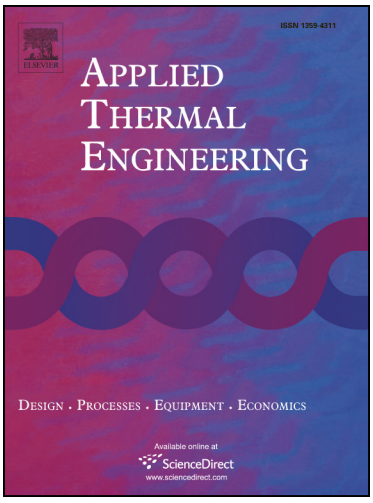

Research Paper

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PII: S1359-4311(17)32340-2
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2017.06.020
Reference: ATE 10538

To appear in: *Applied Thermal Engineering*

Received Date: 7 April 2017
Revised Date: 19 May 2017
Accepted Date: 6 June 2017

Please cite this article as: L. An, R. Chen, Mathematical modeling of direct formate fuel cells, *Applied Thermal Engineering* (2017), doi: http://dx.doi.org/10.1016/j.applthermaleng.2017.06.020

Mathematical modeling of direct formate fuel cells

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Abstract

In this work, we develop a one-dimensional mathematical model for direct formate fuel cells (DFFC), which incorporates transport and electrochemical processes. The present model is validated against literature experimental results and it shows good agreement. In addition, we also investigate effects of operating and structural parameters on the cell voltage. Results exhibit that the cell voltage is increased with the reactant concentration, including formate, hydroxide ions, and oxygen, which originates from the reduced activation polarization and concentration polarization. Moreover, it is also shown that increasing the exchange current density much reduces electrode overpotentials and thus upgrades the cell performance. The model is further used to examine how the anode diffusion layer and the membrane affect the cell performance. It is found that the cell performance is upgraded with increasing the porosity of the anode diffusion layer and decreasing the thickness of the anode