

Supplementary Information:

Dynamic accelerated stress test and coupled on-line analysis program to elucidate aging processes in proton exchange membrane fuel cells

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Supplementary Tables and Figures

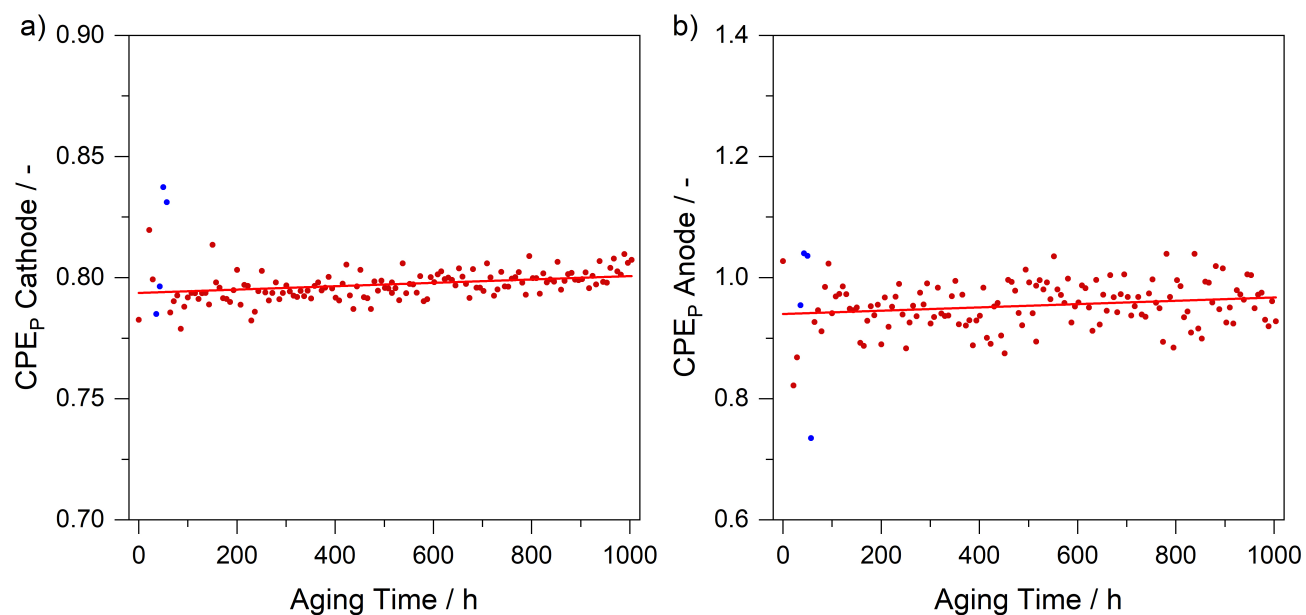


Figure S1. Exponents of the CPE capacitances of the cathode (a) and anode (b) as deduced from equivalent circuit fits of EIS data. The lines are the results of linear regressions of the data points. Blue data points represent measurements with turned-off humidifier.

