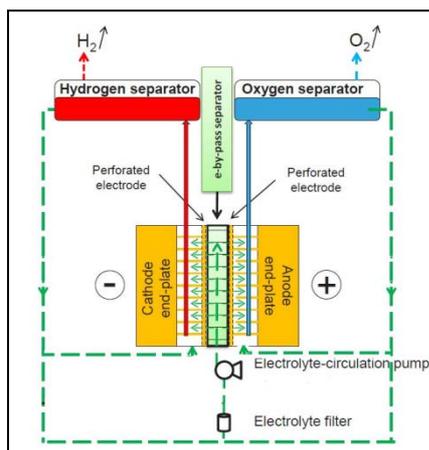


Figure 1: Scheme of system with double layer diaphragm

Conclusions and/or Outlook

Despite being an old technique further improvements for alkaline electrolysers can still be achieved to make them better adapted to new applications in hydrogen fuelling and energy storage.

For further information see www.reselyser.eu.

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