Abstract

This study is an experimental attempt to improve the performance of a double-pipe type heat exchanger, by placing copper-metal foam with various configurations inside an annular space between the inner pipe and the outer pipe of the heat exchanger. The test section consists of two concentric pipes with a length of 500 mm, the inner pipe is made of copper with nominal diameter of 18 mm, and the outer pipe is 42 mm in diameter and is made of plastic. A copper metal foam with 15 pore per inch, and a porosity of 0.95 was used.

Air was used as a working fluid in both hot and cold streams. A wide range of cold air flow rate was covered, namely; (3, 6, 12, 18, 24, 30, and 36) m^3/h, which corresponds to Reynolds number ranged from 2811 to 31,335. Whereas the hot air flow rate was kept constant at 3 m^3/h. The temperature difference between the inlet hot air and inlet cold air was adopted to be (20°C, 30°C, 40°C, and 50°C). The results reveal that the heat transfer, pressure drop and effectiveness depend on the configuration of the metal foam. Also, the heat transfer rate of the heat exchanger with the metal foam for all the arrangements is the greater than the smooth heat exchanger. The friction factor is higher when the metal foam is used than the smooth heat exchanger. The friction factor is found to be affected strongly by the metal foam configuration more than metal foam amount. It also decreases with increasing Reynolds numbers. The results also show that the best performance evaluation criteria is 1.62 for case 7 at lowest Reynolds number 2800.