MODELING OF POLARIZATION CURVES OF A PROTON EXCHANGE MEMBRANE FUEL CELL

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It is of great interest to accurately model the polarization curves of a Proton Exchange Membrane Fuel Cell (PEMFC). Doing so would foster improved fuel cell performance on the current-voltage level. In the present work, a meticulous mathematical description of the polarization curves, also known as the I-V curves, of a Proton Exchange Membrane Fuel Cell's characteristic shape was developed. The primary importance of modeling the I-V curve is to isolate, understand, and quantify actual and potential problem areas within the fuel cell device. Essentially, developing a numerical model of the I-V curves and attaining a fit where the residual error of this fit experiences its least value is one concern of this experimentation. Ultimately, insight gained from the modeling helps improving fuel cell performance which is vital to commercialization of fuel cells. An appropriate form of equation based on the general model is found to fit the I-V curves which were collected under different cathode backpressures. Parameter estimates were then extracted by fitting different areas of I-V curves and simultaneously perturbed in order to minimize the residual error in the fit. Optimal values were attained for the parameters when a minimal residual error was obtained. It is demonstrated by the excellent fitting results that a numerical model of the PEMFC I-V curves does allow for successful identification, understanding, and quantification of possible problem areas within the fuel cell device on the current-voltage level. In addition, the method which was employed to extract the parameters is proved to be successful by the good fits of the I-V curves.