

Begin-of-Life analysis of a 60-cell polymer electrolyte water electrolysis stack

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The most common method to assess the performance of a polymer electrolyte membrane water electrolysis (PEMWE) stack is to record a current-voltage curve (polarization curve). Using a PEMWE stack consisting of 60 cells with an active cell area of 1024 cm², a Begin-of-Life analysis was conducted. With this analysis we want to demonstrate the significance of a polarization curve [1-3]. In addition to simply recording the current and voltage, the test bench equipment also allowed the pressure and temperature at the inlet and outlet of the stack to be measured, as well as the amount of hydrogen produced. Furthermore, the hydrogen crossover can be quantified in the form of H₂ in O₂ monitoring. Figure 1 shows the average cell voltage of the 60 cells, the voltage target values (achieved in a laboratory cell), and the power required to produce one standard cubic meter of hydrogen. In addition, the single cell voltage distribution for selected current densities and the contact resistance on the cathode side are shown. Considering ex-situ contact resistance measurements of the porous transport layer on the anode side and the expanded metal sheet on the cathode side, the single cell voltages show a strong correlation with the cathodic contact resistance which has the highest share of the overall ohmic resistances of the respective cells.

This study shows that the combination of a simple current and voltage measurement together with further sensors allows a wide-ranging characterization. Besides efficiencies and operating parameters, the safety relevant hydrogen in oxygen concentration can be measured. This approach allows conclusions to be drawn at the beginning of the stack characterization process, such as the strong dependence on contact resistance.

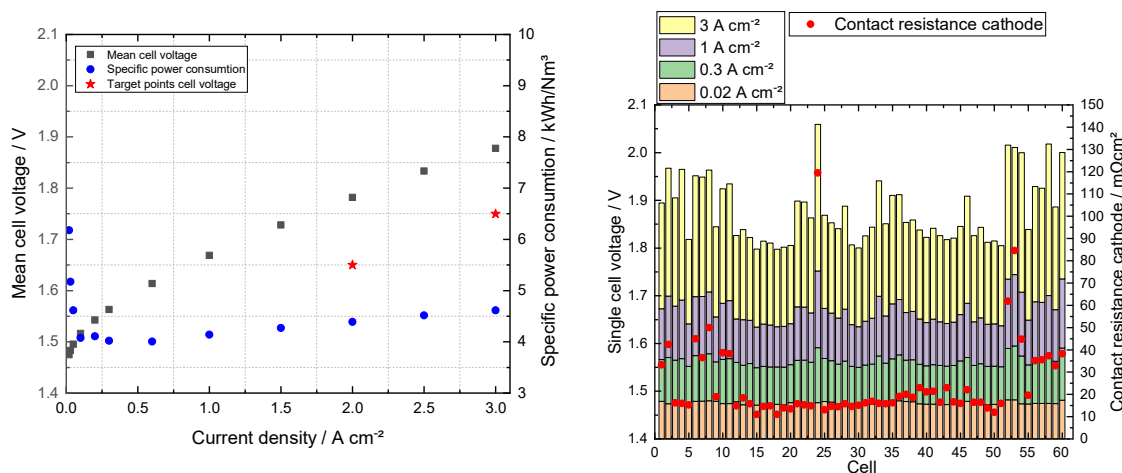


Figure 1. left: Measured mean cell voltage, target cell voltage and specific power consumption; right: Single cell voltages and cathodic contact resistance of all 60 single cells recorded at 70°C, 4/5bar_g and 123 NLPM water flow on anode and cathode side each

References

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