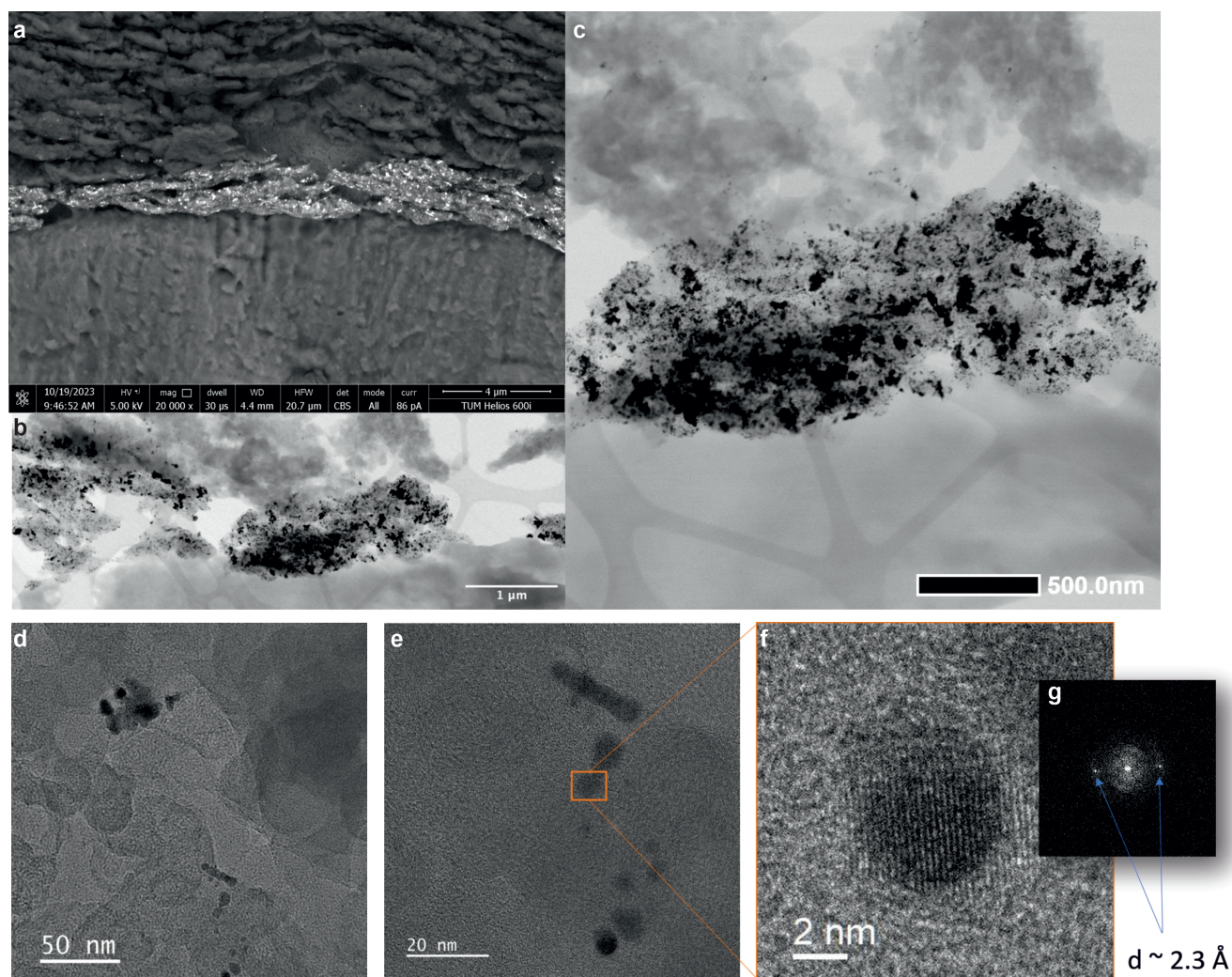


Figure S2. a-c) Scanning Transmission Electron Microscopy (STEM) images of the interface between carbon support, platinum catalyst and membrane. d-f) High Resolution TEM (HRTEM) images of the carbon support, platinum nanoparticles and platinum particle aggregates. g) Selected Area Electron Diffraction (SAED) pattern of the nanoparticle depicted in f. The identified interplanar spacing of 0.23 nm corresponds to the (111) plane of fcc Pt. All images were taken from microtomes of the MEA aged for 1,000 hours.

