INFLUENCE OF HYDROGEN ELECTRODE ACTIVE LAYER THICKNESS ON THE ELECTROCHEMICAL PERFORMANCE OF REVERSIBLE SOLID OXIDE CELLS IN WATER ELECTROLYSIS REGIME

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Due to the growing interest in low (carbon neutral) or zero emission energy sources the photovoltaic cell and wind turbine technologies are becoming increasingly popular [1]. These intermittent power sources, however, need technical solutions for energy storage to be feasible at high shares in the energy market. One such potential solution is the reversible solid oxide cell (RSOC), which can electrolyse water into hydrogen and oxygen and afterwards use these gases as fuel to produce energy [2]. However, due to the different degradation mechanisms present in the electrolysis mode and the fuel cell mode it is not easy to find a cell architecture that is suitable for both uses [3].

In this work the authors try to find the optimal RSOC fuel electrode active layer thickness in electrolysis regime. A number of Ni-3YSZ|Ni-8YSZ|8YSZ|GDC|LSC solid oxide button cells with various Ni-8YSZ layer thicknesses were electrochemically characterised to find out how the thickness of active layer influences the electrochemical performance of the RSOC.

The methods used for electrochemical characterization were electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV) at several operating conditions including different temperatures and water content in the gas stream. The results of the electrochemical studies were analysed using equivalent circuit fitting of experimental Nyquist plots.

References

1. FCH JU. Commercialisation of energy storage in Europe: Final report; 2015.
2. M. B. Mogensen, M. Chen, H.L. Frandsen, C. Graves, J.B. Hansen, K.V. Hansen, A. Hauch, T. Jacobsen, S.H. Jensen, T.L. Skafte and X. Sun, Clean Energy, 3, 175–201 (2019)
3. P. Mocoteguy and A. Brisse, International Journal of Hydrogen Energy, 38 (36), 15887-15902 (2013)

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