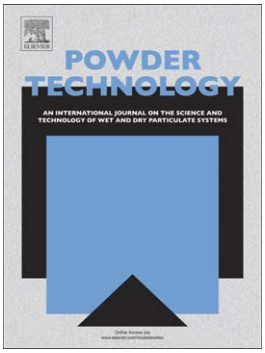

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Numerical Investigation of Heat Exchanger Effectiveness in a Double Pipe Heat Exchanger Filled With Nanofluid: A Sensitivity Analysis by Response Surface Methodology

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Abstract

In this paper, the Response Surface Methodology (RSM) and two phase mixture model are proposed to investigate the sensitivity analysis of heat transfer and heat exchanger effectiveness in a double pipe heat exchanger filled with Al_2O_3 nanofluid. The effective parameters of the Reynolds number ($50 \leq Re \leq 250$), nanoparticles volume fraction ($0.01 \leq \phi \leq 0.05$) and the entrance status of nanofluid S (inner pipe, outer pipe and both of them) are considered to serve the purpose. The governing equations are solved with SIMPLE algorithm and Discretized using a finite volume method. It is found that the mean Nusselt number enhances with the Re number, and this enhancement is in the vicinity of 57.70% for the case with Re=50 to 150 and $\phi = 0.03$, when the nanofluid enters the outer pipe. Increasing the ϕ and S reduces the mean Nusselt number. The heat exchanger effectiveness enhances with ϕ and reduces with S. Furthermore, the sensitivity of the mean Nusselt number to the Re number is positive but to ϕ is negative; while the sensitivity to the Re number and ϕ is positive for heat exchanger effectiveness. Additionally, the effects of physical parameters are illustrated graphically.

Keywords

Response surface methodology**;** Sensitivity analysis; Double pipe heat exchanger; Two phase simulation; Heat exchanger effectiveness.