Solid Oxide Cells at the Forschungszentrum Jülich

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Abstract

At the Forschungszentrum Jülich, one of the main issues in materials research is the realization of ceramic cells operating with high power density at temperatures below 600 °C. In the field of conventional temperature for an SOC which is for an anode-supported cell between 700 and 800 °C, many long-term tests were performed, of which the longest was switched off after 100,000 hours at 700 °C. Operating results and findings of the post-test examination of this stack are presented here.

A special stack design (the so-called window frame concept), allowing increased electrode area per layer was further improved. Both power output and thermal cyclability will be presented. The latter will also be shown for the novel light weight cassette design.

In the area of system development, the work concentrated on the development of a reversibly operable solid oxide cell system (a so-called rSOC system). This means that both the electrolysis and the fuel cell operation can be performed with the same system and the same stack. The system is operated up to now for about 6,700 h. In fuel cell mode a maximum DC system efficiency of 62% could be demonstrated at a stack power of 5.3 kW. The system's DC efficiency in electrolysis operation at 14.3 kW_{DC} was 70%.

Investigations on electrolysis have mainly focused on co-electrolysis. Cell and stack tests showed that the product gas composition of H_2 and CO can be very well tuned by the corresponding input composition ratio of steam to CO_2.