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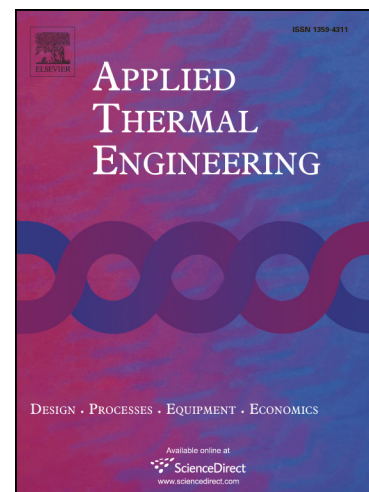
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Experimental investigations of pool boiling on a vertical tube in the confined vs. unconfined spaces

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Abstract

An experimental investigation has been carried out to determine the local characteristics of pool boiling heat transfer on the vertical tube in the confined and unconfined space. The vertical test tube is 20 mm in diameter and 1500 mm in length. Synchronized wall temperature and flow visualization allow to characterize and analyze the heat transfer along the height for the different heat fluxes ($22.13 \text{ kW/m}^2 \leq q \leq 100.20 \text{ kW/m}^2$). We present the flow and heat transfer characteristics at the stage of subcooled boiling and saturation boiling and reveal the differences of pool boiling between in the confined and unconfined space. A sequence of two-phase and boiling heat transfer regimes takes place along the height of the tube. The heat transfer coefficient on the tube surface increases along the height. Compared with pool boiling in an unconfined space, the confined pool boiling can enhance heat transfer and reduce the thermal stratification. Furthermore, we propose a correlation of saturation boiling heat transfer coefficient with q and H/D in confined space.

Keywords: Pool boiling, Vertical tube, Confined space, Saturation boiling, Subcooled boiling

Highlights

The visual characteristics of the vapor distribution along the vertical tube are presented.

The difference between the limited space and pool boiling is studied experimentally

Thermal stratification of the tank can be mitigated by setting a limited space.

A boiling heat transfer correlation with q and H/D in confined space is proposed.

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