能源和环境工程

结构参数对质子交换膜燃料电池阴极有序催化层的影响

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摘要 建立了质子交换膜燃料电池阴极有序催化层的稳态数学模型，目的是研究催化层厚度、铂载量、电解质体积含量和碳载体直径等设计参数对催化层性能的影响。模型方程涉及质子、电子和氧气的传递以及电化学反应等过程。计算结果与实验数据吻合。模拟表明，一定范围内较薄的催化层有利于性能提高，但厚度太小反而不利；提高电解质体积含量和铂载量可以明显改进催化层工作特性，但存在优化值，高于此值，催化层性能迅速下降；较细的碳载体直径会适当改善催化层性能。

关键词 质子交换膜燃料电池 阴极 有序催化层 优化 数学模拟

分类号

Influence of structural parameters on ordered cathode catalyst layer in proton exchange membrane fuel cells

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Abstract

A steady-state numerical model was developed for an ordered cathode catalyst layer of proton exchange membrane fuel cells. The governing equations account for proton and electron transfer, oxygen diffusion and electrochemical reaction kinetics. The simulation results were consistent with the experimental data. The dependence of the ordered catalyst layer (OCL) performance on structural parameters was investigated. It was revealed that the OCL performance was much sensitive to electrolyte volume fraction and platinum loading, and there were optimal values above which the performance dropped quickly. Carbon support with a smaller diameter and thickness is beneficial to the OCL performance.

Key words proton exchange membrane fuel cell cathode ordered catalyst layer optimization mathematical model

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