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ADVANCED TEST SET-UP FOR LONG-TERM TESTING OF ANODE SUPPORTED SOFC STACKS

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BFE Projekt-/Vertrag-Nummer	101936/152389
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ZUSAMMENFASSUNG

Anode supported SOFC stack have the potential of achieving lower degradation rates than stack with electrolyte supported cells, as they operate at more moderate temperature ranges (700-800°C as compared to 950°C), reducing mainly corrosion effects.

Within the EU project Real-SOFC, extensive research has been undertaken to reduce materials degradation, i.e. using better cathode materials and metal coatings. On the materials level, progress was be demonstrated on the cell level for tests lasting up to 3'000 hours.

On the stack level however, extensive testing within Real-SOFC showed that stack failed typically before 2500 hrs. Failures causes were identified to be in the major parts due to the inherent fragility of the anode supported cells towards the exposure to re-oxidising conditions. This exposure is inherent in the stack design currently used (R-design), having an open psot-combustion zone. To move forward on materials evaluation, therefore a design change is required, moving to a stack design recovering exhaust gases. This kind of design was developed jointly between HTc and EPFL and will become the new reference for the Real-SOFC materials test evaluation. It should allow achieving common test duration of well above 3'000 hrs and enable the project measuring effectively the progress on the materials level.

Within the first month of this projct, a prototype set-up has been realised and will be used as base for further adaptations and improvement. The next step involves an analysis of the funcionng of the actual set-up and a detailed job description for the next generation of set-up.

Projektziele

The objective is the design, validate and implement new stack test benches avoiding the open post-combustion zone in order to start long term durability tests on the adapted design within Real-SOFC. The objective is to use the new standard to make several long term tests with partners (EPFL; VTT, GdF, EDF).

Durchgeführte Arbeiten und erreichte Ergebnisse

As an initial step, one set-up in S-design was constructed in order to validate base functions of the concept, as described in Figure 1. The objective is to identify further issues on the first prototype, see Figure 2. 3 to 5 cell stacks will be tested, and a detailed job description for the advanced test set up is being elaborated together with LENI EPFL.

In the current design, reforming, controlled recovery of unused fuel, and protection from Cr+ species (protective coatings on high performance alloys) has not yet been integrated. The chosen approach helps to get physical data on a physical test set up early on in the design phase. The current set-up is gas tight and matches geometrical requirements.

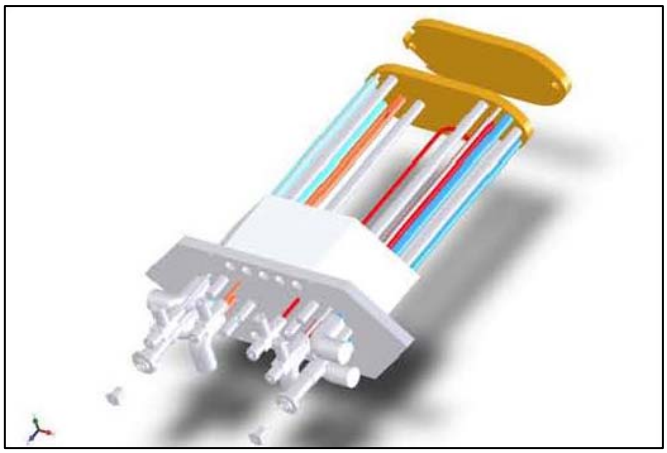

Fig 1:

Preliminary outlay of advanced test set-up

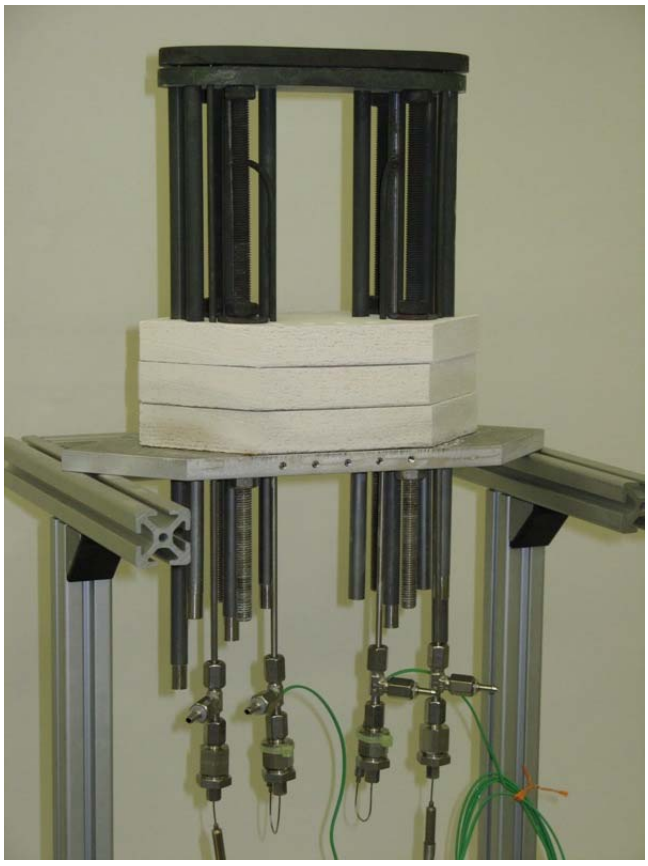

Fig 2:

Realisation of the preliminary set-up configuration. Next steps will integrate the heat management for 5 to 10 cells and Cr evaporation protected steel

Nationale Zusammenarbeit

The advanced test set-ups integrate the SOF-CH roadmap by giving access to relevant materials research results for a several activities, eliminating the major failure cause of the current design.

Internationale Zusammenarbeit

The project is integrated within the activities of EPFL and HTc included in Real-SOFC. It covers the additional effort for the design change, requiring engineering and development of critical parts. Long

term test are included in the base budget of Real-SOFC for EPFL. Further long term tests will also be conducted ion the frame of Real-SOFC at VTT in Finland, EIFER in Karlsruhe and GdF in Paris.

Bewertung 2006 und Ausblick 2007

The project is still at early stage, but the realisation of the prototype was successful. Further progress is expected in the second generation design.

The collaboration with EPFL is professional; EPFL is providing the technical requirements and assists in dimensioning for proper heat management, while HTc designs and executes the realisation adapted to the requirement s of the stacks.