

能源和环境工程

## 质子交换膜燃料电池二维全电池两相流综合数值模型

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收稿日期 2007-3-5 修回日期 2007-5-23 网络版发布日期 2008-1-14 接受日期

摘要

针对直通质子交换膜燃料电池 (PEMFC) 建立了一个二维全电池综合数值模型, 模型综合考虑参与电化学反应的三个要素反应物质、电子和质子的传输过程以及液态水的淹没和膜内水传输现象。研究了供气压力、液态水淹没对电池性能的影响; 比较了不同输出电压、供气湿度等条件对阴极液态水饱和度分布以及电解质膜含水率的影响; 预测了基准供气状态下电池的极化曲线和文献报道的实验结果吻合很好。计算结果显示: 输出电压越小液态水淹没电极现象越严重; 阴极液态水的生成有利于膜的浸润保持较高电导率, 但是会淹没电极使有效电极面积减小, 导致电池性能下降。

关键词

[质子交换膜燃料电池](#) [水管理](#) [综合数值模型](#)

分类号

## A comprehensive two-dimensional computational model of PEM fuel cell with liquid water flooding

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### Abstract

A comprehensive two-dimensional mathematic model was developed for PEMFC with conventional single parallel flow field. In this model, the transport of the two charged species, electrons and ions, as well as that of the chemical species was considered. The model also described the phenomena of liquid water flooding and water transport through membrane. The influence of pressure and liquid water flooding on the fuel cell performance was investigated respectively. The distribution of liquid water in the cathode and water content of membrane were compared under different cell voltage and relative humidity of anode gas. The polarization curves predicted by the model agreed well with the published experimental data. The result indicated that liquid water flooding was more serious with a smaller output voltage. Liquid water condensation was good for keeping high conductivity of membrane near the cathode, but it would flood the electrode and decrease the performance of the cell.

### Key words

[PEMFC](#) [water management](#) [comprehensive model](#)

DOI:

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