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Two-phase vertical downward flow in plate heat exchangers: flow patterns and condensation mechanisms

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Highlights

- Review of condensation mechanisms within plate heat exchangers and influencing factors.
- Flow patterns and visualization experiments of vertical downward flow in plate heat exchangers.
- Construction of flow pattern maps in dimensionless form.
- Qualitative comparison between flow patterns and condensation regimes.

Abstract

This study presents a literature review of work related to the two-phase flow patterns of vertical downward flow in plate heat exchangers with corrugated chevron plates. An understanding of these flow patterns is crucial for developing accurate models of plate heat exchangers functioning as condensers or absorbers. Flow pattern maps of the previous studies are combined and translated to dimensionless forms. One of the proposed flow pattern maps is based on Re_L versus $Fr_{TP,hor} / A^{0.5}$ and performs better than other representations. This map is compared with the map of tubes and shows general agreements in terms of the pattern positions, but the separating lines between flow patterns fit poorly. Influencing factors of condensation mechanisms are presented, among which mass flux and vapor quality are dominant. The preferred flow pattern map explains the transition of condensation mechanisms qualitatively when variations of mass flux and vapor quality are considered. Recommendations are given to come to more uniform flow pattern maps in plate heat exchangers with chevron corrugations.

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