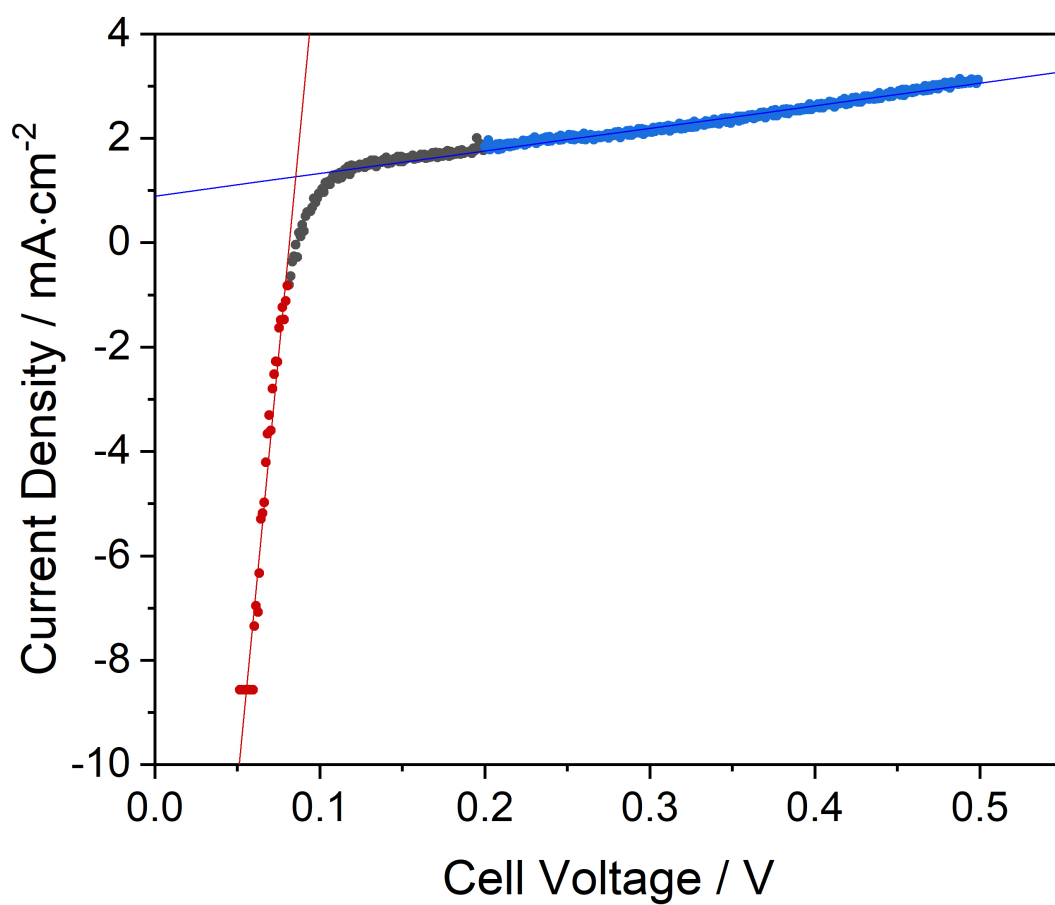


Figure S3. Exemplary linear sweep voltammogram for determining the short-circuit resistance (reciprocal slope of blue line) and the hydrogen crossover current density (intersection between red and blue line).

