

传递现象

多开口方腔内自然对流的流动与传热特性

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摘要

以计算流体力学与传热学理论为基础, 建立三开口方腔内有热源驱动自然对流的物理数学模型, 利用CFD方法对多开口方腔内流体的流动特性进行数值模拟和理论分析。在4种不同的通风模式下, 比较热源强度和活动开口位置对热源表面的Nusselt数和方腔的量纲1有效流通量等流体流动、传热参数的影响。结果表明, 在有热源驱动的自然对流条件下, 与开口通风位置相比, 热源强度对方腔内热流场的均匀性有更加重要的影响, 揭示了三开口方腔内流体的流动特性与换热规律。

关键词

[自然对流](#) [开口方腔](#) [流场分布](#) [数值模拟](#)

分类号

Characteristics of natural convection flow and heat transfer in cavity with multi-openings

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Abstract

Natural convection in a partially open enclosure is encountered in many practical applications such as the cooling of electronic device, the ventilation of building and the heat transfer in chemical process.A model that was formed by adiabatic walls and three partial openings, where the density of fluid changed continuously by linear heat source, was developed based on the theories of computational fluid dynamics and heat transfer.And four different ventilation modes were discussed based on the model.The comparisons among four ventilation modes indicated that the height of neutral level depended on both the source and the ventilation modes.For a specific ventilation mode, the ventilation air-flow rate and heat transfer can be increased by increasing the heat source strength but not by lifting the height of middle opening (MO).It implied that expanding the area of openings directly made ventilation air-flow rate larger, whereas not affirmatively reinforced heat transfer because the heat transfer from the source in the enclosure with a small-area opening was sometimes more than that with a large-area opening.Some general guidelines for optimizing natural convection in practical applications with multi-opening were provided.

Key words

[natural convection](#) [enclosure with partial openings](#) [flow field distribution](#) [numerical simulation](#)

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