Catalyst-Independent Performance Improvement of Proton Exchange Membrane Water Electrolyzer

Peter Kúš, Tomáš Hrbek, Hridya Nedumkulam, Jaroslav Herman, Iva Matolínová

Charles University, Faculty of Mathematics and Physics, Department of Surface and Plasma Science, Prague, Czech Republic

With the worldwide transition to volatile renewable sources, the proton exchange membrane water electrolyzers (PEM-WEs) are getting increasing attention as they allow to convert and store electrical energy to clean hydrogen. It is therefore of the utmost importance to improve the electrochemical performance and lifetime of PEM-WEs should they continue to be installed in multi gigawatt capacities. A significant part of today´s research is dedicated to optimizing catalysts and to lowering the content of noble metals within. Yet, the PEM-WE performance and lifetime can also be improved by modifying the cell components or even by tunning the operational regime of the system when coupled with intermittent power sources. In this talk we will demonstrate that interrupting the PEM-WE operation by putting it on open circuit voltage (OCV) in regular intervals has a positive effect on its performance. Our experiments proved that when operated in dynamic regime, i.e. periodic OCV interruptions in between long potentiostatic segments, the average current density increased when compared to purely potentiostatic operation. Interestingly, the integration of transferred charge over the fixed time confirmed that when OCV periods are kept sufficiently short, the PEM-WE operated dynamically produced more hydrogen in comparison to statically functioning one. This effect was consistent regardless of the design of the membrane electrode assembly or the catalyst loading.