Experimental And Numerical Study Of Thermo-Hydraulic Performance Of Circumferentially Ribbed Tube With Al_2O_3nanofluid

AbdolBaqi Mohammed Khdher[a], Nor Azwadi Che Sidik[b,], Rizalman Mamat[a], Wan Azmi Wan Hamzah[a]*
[a]Faculty of Mechanical Engineering, University Malaysia Pahang, 26600 Pekan, Pahang, Malaysia
[b]Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, 81200 Skudai, Johor Bahru

ABSTRACT

The mechanisms of heat transfer enhancement are used in many industrial applications. Several techniques have been promoted to enhance heat transfer rate and to decrease the size and cost of equipment especially the heat exchangers. In this paper, heat transfer coefficient and pressure drop for Al_2O_3/water nanofluid flow inside circumferential ribbed tubes with different rib dimensions have been experimentally and numerically studies. The nanoparticle size was set equal to 13 nm and the volume fractions from 0% to 3% were considered. The ribbed copper tubes tested in this investigation with inner diameter of 14.9 mm have the ranges: circumferential depth from 0.5 mm to 1.0 mm and axial pitch distance from 5 mm to 15 mm. The inlet temperature of turbulent nanofluid was 25 °C and the constant wall heat flux was 5,000 W/m^2. Comparison of numerical data of ribbed tubes with plain tube shown that the heat transfer coefficient from 92% to 621% and friction factor from 25% to 241% compared to those obtained in smooth tube depending on the circumferential geometric parameters, mass velocity and thermal conductivity of the working fluid.

KEYWORDS

Al_2O_3 nanofluid; Ribbed tube; Turbulent flow; Single-phase

DOI: 10.1016/j.icheatmasstransfer.2015.10.003