

传递现象

## 新型管内插入物——立交盘强化传热的实验与模拟

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摘要

对装有新型强化传热管内插入物-立交盘的管路压降与传热情况进行了实验研究, 并利用计算流体力学方法模拟了结构参数变化对传热及压降的影响。实验方面, 通过不同黏度的测量物系, 测定了Reynolds数为 $2 \times 10^4 \sim 4 \times 10^4$ 时装有立交盘管路的压降, 得到了摩擦系数与Reynolds数的关系曲线, 并拟合了关联式, 结果表明相同条件下装有立交盘的管路其压降为空管的7~40倍。其次, 利用蒸气加热麦芽糖浆的传热实验, 测量了水平放置与垂直放置条件下空管与装有立交盘时管路传热情况, 拟合了相应的传热关联式, 结果表明爬流条件下水平放置时传热强化倍数为2~3.5倍, 垂直放置时传热强化倍数为2.5~4倍。最后, 采用计算流体力学的方法, 利用Fluent软件对立交盘的传热及流动过程进行了模拟研究, 考察了结构参数变化对传热及压降的影响, 整合了内外流道直径比及长径比对传热及压降的影响关联式, 为立交盘的优化设计提供了理论依据。

关键词

[强化传热](#) [立交盘](#) [摩擦系数](#) [计算流体力学](#)

分类号

## Heat transfer enhancement in round tube with cross over disk: experiment and simulation

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### Abstract

Experimental and numerical methods were used to study heat transfer enhancement in a round tube with a new type of insert: cross over disk (COD). Pressure drop experiments were carried out in the round tube with maltose. The correlation of friction factor for Reynolds number was given under Re range from  $2 \times 10^4$  to  $4 \times 10^4$ . The pressure drop in the round tube with COD was 7—40 times bigger than the empty tube. Heat transfer experiments were performed both in vertical and horizontal tubes with COD. The maltose was heated by steam in the tube. The heat transfer correlations were obtained. In the creeping flow, the heat transfer enhancement for the horizontal tube was about 2—3.5 times bigger than the empty tube, and about 2.5—4 times for the vertical tube. The influence for geometrical parameters, such as  $r/R$  and  $l/d$  on heat transfer and pressure drop was examined by computational fluid dynamics software Fluent and correlations to describe the effect of these parameters were obtained. These correlations could be used in optimal design of the heat transfer system using COD as insert.

### Key words

[heat transfer enhancement](#) [cross over disk](#) [friction factor](#) [CFD](#)

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