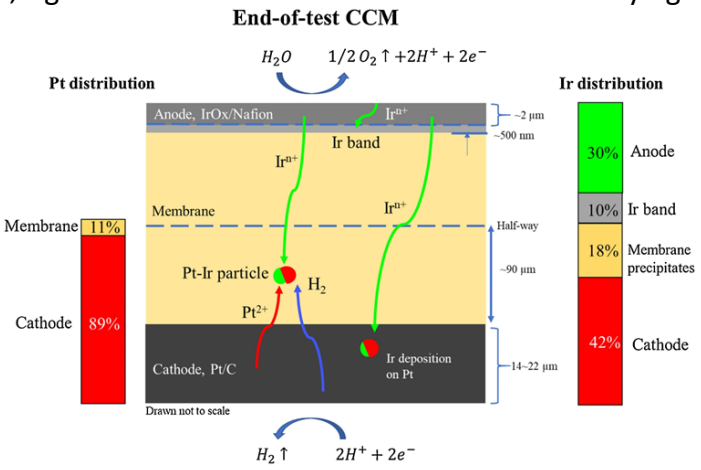
MSc thesis project:

Improved stability of Pt/C catalyst for long-term water splitting assisted by atomic layer deposition

Background

Nowadays, water splitting is considered one of the most promising methods for producing clean hydrogen using renewable electricity, such as wind and solar cells. In this process, precious noble metals, particularly Pt, need to be utilized as the cathode catalyst for hydrogen production, for example, in a proton-exchange-membrane water electrolyzer (PEMWE). However, Pt is very expensive due to its rare abundance on earth, making it costly when scaling up the electrolyzer. Therefore, significant efforts have been dedicated to studying the reduction of Pt loading. On the other hand, it has been widely observed that the catalyst's stability presents a significant barrier to the long-term utilization of the electrolyzer due to degradation issues. The stability of Pt is of utmost importance in sustaining the electrolyzer's performance in the context of the reducing the Pt loading.



Proposal

In this project, we will prepare a lower loading of Pt on commercial carbon black using atomic layer deposition (ALD), as compared to commercial Pt/C. To enhance the stability of the Pt in a water electrolyser, we will apply an additional thin film of metal oxides onto the Pt through ALD. However, it is not clear how the coated metal oxide layer would affect the catalytic performance and stability of Pt in the electrolyser. This uncertainty forms the basis of our investigation in this project.

Contact information: For those who are interested in this master end project, please contact dr. Mingliang Chen (m.chen-1@tudelft.nl). The project will be supervised by dr. Mingliang Chen and prof. Ruud van Ommen

References:

Lee, Woo-Jae, et al. "In situ engineering of a metal oxide protective layer into Pt/carbon fuel-cell catalysts by atomic layer deposition." Chemistry of Materials 34.13 (2022): 5949-5959.

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Marichy, Catherine, et al. "ALD SnO2 protective decoration enhances the durability of a Pt based electrocatalyst." Journal of Materials Chemistry A 4.3 (2016): 969-975.