와류발생기를 부착한 plate fin - oval tube 열교환기의 성능에 관한 연구

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Study on Performance of Plate Fin - Oval Tube Heat Exchanger with Vortex Generators

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Key Words : Heat Exchanger(열교환기), Vortex Generator(와류발생기), Oval Tube(타원형 관) Heat Transfer Enhancement(열전달 촉진), Longitudinal Vortices(종방향 와류)

Abstract : An experimental study was carried out to investigate the enhancement of heat transfer from the in-line and staggered arrays of oval tubes in the plate fin - tube heat exchanger with delta - wing type vortex generators(DWVG). Measurements of average heat(mass) - transfer coefficients on the tube surface were made using a naphthalene sublimation technique, and the flow losses were measured for Reynolds number ranging from 2000 to 3200. The influence of vortex generators parameters such as position and angle of attack was investigated. It was found that the heat transfer enhancement were increased by the existence of a vortex generators and flow losses were decreased by the oval tubes. The results indicate that performance of plate fin - tube heat exchanger can be improved simultanously by using vortex generators and oval tubes.

딤플/돌출이 설치된 사각채널에서의 열전달 및 압력강하 특성에 관한 실험적 연구

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An Experimental Study on Heat Transfer and Pressure Drop of a Rectangular Channel with Dimple and Protrusion Arrays

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Key Words: Rectangular channel(사각채널), Dimple(딤플), Protrusion(돌출), Dimple-Protrusion(딤플-돌출), Transient TLC technique(비정상 감온 액정법), Heat transfer(열전달), Pressure drop(압력강하), Performance factor(성능계수)

Abstract : An experimental study was conducted to investigate the heat transfer and pressure drop of a rectangular channel with the dimpled and/or protruded walls. And the effects of complex geometries of dimple and protrusion on heat transfer and pressure drop were investigated. In the present study, three different roughened surfaces of dimpled, protruded and complex(dimple-protrusion) surface were tested. The dimples/protrusions were installed at both top and bottom walls of the rectangular duct. The dimple depth is 0.25times dimple diameter(D) and the protrusion height is also 0.25D. The dimple or protrusion has staggered array pattern, and the complex case has the pattern of repeat of the rows of dimples and protrusions. The local heat transfer coefficients on the dimpled/protruded walls were measured using a transient TLC(Thermocromic Liquid Crystal) technique. The friction factors of the rectangular channel with dimples/protrusions were obtained using pressure taps installed at the channel side wall. And the performance factors, which indicate the enhancement levels by both considerations of heat transfer enhancements and pressure loss increases were evaluated. As a result, high heat transfer region appeared at the rear side of the dimple due to the increased flow mixing on the dimpled surface. For the protruded surface, heat transfer was enhanced on the front side of the protrusion by the impingement effects of the flow induced by the horseshoe vortices. In case of complex geometry, dimple-protrusion, the compound effects of the dimple and protrusion occurred. The protrusion case showed the highest heat transfer enhancement among test cases. However, pressure loss increased. For the performance factor, the dimple-protrusion case shows the highest performance factor among tested cases due to compound effects of the dimple and protrusion.