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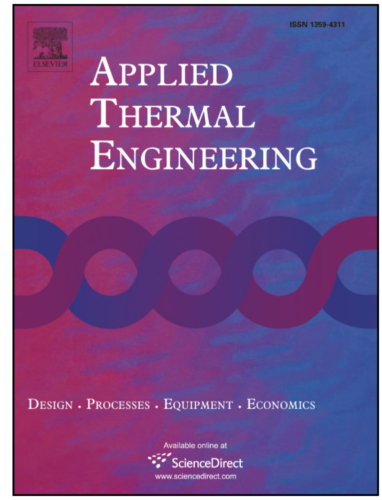

Research Paper

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Modeling of passive vapor feed alkaline membrane direct methanol fuel cell

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Abstract

A two-dimensional model for passive vapor feed alkaline anion membrane direct methanol fuel cell (AAEM-DMFC) is developed to investigate the effects of open ratio, carbon dioxide (CO_2) exit length, micro-porous layer (MPL) and porous layer's hydrophobicity. The results show that decreasing the open ratio and enlarging the CO_2 exit can relieve the methanol crossover. The fuel utilization efficiency can be significantly improved with the help of methanol recovery. The back-flow water direction shifts toward anode at low current density. The anode MPL (AMPL) can effectively mitigate the methanol intake from the tank and methanol crossover, however, the cathode MPL (CMPL) enhances the methanol intake and crossover at low current density. Moreover, the minimum methanol crossover can be achieved under an appropriate AMPL contact angle at high current density. Increasing the ACL hydrophobicity and vapor transport layer (VTL) hydrophilicity contributes to reducing methanol crossover. Overall, good water management and low methanol crossover can be achieved by optimizing porous layer structure, open ratio and carbon dioxide (CO_2) exit length. The simulation results presented in this study can provide further guidance on the optimization of passive vapor feed AAEM-DMFC.