

Analysis of Coolant Fluid Orientation on Thermo-Fluidic Characteristics of the Porous Channel

Tzer-Ming, Jeng Sheng-Chung, Tzeng* Ting-Yin, Luo
Department of Mechanical Engineering, Chienkuo Technology University

Abstract

This study experimentally investigated the fluid flow and heat transfer in the brass-beads-packed-bed channel with the 90-deg turned flow and the small ratio of channel width to bead diameter. The diameters (d) of brass beads were 2 mm, 4 mm and 6 mm. The corresponding ratios (D_H/d) of channel width to bead diameter were 7.5, 3.75 and 2.5. The other parameters included the heated surface and Reynolds number. The results indicate that the friction factor (C_f) increased with decreasing the bead diameter. Besides, the C_f values of the straight-flow system were slightly higher than those of the 90-deg-turned-flow system at the cases of $d=2$ mm, they were similar for the cases of $d=4$ mm and 6 mm. When the D_H/d was small and the Re was large, the local Nusselt number (Nu) firstly increased along the streamwise direction and then decreased until the exit. Furthermore, the average Nusselt number (\overline{Nu}) of $d=6$ mm ($D_H/d=2.5$) was maximum, and that of $d=4$ mm ($D_H/d=3.75$) was minimum. The \overline{Nu} of $d=2$ mm was generally medium. The \overline{Nu} for the straight-flow system was generally higher than that for the 90-deg-turned-flow system, especially for the shorter length of the channel being analyzed. However, the effect of the heated surface on the heat transfer was insignificant.

Keywords: brass-beads packed bed, 90-deg turned flow, ratio of channel width to bead diameter, heat transfer.