

Countercurrent Flow Limited CHF in a 3 x 3 rod bundle
with a non-uniform axial heat flux

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Abstract

KAERI has performed an experimental study of water critical heat flux (CHF) under zero flow conditions with a non-uniformly heated 3 by 3 rod bundle. Experimental conditions are in the range of a system pressure from 0.5 to 15.0 MPa and inlet water subcooling enthalpies from 67.5 to 351.5 kJ/kg. The test section used in the present experiments consisted of a vertical flow channel, upper and lower plenums, and a non-uniformly heated 3 by 3 rod bundle. The experimental results show that the CHF's in low-pressure conditions are somewhat scattered within a narrow range. As the system pressure increases, however, the CHF's show a consistent parametric trend. The CHF's occur in the upper region of the heated section, but the vertical distances of the detected CHF's from the bottom of the heated section are reduced as the system pressure increases. Even though the effects of the inlet water subcooling enthalpies and system pressure in the flooding CHF are relatively smaller than those of the flow boiling CHF, the CHF increases by increasing the inlet water subcooling enthalpies. Several existing correlations for the countercurrent flooding CHF based on Wallis's flooding correlation and Kutateladze's criterion for the onset of flooding are compared with the CHF data obtained in the present experiments to examine the applicability of the correlations.