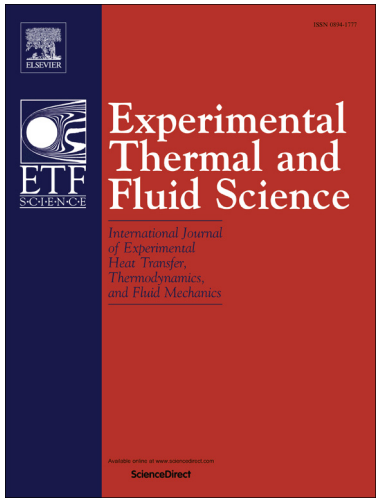

Experimental Study of Cu-Water Nanofluid Heat Transfer and Pressure Drop in a Horizontal Double-Tube Heat Exchanger

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EXPERIMENTAL STUDY OF CU-WATER NANOFLUID HEAT TRANSFER AND PRESSURE DROP IN A HORIZONTAL DOUBLE-TUBE HEAT EXCHANGER

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Abstract

This article reports an experimental study on the performance of horizontal double tube counter-flow heat exchanger. Due to the modicum in the heat transfer surface area, the overall heat transfer coefficient is enhanced. Cu- nanoparticles are added to the cold water in the annulus of the heat exchanger, however, the inner tube that contains the hot water is rotated. The inner tube is made of copper with 25.4 mm outer diameter with a thickness of 2 mm, while the outer tube, which is made of transparent Acrylic Plexiglass, has an outer diameter of 76.2 mm and 5 mm thickness. Cu-water nanofluid is prepared at volume fractions of 1% to 3% and the inner tube is rotated with speed from 0 to 500 rpm. Results demonstrated a remarkable enhancement in the rate of heat transfer due to the nanoparticles addition as well as the inner tube rotation. Consequently, the effectiveness and the transfer number units (NTU) of the heat exchanger are augmented. Optimization between heat transfer augmentation and the pressure drop penalty is carried out. Finally, the use of the nanofluid has a little penalty in pressure drop in compared with the inner tube rotation.

Keywords: Experimental, Double tube, NTU, Cu-Nano, Rotating

Nomenclature

A	heat transfer surface area, m^2
b	annulus width, $b= R- r_o$, m
C	heat capacity rate, W/ ^oC
C_p	specific heat, J/kg ^oC.
G	mass flow rate, kg/s
N	rotational speed, RPM
NTU	number of transfer units
Q	heat transfer rate, W
r_i	inside tube inner radius, m
r_o	inside tube outer radius, m
R	outside tube inner radius, m