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CONFINED AND NOT CONFINED NUCLEATE BOILING UNDER TERRESTRIAL AND MICROGRAVITY CONDITIONS

Abstract

This paper presents experimental results for the subcooled nucleate boiling regime for n-Pentane fluid, on a downward facing surface and in confined spaces, in a boiling chamber, subject to changes in internal pressure and under terrestrial and microgravity conditions. The test section consists of a copper disk with a diameter of 12 mm and thickness of 3 mm, where the confinement level (s) is adjusted through the positioning of the disk in relation to the bottom (acrylic) of the boiling chamber. The effect of the heat flux (at between 20 and 60 kW/m) and the confinement (at two distances of s = 0.3 and 0.9 mm) on the coefficient of heat transfer was analyzed. Microgravity conditions were obtained during the Maracati II mission, which involved the launching of the suborbital Brazilian rocket VSB 30. The period under microgravity conditions was approximately 6 min and five heat flux levels were tested. The results under terrestrial conditions showed a decrease in the coefficient of heat transfer with a greater degree of confinement. Tests were also carried out with initial fluid temperatures of 26 and 36C. For the same level of confinement, increasing the temperature of the liquid inside the boiling chamber increases the coefficient of heat transfer. These novel results obtained under microgravity conditions are compared with those for terrestrial conditions. The results for confined conditions are very similar; however, those for unconfined conditions are, according to a preliminary analysis, completely different.

Keywords: Boiling, Nucleate boiling, Microgravity, Bond number, Heat transfer