

## Understanding degradation of solid oxide electrolysis cells through modeling of electrochemical potential profiles - DTU Orbit (08/11/2017)

### Understanding degradation of solid oxide electrolysis cells through modeling of electrochemical potential profiles

Establishing the spatial distribution of the various chemical and electrochemical potentials in an operating SOEC is critical as several degradation mechanisms are tightly connected to them, but at the same time very challenging to achieve experimentally. Such distributions are presented here on the basis of a two dimensional bi-layer electrolyte SOC model including for both electrodes a description of activation, concentration, and conversion losses. An extensive parametric study is reported to illustrate the influence of the electrode polarization resistances, the ionic and electronic conductivities in the electrolyte, the gas composition, temperature, and pressure on the current density distribution over the cell and the oxygen activity distribution within the electrolyte. The developed model is further used to simulate long-term durability experiments during different stages of operation, thereby helping to rationalize microstructural and chemical changes observed in post-mortem analysis. Finally, measures to mitigate degradation by changing conditions of operation, material or electrode properties or overall cell geometry are suggested.

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Authors: Chatzichristodoulou, C. (Intern), Chen, M. (Intern), Hendriksen, P. V. (Intern), Jacobsen, T. (Intern), Mogensen, M. B. (Intern)

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