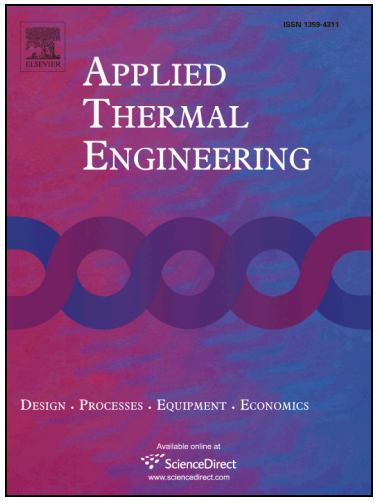

Research Paper

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S. Baghdar Hosseini, R. Haghighi Khoshkhoo, M. Javadi

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Experimental and Numerical Investigation on Particle Deposition in a Compact Heat Exchanger

S. Baghdar Hosseini[1], R. Haghighi Khoshkhoo[2,*], M. Javadi[3]

[1,2]*Department of Mechanical and Energy Engineering, Shahid Beheshti University, Tehran – Iran*

[3]*Department of Mechanical Engineering, Quchan University of Advanced Technologies, Quchan-Iran*

* Corresponding author E-mail: r_haghighi@sbu.ac.ir Telephone No: (+98) 912 564 49 02

Abstract

In this study the effect of particle size on deposition in compact heat exchanger was investigated experimentally and numerically. An experimental setup was designed to visualize particle deposition and measure pressure drop across the exchanger. Numerical study was performed on five fin channels. The flow was modeled by solving Reynolds-Averaged Navier-Stokes (RANS) equations, and particle motions were simulated by discrete particle model (DPM) with UDF to model deposition. Experimental study was performed for particle size over a range from 1 μm to 4 mm and numerical investigation were done for particle size from 1 μm to 100 μm which were placed in A1 particle group of experiment. Experimental results show enhancement of particle deposition; besides, pressure drop rises with increase of particle size. Numerical study also demonstrates that particle deposition increases with increase of particle size up to 50 μm. Studies show that velocity increase pressure drop and can promote or hinder particle deposition.

Keywords

Compact heat exchanger, CFD analysis, DPM, Experimental investigation, Particle deposition, Pressure drop

Nomenclature

C_c	Cunningham correction	U_p	Particle velocity
d	Diameter	V	Volume
d_{ij}	the deformation tensor	v_{rel}	relative velocity of particle-fluid
$\vec{g}$	gravitational acceleration	X	Position
k	turbulent kinetic energy	Greek Symbols	
k_s	sliding ratio	δ_{ij}	Kronecker delta
K_B	Boltzmann constant	ε	turbulent dissipation
p	Pressure	ζ_i	zero-mean, unit-variance-independent Gaussian random numbers