MSc thesis project:

Ionomer-free Pt catalyst with ultra-low loading in proton exchange membrane electrolyzer cells

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. According to a recent study by the group of Zhang, it revealed that

the HER and hydrogen bubble nucleation mainly occur on catalyst layers at the rim of the thin/tunable pores of the liquid/gas diffusion layers. Therefore, direct coating of catalyst on the surface of GDL would reduce the loading and improve the utilization of Pt catalyst efficiently.



Proposal

In this project, we will prepare an ultra-low loading of Pt on GDL using atomic layer deposition (ALD) and sputter deposition, the performance of these novel designed GDE will be compared with commercial Pt/C and those coated with a layer of ionomer after Pt deposition.

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

References

Kang, Zhenye, et al. "Novel thin/tunable gas diffusion electrodes with ultra-low catalyst loading for hydrogen evolution reactions in proton exchange membrane electrolyzer cells." Nano energy 47 (2018): 434-441. Mo, Jingke, et al. "Discovery of true electrochemical reactions for ultrahigh catalyst mass activity in water splitting." Science advances 2.11 (2016): e1600690.