

Experimental Study on Enhancement of Laminar Convective Heat Transfer Using twisted tape inserts

The enhancement of laminar convective heat transfer inside pipes by means of twisted tape of many shapes as an augmented device is experimentally studied and its performance is compared with smooth pipes under constant heat flux conditions . For this purpose , an aluminum pipe (0.048) m internal diameter, (0.054) m external diameter (3) mm thickness and one meter long is used with metal twisted tapes (0.7) mm thickness manufactured from aluminum material , the length of twisted tape is equal to the length of the test section . The range of Reynolds number used is (690 – 2195) and the range of Prandtl number used is (2.9 – 3.55) besides using four levels of heating , where the range of average heat flow rate provided on the tube surface is (150 – 650) W . Five levels of discharge has been used for every level of heating used , where the range of discharge is (1.538×10⁻⁵ - 4×10⁻⁵) m³/sec and the water has been used as a medium fluid for heat transfer . Metal twisted tapes that used in experiments have width changing with change configuration of twisted tape at every time . The twisted tapes that are used have (1.5 , 3 , 4.5) Cm width , respectively at constant twist ratio which is equal to (2.77) . Every twisted tape from the used tapes is used as twisted tape time and twisted tape with triangular notches distributed as uniform shapes (aligned shapes) on the tape sides another time and twisted tape with triangular notches and holes spread out in the middle for the tape by constant distances between each hole and the hole that it follows third time , where the test is to be in operation for each tape from these tapes for all heating and discharge levels that are mentioned above . The performance of pipe with twisted tapes should have assessment by depending on the calculation of the pumping power and overall enhancement ratio . The experimental results show that Nusselt number is directly proportional with the pumping power and overall enhancement ratio , where as the twisted tape has (4.5) Cm width with triangular notches and holes which explain the higher pumping power and the overall enhancement ratio for all levels of heating . The overall enhancement ratio was (575%) for the heat flow rate (150)W , (830%) for the heat flow rate (260) W, (217%) for the heat flow rate (400) W , (400%) for the heat flow rate (650)W , respectively compared with a plain tube without any tape at Reynolds number which is equal to (2195) .