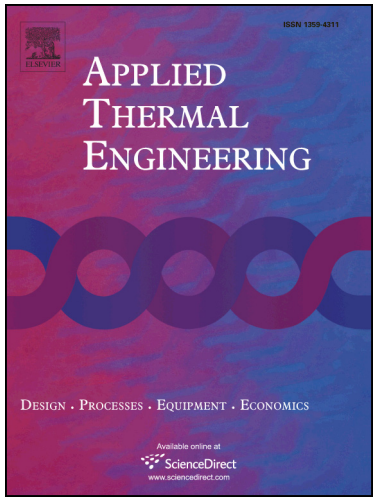

Research Paper

Experimental and numerical studies on the air-side flow and heat transfer characteristics of a novel heat exchanger

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PII: S1359-4311(17)30100-X
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2017.05.027
Reference: ATE 10338

To appear in: *Applied Thermal Engineering*

Received Date: 6 January 2017
Revised Date: 15 April 2017
Accepted Date: 6 May 2017

Please cite this article as: K. Wang, J. Li, P. Wang, L. Cheng, Experimental and numerical studies on the air-side flow and heat transfer characteristics of a novel heat exchanger, *Applied Thermal Engineering* (2017), doi: http://dx.doi.org/10.1016/j.applthermaleng.2017.05.027

Experimental and numerical studies on the air-side flow and heat transfer characteristics of a novel heat exchanger

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Abstract:

A novel heat exchanger involving rotated aligned tube banks is proposed and investigated experimentally and numerically. It is utilized within a waste heat recovery system in a cement plant, and has features of both staggered and aligned arrangements. Heat transfer and flow characteristics of the heat exchanger are analyzed. Experimental data of the rotated aligned arrangement are compared with that of the aligned arrangements, and correlations of Nusselt number as well as friction factor are obtained. A two-dimensional numerical study is conducted employing CFD simulation. A model of the entire heat exchanger is built and simulated. Boundary conditions are formulated by a given inlet temperature of 300 ^{o}C and a constant tube wall temperature of 150 ^{o}C, with inlet velocity ranging from 2 m/s to 7 m/s. Simulated results are compared with the experimental data, and good agreement is achieved with the correlation results for rotated aligned arrangement. Moreover, simulations of aligned and staggered tube banks are implemented in comparison with the rotated aligned tube bank. Numerical results indicates the superior heat transfer performance of the rotated aligned tube bank over the other two arrangements. Heat transfer coefficient is 37.5%~78.8% higher than the aligned