

Heat Transfer Investigation in a Dimple Plate Heat Exchanger Using Ionic Liquid and Ionanofluid

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Abstract : Heat transfer characteristics of ionic liquid solution as cold fluid in plate heat exchanger with dimple plate geometry was studied. The ionic liquid solution used in this study was 1-butyl-3-methylimidazolium bromide in water. The present experimental study is to understand the heat transfer behavior of different 1-butyl-3-methylimidazolium bromide concentrations (0.1 and 0.2% w/w) in water. In addition, the heat transfer activity of ionanofluid as cold fluid was investigated. The ionanofluid was prepared by dispersing 0.3% w/w Al₂O₃ in the ionic liquid solution as base fluid. Experiments were also conducted to determine thermophysical properties of ionanofluid. The empirical correlations as a function of temperature were developed to predict the thermophysical properties. Finally, the heat transfer performance of ionic liquid solution, ionanofluid, nanofluid and water were compared. The impact of hot fluid's (water) Reynolds number on overall heat transfer coefficient and Nusselt number of cold fluids were analyzed. The nanofluid and ionanofluid were found to possess better heat transfer behavior than water and ionic liquid solution. Heat transfer augmentation was observed for ionanofluid when compared with the base fluid (0.1% w/w ionic liquid solution).

Keywords : ionic liquid, nanofluid, ionanofluid, dimple plate heat exchanger, Nusselt number, overall heat transfer coefficient

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