Characterization and simulations of model electrodes in proton ceramic electrochemical cells

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Related projects: FME HYDROGENi

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Introduction

Proton Ceramic Electrochemical Cells (PCECs) are promising candidates for energy conversion and storage of renewable energies using hydrogen. PCECs can be used as reversible cells operating either in electrolysis or fuel cell mode solely with hydrogen, oxygen and steam, but are capable of operating with other fuels too.

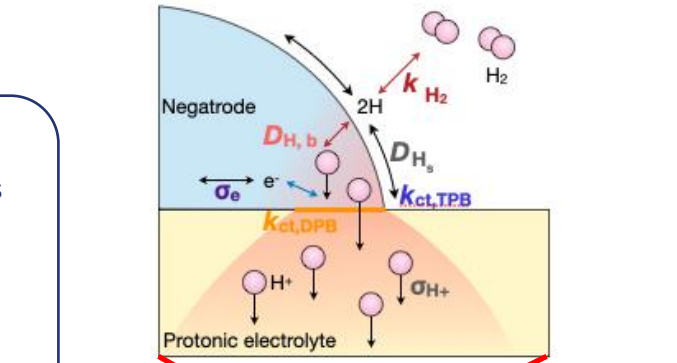
Current cells suffer from sluggish reaction kinetics especially at the steam electrode (positrode) as well as poor durability. While many studies concentrate on the improvement of the used materials, in depth investigations of the reaction pathways are scarce. Therefore, we focus on a fundamental understanding and want to elucidate the limitations of operating cells by the use of model electrodes with well-defined geometry.

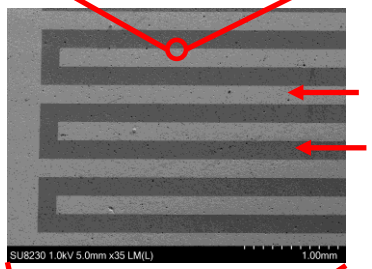
Primary objective

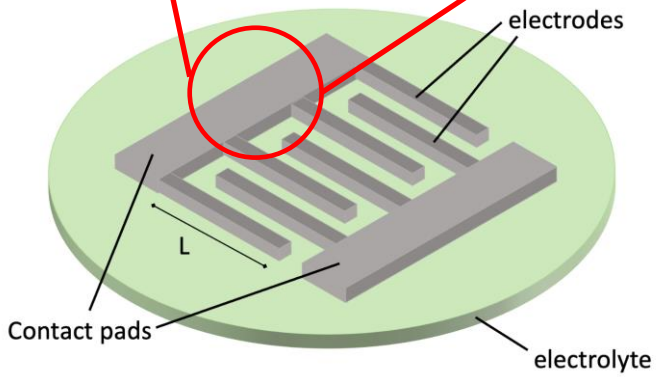
- Fundamental understanding of the electrodes and their limitations

Secondary objectives

- Development of finite element models for the positrode (air electrode) and negatrode (hydrogen electrode) implemented in Comsol
- fabrication and characterization procedure for model electrodes







Estimated progress of the PhD project:

Just started ...	< 50 %	> 50 %	Almost done ☺

Publications

- Doppler, M. C., Fleig, J., Bram, M., & Opitz, A. K. (2019). Comparison of electrochemical hydrogen oxidation on different metal/ceramic model anodes and mechanistic implications. Journal of Physics: Energy, 1(3).
- Zhu, H., & Kee, R. J. (2017). Modeling Protonic-Ceramic Fuel Cells with Porous Composite Electrodes in a Button-Cell Configuration. Journal of The Electrochemical Society, 164(13), F1400-F1411.

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