Flow Boiling Heat Transfer of Carbon Dioxide Inside a Small Size Internal Grooved Tube

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In this study, flow boiling heat transfer coefficients of carbon dioxide inside a horizontally located internal grooved tube were experimentally investigated. The mean inner diameter of the grooved tube is 2 mm, with helix angle of 6.3º and an average area enlargement ratio of 2.0. Experiments were conducted at saturation temperature of 15 ºC, heat fluxes of 4.5 to 18 kW/m2, mass fluxes of 360 to 720 kg/m^{2}s. Experimental results showed that the effects of heat flux and mass flux on the heat transfer coefficient are much more significant on the internal grooved tube at the pre-dryout region than that on smooth tube. At some conditions, the heat transfer coefficient at higher mass flux may lower than that at a lower mass flux, showing a suppression effect of nucleation boiling by convective heat transfer. The heat transfer coefficients of grooved tubes were higher than those in smooth tubes by 2.0-2.5 times due to the enlarged heat transfer surface area. In addition, the dryout occurs at a much higher quality as compared to that of smooth tube, the maximum dryout quality may increase to as high as 0.3. Pressure drops were found increase 1.5-2.7 at different conditions. The experimental results shown that by using internal grooved, the over-all heat transfer performance may increase significantly.