Experimental Thermal and Fluid Science 65 (2015) 41–51
Contents lists available at ScienceDirect
Experimental Thermal and Fluid Science
journal homepage: www.elsevier.com/locate/etfs

Heat transfer characteristics and pressure drop of the concentric tube equipped with coiled wires for pulsating turbulent flow

Abstract

The influence of pulsation with different amplitudes on the heat transfer rates in a double-pipe heat exchanger where a coiled wire inserts around the outer surface of the inner tube is investigated. The heat transfer and pressure drop characteristics were investigated for a coiled wire inserts with different pitch values in absence of pulsation. Pulsation frequencies that were produced by using a reciprocating device ranged from 140 to 260 cycles per minute (2.3–4.3 Hz). Five different displacement amplitudes were used where the stroke length of the reciprocating piston was varied from 60 to 185 mm. Thermally insulated wires having circular cross section of 2 mm diameter, forming a coil of different pitches (p = 6, 12 and 20 mm) are used as turbulators. The investigation is performed for pulsating turbulent water flow in a double-pipe heat exchanger with cold water in the annulus space for counter flows. The experiments are performed for Reynolds numbers ranging from 4000 to 12,000. The experimental results indicated that heat transfer rates are enhanced with the increase in the pitch of coiled wire. This was attributed to the combined effect of both pulsation and coiled wires compared with the smooth annulus case (no coiled wire). The highest enhancement ratio in the Nusselt number compared with smooth annulus with no pulsation reached a value of about 12.7 (for the pitch ratio 10, stroke ratio 4.2 and Re = 3856 with pulsating frequency 230 cycles/min) while the friction factor is about 8.7 times at same conditions. An empirical correlation was obtained and expresses the Nusselt number for different study parameters in 13% deviation.