Low Pt Cathodes for High Performance PEMFCs: Modeling and Experiments

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Abstract

We present a novel multi-layered electrode fabrication technique for polymer electrolyte membrane fuel cells (PEMFCs). This method consists of alternate layers of Pt deposition (0.05 mg/cm²) by sputtering on the painted multi-walled carbon-Nafion layer (CNL) with larger concentration of catalyst particles closer to the membrane. Parametric models were developed and validated by experimental results. We observed that three layers of Pt on CNL increases the electrode activity over a single and dual-layer electrode due to improved porosity and CN loading. A good agreement is obtained between the experimental and numerical results. The design of the cathode was done using COMSOL. The governing equations containing terms non-linear were implemented and solved using Finite Element Method of COMSOL Multiphysics.

Reference

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3. B. Bird, W.E.S., E.N. Lightfoot, ed. Transport Phenomena. 1960: Wiley, New York.
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Figures used in the abstract

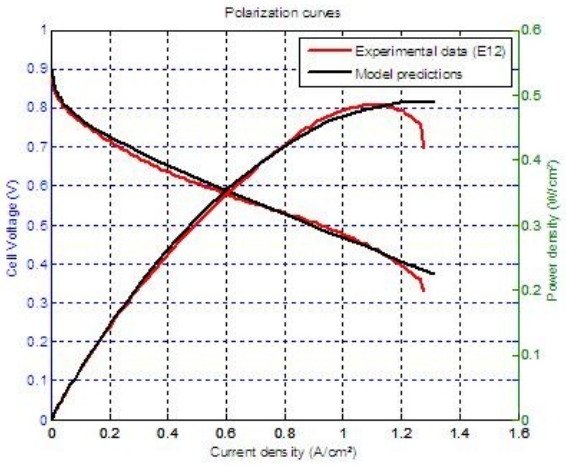

Figure 1

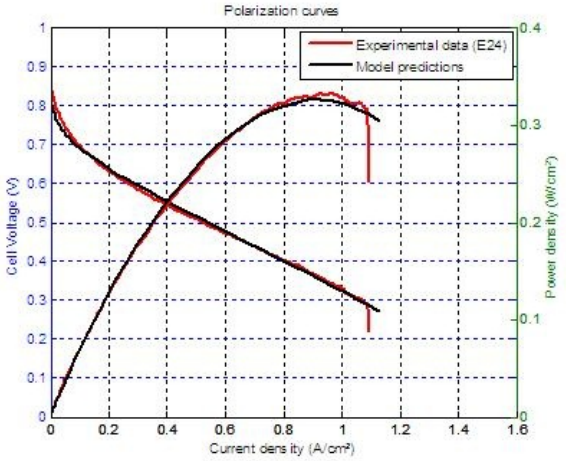

Figure 2

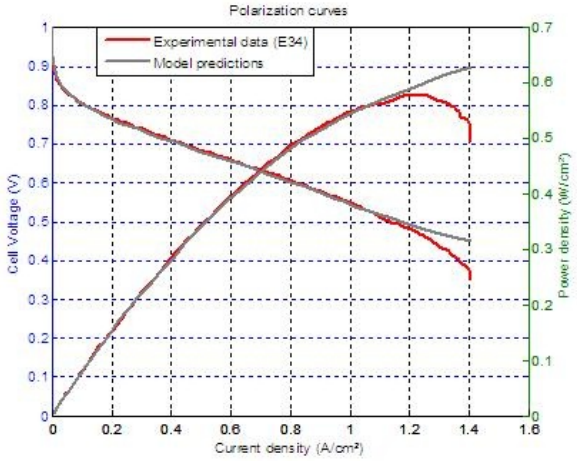
Polarization curves
Experimental data (E34)
Model predictions
Cell Voltage (V)
Power density (W/cm²)
Current density (A/cm²)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.2
1.4
1.6

Figure 3