Workshop »Coatings for Energy Technologies«

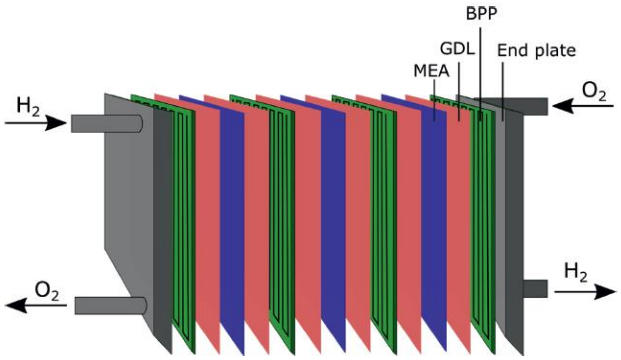
Coatings for Bipolar Plates

Dr. Sigrid Lædre[1], Dr. Katie McCay[1], Dr. Anders Ødegaard, Dr. Frode Seland[2], Dr. Håvard Karoliussen[2], Dr. Ole Edvard Kongstein[1†]

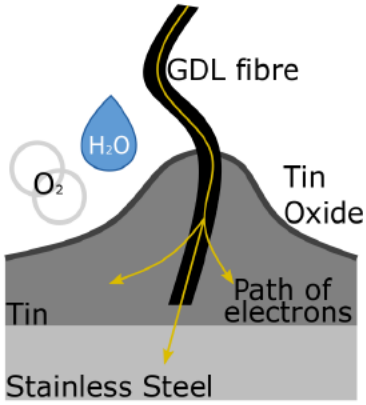
[1]SINTEF AS, Trondheim; [2]NTNU, Trondheim

sigrid.ladre@sintef.no

According to the REPowerEU plan, hydrogen will play an important role in the 2030 European energy system. Both production- and use of hydrogen can be done without CO_2 emissions by use of water electrolyzers and fuel cells. Various technologies for both water electrolyzers and fuel cells are already commercially available, but there is a continuous need to increase the lifetime and lower the cost for such systems. For fuel cells (FC) and water electrolyzers (WE) based on the Proton Exchange Membrane (PEM) the total weight and cost is dominated by the bipolar plates. These separator plates combine several single cells into a stack, and are in addition used to conduct water, gases, heat and current between each cell in the stack. In order to do so, the BPP should possess high mechanical strength, high shock durability, high electrical- and thermal conductivity, have high corrosion resistance, be relatively cheap and easy to manufacture. Many metals fulfil most of these acquirements, but metals are also prone to corrosion in the PEM environment.



PEMWE stack with Bipolar Plates separating each single cell



Sn/GDL concept where the GDL is soldered to the BPP through the electrodeposited tin[3]

At SINTEF and NTNU we have worked with various surface treatments and coatings for BPPs for use in both PEMFE and PEMWE. We have developed test methods both in-situ and ex-situ to better understand the surface changes leading to degradation and oxide formation surface.

The correlation between in situ and ex situ testing lead to improved ex situ test protocols for BPPs in PEMFE[1]. Various metals were investigated as potential BPP materials[2]. The combination of electrodeposition and hot pressing with the GDL led to tin coatings with promising performances[3]. An In situ method for determination of Interfacial Contact Resistance (ICR) was developed.

1. https://doi.org/10.1016/j.ijhydene.2012.09.021
2. https://doi.org/10.1016/j.ijhydene.2016.11.106
3. https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2723895
4. https://iopscience.iop.org/article/10.1149/2.1511912jes