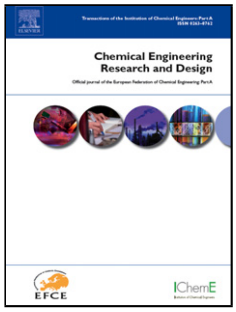


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# Modeling and simulation of a direct ethanol fuel cell considering overpotential losses and variation of principal species concentration

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**Abstract**

In this paper, we use a three-dimensional mathematical model to analyze the flow in a direct ethanol fuel cell (DEFC). The overpotential losses are estimated based on the operating parameters of the cell, and based on the reactive flow within the channels, in the diffusion layer, and on the electrocatalyst surface. The model includes fuel consumption and the formation of acetic acid and acetaldehyde, and the rate of ethanol crossover through the membrane. The numerical simulation of the reactive flow was made based on the central finite difference method. The equations were discretized in time using the Crank-Nicolson method. The model calculates the flow velocity and species concentration along the inlet channel, the diffusion layer and the catalyst surface. The molar fraction of the species is calculated according to the current density in the DEFC. The results for the cell voltage versus current density were obtained for different catalysts on the anode side, for three temperatures and two initial concentrations of ethanol. The results obtained are consistent with the experimental data found in the literature.

*Keywords:* Direct ethanol fuel cell, Overpotential losses, Mole fraction, Numerical simulation.

Declarations of interest: none.

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