Investigation of the Growth Kinetics of Tetra-n-butylammonium Bromide Hydrate Formation in Small Spaces - DTU Orbit (03/04/2019)

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The kinetics of tetra-n-butylammonium bromide (TBAB) hydrate formation orientated within the space of a small dimensional tube is investigated through microscopic experiments in the temperature range of −5.5 to −9.7 °C. Based on the experimental data, a kinetic model in a small dimensional space is proposed to describe the formation process. Hydrate crystals are observed uniformly growing in the small dimensional space. The experimental results show that the nucleation time of TBAB hydrate increases from 9 to 25 min and the linear growth rate decreases from 16.36 to 9.66 μm/s with the increasing temperature. Crystal morphologies show that the tube wall has less effect on the inner crystal growth when the temperature is lower. Furthermore, the number of nucleation sites increases under even lower temperatures. The varying degree of brightness of the crystals indicates that there is a variation of facets of hydrate crystals formed at different temperatures. Hydrate crystals under lower temperatures exhibit more growth points, and the linear growth rate of crystals in a tube is larger than that in the bulk because of heat-transfer effects. A negative activation energy during hydrate formation in this study is obtained according to the kinetic equation to be −58.27 kJ/mol.

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