An experimental analysis of flow boiling and pressure drop in a brazed plate heat exchanger for organic Rankine cycle power systems

Organic Rankine cycle power systems for low quality waste heat recovery applications can play a major role in achieving targets of increasing industrial processes efficiency and thus reducing the emissions of greenhouse gases. Low capacity organic Rankine cycle systems are equipped with brazed plate heat exchangers which allows for efficient heat transfer with a compact design. Accurate heat transfer correlations characterizing these devices are required from the design phase to the development of model-based control strategies. In this paper, the experimental heat transfer coefficient and pressure drop during vaporization at typical temperatures for low quality waste heat recovery organic Rankine cycle systems are presented for the working fluids HFC-245fa and HFO-1233zd. The experiments were carried out at saturation temperatures of 100°C, 115°C and 130°C and inlet and outlet qualities ranging between 0.1–0.4 and 0.5–1 respectively. The experimental heat transfer coefficients and frictional pressure drop were compared with well-known correlations and new ones are developed. The results indicated weak sensitivity of the heat transfer coefficients to the saturation temperature and were characterized by similar values for the two fluids. The frictional pressure drop showed a linear dependence with mean quality and increased as the saturation temperature decreased.