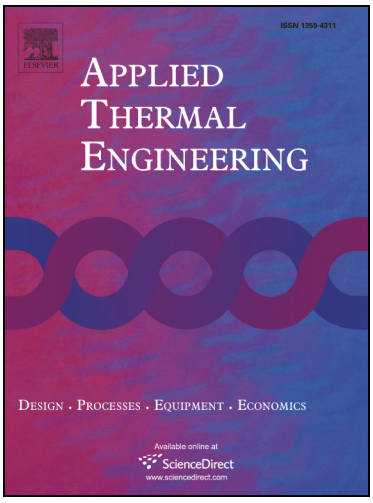

Research Paper

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Flow and heat transfer characteristics of a double-tube structure internal finned tube with blossom shape internal fins

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Abstract

Turbulent flow and heat transfer characteristics of double-tube structure internal finned tube with blossom shape internal fins were investigated. A sample with 3 pieces of blossom shape fins was investigated experimentally and numerically at 6 different air flow rates and a constant air inlet temperature, the Reynolds number at the air side varied from 3255 to 19580. The simulation results obtained are in good agreement with the experimental data. Then the effects of finned tube geometric structures (different fin numbers and different core tube diameter) on thermal behaviors were analyzed. The results demonstrated that the increase of fin numbers led to more uniform distribution of temperature and velocity field. The heat transfer performance of the internal finned tube with 3 pieces and 4 pieces of blossom shape fins were similar and both of them were appreciably higher than that of the internal finned tube with 2 pieces of blossom shape fins. There existed an optimal ratio of ($d_o/D_i \leq 0.28$) which led to better cost-effectiveness performances. Compared with wave-like fin, blossom shape fin is more suitable for the operating conditions with strict limits on pressure drop, especially in exhaust gas heat recovery system. Furthermore, dimensionless empirical correlations of Nusselt number *Nu* and Darcy factor number *f* are regressed based on the numerical simulation results for $2800 \leq Re \leq 21650$, $0.34 \leq W_f/d_e \leq 0.98$, and $0.78 \leq H_f/d_e \leq 1.51$. The mean deviations are 8.69% for *Nu*, and 6.76% for *f*, respectively.

Key Words: internal finned tube, blossom shape fin profile, double-tube structure, heat transfer performance, waste heat recovery

1. Introduction

As a result of economic growth, the energy-intensive process industries (especially petrochemicals and

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