TRANSIENT OPERATING STRATEGIES FOR SOLAR HEAT SUPPORTED SOLID OXIDE ELECTROLYSIS SYSTEMS FOR HYDROGEN PRODUCTION

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Abstract

Considering the transformation of the energy system, there are two main challenges. First, efficient and cost competitive long-term energy storage on a large scale. Second, making renewable energy accessible for hard-to-electrify sectors like transport and heavy industry. Converting renewable electricity into green hydrogen in Solid Oxide Electrolysis Cells (SOEC) is considered a viable solution for both challenges. Besides the superior efficiency, SOEC offer the possibility to supply part of the energy demand by industrial waste heat or by renewable sources, such as solar thermal energy. The SOEC technology is mature but the integration within large systems and coupling with up- and downstream processes still requires research to be done on the SOEC's transient behaviour as well as identifying safe and efficient operating strategies.

In this contribution, a solar-SOEC coupled system concept is analysed for its capability to cope with typical fluctuations in solar irradiance. Different operating parameters, namely current, feed gas temperature and reactant conversion are varied. Results show on the SOEC. Additionally, an improved operating strategy for a fluctuating scenario of two hours of overcast is presented. An exergy efficiency increase of about 4% could be achieved in comparison to a reference strategy.