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传递现象

# 湿工况下平翅片传热传质实验与数值模拟

任能，谷波

上海交通大学制冷与低温研究所

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摘要

研究了湿工况下2排错列平翅片管换热器，迎面风速在0.77～3.06 m·s$^{-1}$范围内的传热特性：潜热换热量先是随迎面风速的增加而增加，当迎面风速增加到一定值后，潜热换热量受迎面风速的影响很小；与干工况相比，湿工况下空气侧的对流换热系数有所增加。在实验研究的基础上，为降低数值求解的难度，引入了“壁面反应”来模拟水蒸气在冷壁面的相变传热、传质过程，建立了湿工况平翅片管换热器空气侧三维传热、传质的简化模型。得到了湿空气的温度分布及水蒸气组分分布，并用场协同理论就迎面风速对传热、传质的影响进行了分析。将数值计算的结果与实验数据进行了对比，两者吻合很好。

关键词 湿工况 平翅片 传热 传质 数值模拟

分类号



# Experimental study and numerical simulation of heat and mass transfer on plain fin in wet conditions

REN Neng,GU Bo

**Abstract**

The effect of frontal velocity on heat transfer characteristics of two-row staggered flat fin-and-tube heat exchanger in wet condition was studied experimentally.The latent heat transfer firstly increased with increasing frontal velocity, then it seemed that there was no relationship between them when frontal velocity exceeded 1.27 m·s$^{-1}$ .The wet sensible heat transfer coefficients were slightly higher than those in dry condition.Based on the results of experiment, a “surface reaction” concept was introduced to simulate the phenomenon of heat and mass transfer during the process of vapor condensation on the cold surface, then a simplified three-dimensional numerical model was presented.The humid air temperature and vapor distribution were obtained, and then the effect of frontal velocity on heat and mass transfer was analyzed with the field synergy principle.Finally, the numerical simulation results agreed well with experimental data.

**Key words**

wet condition plain fin heat transfer mass transfer numerical simulation

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通讯作者 谷波 Gubo@mail.sjtu.edu.cn