Phase coexistence in fluidization

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Abstract

The coexistence of granular liquid-like phase (cluster) and gas-like phase (void) in fluidization, a spontaneous symmetry-breaking dissipative state, contributes to excellent mixing behavior in multi-phase reactors. In present study, a universal granular state equation to describe phase coexistence far from critical point is developed, where both the inelastic solid-collision and asymmetrical instability is taken into consideration. Catastrophe theory is applied to find the stable boundary of phase coexistence, and verified by cold-flow experiment with different solid pressure. A phase diagram, based on both theoretical analysis and experimental study, is given as a useful guideline of design and operation of efficient multi-phase reactors.

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