

The coupling relation of flow patterns and heat transfer in direct-contact heat exchanger using box-counting with erosions method

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Abstract

This paper proposes a novel method to investigate the coupling relation of flow patterns and heat transfer in a direct-contact heat exchanger (DCHE) by using fractal theory. Bases on experiment, the box-counting with erosions method is used to estimate the characteristics of bubbles swarm in flow patterns, and two feature parameters are extracted from the fractal dimension p changing with time. One is pseudo-homogeneous time t , another is fractal dimension average \bar{p} . At the same time, a new index (P_t) is defined by the t as well as the \bar{p} .

The results show that the volumetric heat transfer coefficient average \bar{h}_V and P_t show a good fitting curve with the correlation coefficient 0.9. A paradigm is established based on this novel method in the study of coupling relation between flow patterns and heat transfer, which is proven to be an effective method for analyzing the bubbles swarm flow signals in DCHE.

Keyword: direct-contact heat transfer; bubble swarm; box-counting with erosions method; unintrusive measurement technique; coupling relation

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