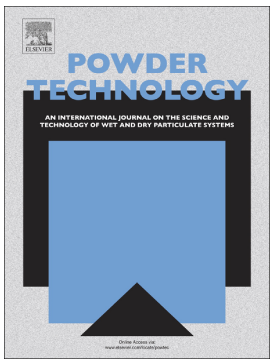

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S.H. Pourhoseini, N. Naghizadeh, H. Hoseinzadeh

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Effect of silver-water nanofluid on heat transfer performance of a plate heat exchanger: An experimental and theoretical study

S.H. Pourhoseini[1], N. Naghizadeh[2], H. Hoseinzadeh[3]

[1,3] Department of Mechanical Engineering, Faculty of Engineering, University of Gonabad, Gonabad, Iran.

[2] Department of Analytical Chemistry, University of Gonabad, Gonabad, Iran.

Abstract

A simple and economical process for synthesis of silver-water nanofluid is proposed and the nanofluid is examined to determine how variations in its volume flow rate and concentration, in the range of 0-10 mg/L, affect the overall heat transfer coefficient of a CR14-45 COMER plate heat exchanger (PHE) and thermal characteristics of the nanofluid. The results indicate that both nanofluid concentration and volume flow rate enhance the overall heat transfer coefficient of PHE. However, volume flow rate has a greater effect on enhancing the overall heat transfer coefficient than nanofluid concentration does. In addition, at some critical nanofluid concentration (2.5 mg/L), the rate of heat transfer reaches its maximum. As the concentration of silver nanoparticles in water increases, thermal conductivity initially rises to a maximum at a concentration of about 2.5 mg/L. The thermal conductivity of silver-water nanofluid in such a state is 36.6% greater than that of pure water. However, due to aggregation phenomenon and smaller area-to-volume fraction (A/V) at high concentrations, the effective thermal conductivity decreases. Also, the rate of temperature rise and Brownian motion intensify with concentration. Superposition of the results related to conductivity and temperature rise confirm the existence of a critical concentration for silver-water nanofluid.

Key Words: Silver-Water nanofluid, Plate heat exchanger, Overall heat transfer coefficient, Nanofluid concentration.

[1] Corresponding author

hadipoorhoseini@gmail.com