Heat Transfer Enhancement Due to the Optimal Porosity in Plate Heat Exchangers with Sinusoidal Plates

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Abstract : In this paper, the effect of thermal dispersion on the performance of plate heat exchangers (PHEs) with sinusoidal plates is investigated. In this regard, the PHE is considered as a porous medium. The important property of a porous medium is porosity that is defined as the total fluid volume divided by the total volume occupied by the solid and fluid. A 2D array of parallel sinusoidal plates with laminar periodically developed forced convection and single-phase constant property flows and conduction in a homogenous solid phase in two directions is considered. The array of flows is counter and the flows heat capacities are equal. Numerical study of conjugate heat transfer and axial conduction in the solid phase with different plate thicknesses showed that there is an optimal porosity in which the efficiency of heat transfer is up to 4% more than the time when the porosity is near one. It is shown that the optimal porosity at zero angle of inclination depends both on Reynolds number and the aspect ratio. The optimal porosity increased while either the Reynolds number or waviness of plates increased.
Keywords : plate heat exchanger, optimal porosity, efficiency, aspect ratio
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