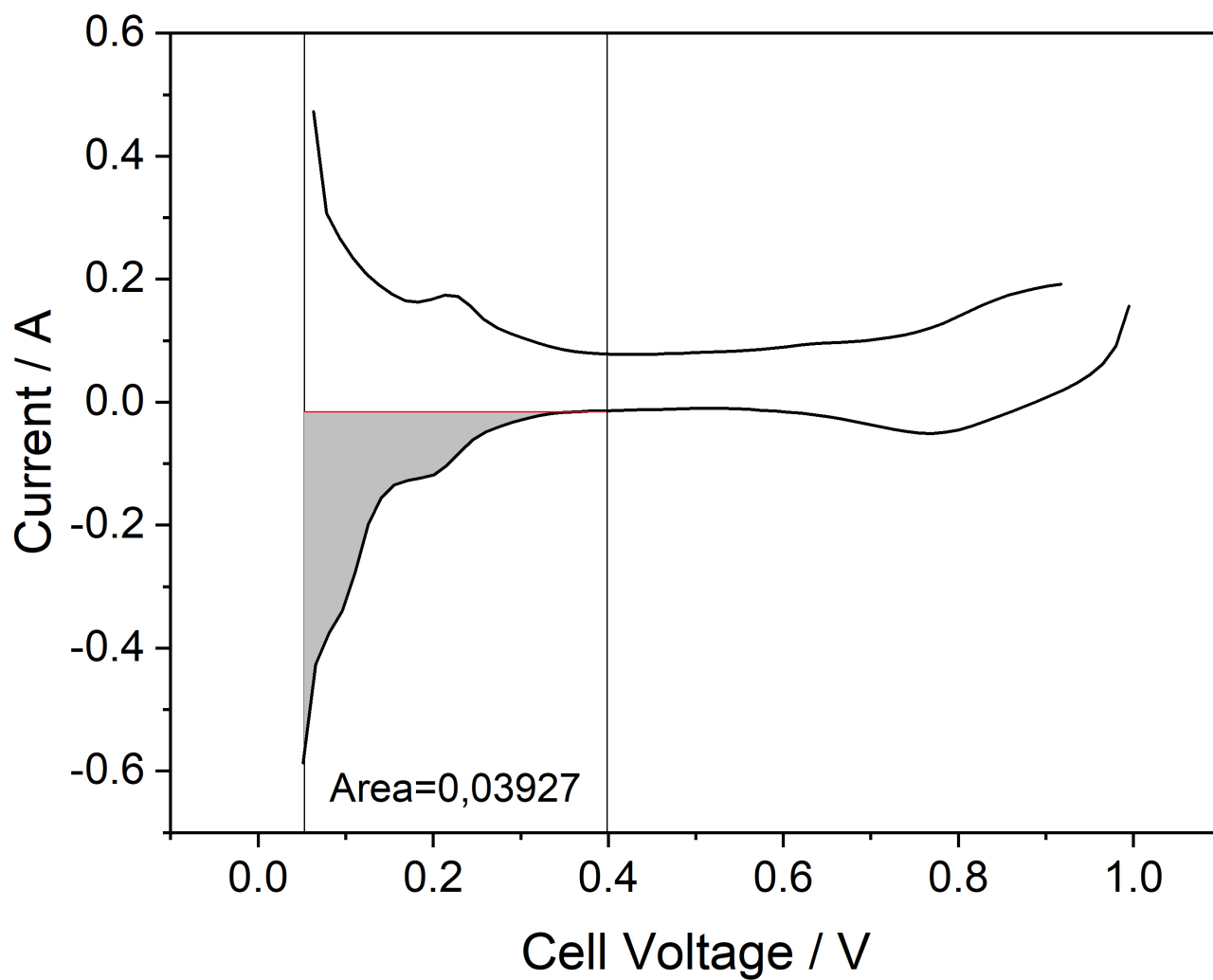


Figure S4. Exemplary cyclic voltammogram for the determination of the electrochemically active surface area (ECSA) by integration of the area under the peaks associated with hydrogen desorption (grey area).

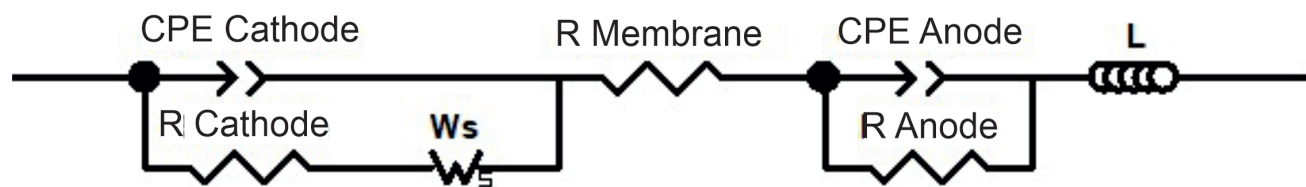
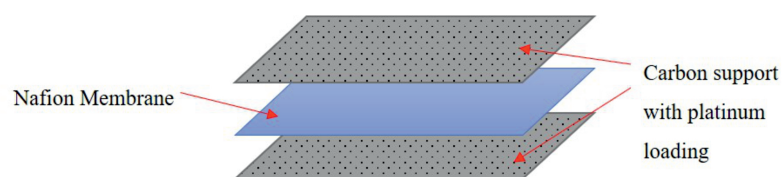


Figure S5. Equivalent circuit model used for the evaluation of the electrochemical impedance spectroscopy data.

a



b

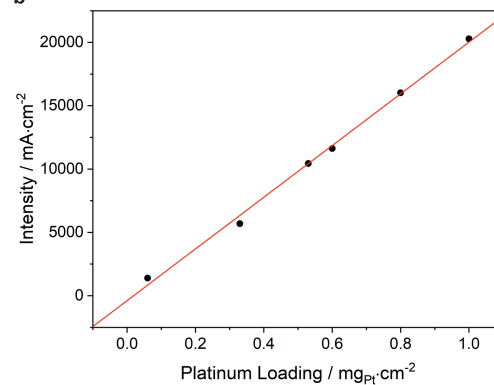


Figure S6. a) Measuring arrangement of membrane and carbon-supported catalyst layers to accommodate the XRF calibration line. b) Calibration line for the analysis of platinum in fuel cell MEAs by XRF.