CO_2 Condensation Heat Transfer and Pressure Drop in Multi-Port Microchannels

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CO_2 flow condensation heat transfer coefficients and pressure drop are investigated for 0.89 mm microchannels at horizontal flows. They were measured at saturation temperatures of –15 and –25 °C, mass fluxes from 200 to 800 kg m^{-2} s^{-1}, and wall subcooling temperatures from 2 to 4 °C. Vapor qualities were changed from 0.1 to 0.9. Flow patterns for experimental conditions were predicted by two flow pattern maps, and it could be predicted that annular flow patterns could exist in most of flow conditions except low mass flux and low vapor quality conditions. Measured heat transfer coefficients increased with the increase of mass fluxes and vapor qualities, whereas they were almost independent of wall subcooling temperature changes. Several correlations could predict heat transfer coefficients within acceptable error range, and from this comparison, it could be inferred that the flow condensation mechanism in 0.89 mm channels should be similar to that in large tubes. CO_2 two-phase pressure drop, measured in adiabatic conditions, increased with the increase of mass flux and vapor quality, and it decreased with the increase of saturation temperature. By comparing measured pressure drop with calculated values, it was shown that several correlations could predict the measured values relatively well.