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Efficient Solid Oxide Electrolysers for Syn-Gas Generation Using Renewable Energy

Authors : G. Kaur, A. P. Kulkarni, S. Giddey

Abstract : Production of fuels and chemicals using renewable energy is a promising way for large-scale energy storage and export. Solid oxide electrolysers (SOEs) integrated with renewable source of energy can produce 'Syngas' H_2/CO from H_2O/CO_2 in the desired ratio for further conversion to liquid fuels. As only a waste CO_2 from industrial and power generation processes is utilized in these processes, this approach is CO_2 neutral compared to using fossil fuel feedstock. In addition, the waste heat from industrial processes or heat from solar thermal concentrators can be effectively utilised in SOEs to further reduce the electrical requirements by up to 30% which boosts overall energy efficiency of the process. In this paper, the electrochemical performance of various novel steam/CO_2 reduction electrodes (cathode) would be presented. The efficiency and lifetime degradation data for single cells and a stack would be presented along with the response of cells to variable electrical load input mimicking the intermittent nature of the renewable energy sources. With such optimisation, newly developed electrodes have been tested for 500+ hrs with Faraday efficiency (electricity to fuel conversion efficiency) up to 95%, and thermal efficiency in excess of 70% based upon energy content of the syngas produced.

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