中国化学工程学报 2004 12 (1): 14-26 ISSN: 1004-616x CN: 44-1063/R

TRANSPORT PHENOMENA & FLULD MECHANICS

采用不同流场的质子交换膜燃料电池内部传递现象模拟

胡鸣若[a,b], 朱新坚[a], 顾安忠[b]

[a] Institute of Fuel Cell, [b] Institute of Refrigeration and Cryogenics, Shanghai Jiaotong University, Shanghai 200030,China

收稿日期 修回日期 网络版发布日期 接受日期

摘要 A numerical model for proton exchange membrane (PEM) fuel cell is developed, which can simulate such basic transport phenomena as gas-liquid two-phase flow in a working fuel cell. Boundary conditions for both the conventional and the interdigitated modes of flow are presented on a three-dimensional basis. Numerical techniques for this model are discussed in detail. Validation shows good agreement between simulating results and experimental data. Furthermore, internal transport phenomena are discussed and compared for PEM fuel cells with conventional and interdigitated flows. It is found that the dead-ended structure of an interdigitated flow does increase the oxygen mass fraction and decrease the liquid water saturation in the gas diffusion layer as compared to the conventional mode of flow. However, the cathode humidification is important for an interdigitated flow to acquire better performance than a conventional flow fuel cell.

关键词 proton exchange membrane fuel cell numerical model liquid water saturation conventional flow interdigitated flow humidification

分类号

DOI:

Simulation of the Internal Transport Phenomena for PEM Fuel Cells with Different Modes of Flow

HU Mingruo[a,b], ZHU Xinjian[a], GU Anzhong[b]

[a] Institute of Fuel Cell, [b] Institute of Refrigeration and Cryogenics, Shanghai Jiaotong University, Shanghai 200030,China

Received Revised Online Accepted

Abstract A numerical model for proton exchange membrane (PEM) fuel cell is developed, which can simulate such basic transport phenomena as gas-liquid two-phase flow in a working fuel cell. Boundary conditions for both the conventional and the interdigitated modes of flow are presented on a three-dimensional basis. Numerical techniques for this model are discussed in detail. Validation shows good agreement between simulating results and experimental data. Furthermore, internal transport phenomena are discussed and compared for PEM fuel cells with conventional and interdigitated flows. It is found that the dead-ended structure of an interdigitated flow does increase the oxygen mass fraction and decrease the liquid water saturation in the gas diffusion layer as compared to the conventional mode of flow. However, the cathode humidification is important for an interdigitated flow to acquire better performance than a conventional flow fuel cell.

Key words proton exchange membrane fuel cell; numerical model; liquid water saturation; conventional flow;interdigitated flow; humidification

通讯作者:
胡鸣若 mingruohu@sjtu.edu.cn
作者个人主页:

胡鸣若[a;b]; 朱新坚[a]; 顾安忠[b]