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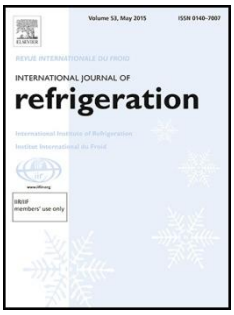

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Effect of periodic reverse flow on the heat transfer performance of microchannel evaporators

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Highlights

- Periodic flow reversal affects the performance of a microchannel evaporator.
- Flow reversal helps to improve heat exchanger cooling capacity and UA
- Numerical results show oscillations in heat transfer at higher boiling instabilities
- The oscillation in velocity enhance heat transfer especially in the upstream part

ABSTRACT

Periodic flow reversal are commonly present in microchannel heat exchangers, but have been studied in air conditioning systems only recently. This paper presents the effect of periodic reverse flow on the heat transfer performance of a heat exchanger. Two heat exchangers with identical geometries in the heat transfer areas are employed and an artificial upstream flow resistance is added for one of them. The heat exchanger without artificial flow resistance is subject to more severe boiling instabilities and consequently generates four times more reverse vapor flow than the other one. The comparison of capacities under identical operating conditions reveals that higher intensity of reverse flow helps to improve cooling capacity by up to 13.3%. Meanwhile, numerical simulations of bubble dynamics coupled with heat transfer are carried out for both heat exchangers. Results shows that in the heat exchanger with more reverse flow, the refrigerant side heat transfer coefficients are enhanced, especially in the upstream part of a channel where the flow velocity is relatively low.

Key words: microchannel heat exchanger; boiling instabilities, flow reversal; model of bubble dynamics