MSc thesis project:

"Enhancing Anodic Selectivity in Acidic Electrolysis: Coating for Chlorine Evolution Suppression"

Background

Direct seawater electrolysis for hydrogen generation is an excellent option to contribute to the energy transition to non-fossil-based fuels by using one of the most abundant and available resources. However, using seawater brings some technical challenges, such as the competition at the anode between the undesired chlorine evolution reaction (CER) and the targeted oxygen evolution reaction (OER). The primary focus of this research is to address this challenge by developing a coating to enhance OER selectivity.

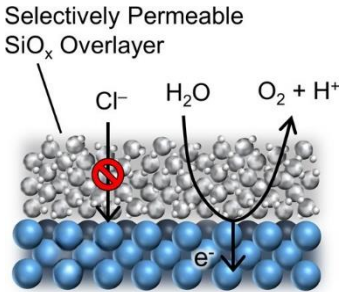

Figure 1. SiO_2 overlayer to enhance O_2 selectivity. Reproduced from Bhardwaj et al. [1]

Proposal

This project involves using a coating technique to apply a protective layer on a catalyst. The initial setup and method will replicate a previously conducted study (wet chemical deposition technique), and the results will be analyzed to validate the effectiveness of this coating method. The research aims to explore potential variations, limitations, or extensions of the original work, thereby contributing new insights to the field. Comparative tests will be conducted to evaluate the coating's effect on the catalyst's behavior. Additionally, advanced analysis techniques will be used to study changes in the catalyst's surface and chemical properties.

Contact information

Those interested in this master's end project should contact your daily supervisor, Ph.D. Candidate Katherine Encalada (K.S.EncaladaFlores@tudelft.nl). Your main supervisors will be either Dr. Ruud Kortlever or Professor dr. Ruud van Ommen.

References:

[1] A. A. Bhardwaj *et al.*, "Ultrathin Silicon Oxide Overlayers Enable Selective Oxygen Evolution from Acidic and Unbuffered pH-Neutral Seawater," *ACS Catal.*, vol. 11, no. 3, pp. 1316–1330, Feb. 2021, doi: 10.1021/acscatal.0c04343.

[2] J. G. Vos, A. A. Bhardwaj, A. W. Jeremiasse, D. V. Esposito, and M. T. M. Koper, "Probing the Electrode Composition and Morphology on the Effectiveness of Silicon Oxide Overlayers to Enhance Selective Oxygen Evolution in the Presence of Chloride Ions," *J. Phys. Chem. C*, vol. 126, no. 48, pp. 20314–20325, Dec. 2022, doi: 10.1021/acs.jpcc.2c07116.

[3] J. G. Vos, T. A. Wezendonk, A. W. Jeremiasse, and M. T. M. Koper, "MnO_x/IrO_x as Selective Oxygen Evolution Electrocatalyst in Acidic Chloride Solution," *J. Am. Chem. Soc.*, vol. 140, no. 32, pp. 10270–10281, Aug. 2018, doi: 10.1021/jacs.8b05382.