

能源和环境工程

## 质子交换膜燃料电池双层扩散层特性三维分析

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摘要

针对直流道质子交换膜燃料电池提出一种混合的两相三维非等温数学模型, 考虑了液态水在多孔介质内的毛细流动和分布, 分析了双层扩散层结构及碳纤维特性对电池性能的影响。结果表明, 扩散层第一层(靠近催化层)厚度对质子膜电导率和气体传递特性有着相互制约的影响, 需进行优化; 在一定范围内, 扩散层第一层碳纤维直径的减小可提高质子膜电导率, 有利于电池性能的改善; 在保持其他参数不变的前提下, 应尽可能提高多孔介质的憎水性和孔隙率以提高电池输出性能。

关键词 [数学模型](#) [双层扩散层](#) [电池性能](#)

分类号

## Three-dimensional analysis of two-layer gas diffusion layer characteristics of proton exchange membrane fuel cell

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### Abstract

A hybrid two-phase three-dimensional and non-isothermal mathematical model was developed for proton exchange membrane fuel cell (PEMFC) with straight channel. The capillary flow and the distribution of liquid water in porous media were considered in this model. And the effects of the structure of two-layer gas diffusion layer (GDL) and the characteristics of carbon fiber on fuel cell performance were analyzed. The results indicated that the thickness of the first layer of GDL, which should be optimized, had contrary effects on the conductivity of membrane and the transport process of gas species. For certain conditions, the decrease of carbon fiber's diameter of the first layer of GDL increased the conductivity of membrane, which enhanced the performance of fuel cell. The hydrophobicity and porosity of porous media should be increased to improve the cell performance while keeping other parameters constant.

### Key words

[mathematical model](#) [two-layer GDL](#) [cell performance](#)

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