Title:

Modeling of a three-stage low temperature ethanol steam reforming reactor for fuel cell applications

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Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

Ethanol is a promising source of hydrogen as it is a renewable source when obtained from biomass, and hence, catalytic steam reforming of ethanol to produce hydrogen is acquiring increasing interest. Although the catalytic aspects of the ethanol reforming reaction have been extensively studied, the design and control of ethanol reformers in real applications is still not yet developed.

The main objective of this work is to obtain a dynamic model of an ethanol reformer for a PEMFC based on detailed kinetic experimental data over well-defined catalysts. This model will be the basic tool for designing a tubular reactor and its control system, taking into account the operation temperatures.

The model is based on the coupling of mass and energy balance equations and calculates concentration and temperature profiles along the reactor as a function of time. It considers the volumetric flow rate variation over the tubular reactor, and the heat exchange. The influence of the volume discretization is analysed.

The following figure shows a scheme of the reactor and its discretization.

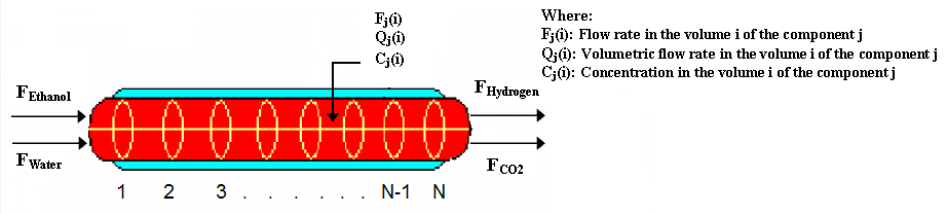

Fig 1: Scheme of the discretized reactor

Ethanol steam reforming is carried out in three separated stages. A first stage, where ethanol dehydrogenation into acetaldehyde and hydrogen over an appropriate catalyst occurs, followed by the reforming of acetaldehyde into a mixture of hydrogen and carbon oxides in a separate catalytic bed. Finally, a third stage can be introduced after the reforming step for a specific water gas shift module operating at low temperature in order to eliminate carbon monoxide resulting from the previous steps. The simulation model is validated by comparing the ethanol conversion at various operating conditions.

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