

## 轴向热传导和入口效应对圆形微通道对流换热特性的影响

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收稿日期 2008-4-1 修回日期 网络版发布日期 2008-9-25 接受日期

**摘要** 提出了一种考虑轴向热传导、速度滑移、温度跳跃和入口效应情况下圆形微通道能量方程的求解方法. 运用分离变量法将能量方程转化为本征值问题, 再通过温度跳跃边界条件求解得到了本征值, 由本征函数的正交性确定了能量方程的完备解的待定常数, 给出了流体温度场和努塞尔数的计算表达式. 对圆形微通道换热特性进行了数值仿真, 结果表明, 轴向热传导和入口效应增加了入口处的局部努塞尔数, 速度滑移系数越小, 局部努塞尔数的渐进值越大.

**关键词** [轴向热传导](#) [速度滑移](#) [温度跳跃](#) [入口效应](#) [努塞尔数](#) [热交换特性](#) [强迫对流](#)

**分类号** [TK124](#)

## Effect of axial heat conduction and thermal entrance on heat transfer for the circular microchannel

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### Abstract

A method for resolving the energy equation of the circular microchannel, which considers axial heat conduction, temperature jump, velocity slip and thermal entrance is presented. The energy equation can be transformed into the eigenvalue problem by separation of variables. The temperature jump condition provides a procedure for determining the eigenvalues. The undermined coefficients of the complete solution to the energy equation are derived by the orthogonality eigenfunction and then the expressions of temperature field and Nusselt number are obtained. The expressions for temperature and the Nusselt number are achieved. Simulation of heat transfer in the circular microchannel is conducted and it is revealed that heat transfer to the wall increases with the effect of axial conduction. The effect of thermal entrance is to increase the local Nusselt number. The smaller the velocity slip coefficient, the larger the asymptotic value of the Nusselt number. <BR>

**Key words** [axial heat conduction](#) [velocity slip](#) [temperature jump](#) [thermal entrance](#) [nusselt number](#) [eigenvalue problem](#) [heat transfer](#) [forced convection](#)

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