Continuous Crystallization with Gas Entrainment: Evaluating the Effect of a Moving Gas Phase in an MSMPR Crystallizer - DTU Orbit (30/01/2019)

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Dispersion of a saturated gas in a supersaturated solution has been previously reported to promote nucleation rates during batch crystallization, leading to the exploration of this technique as a cost-effective method to control crystal size distributions. Despite the mechanisms are still unknown, it has been hypothesized that the presence of a flowing gas could promote variations in the flow pattern inside the crystallizer, leading to improved mass transfer and higher rates of secondary nucleation through an increased number of crystal collisions. In this work, we have constructed a lab-scale MSMPR crystallizer with self-induced gas dispersion to investigate the applicability of this technique in continuous crystallization. The effect of different gas hold-ups has been evaluated at high supersaturations and for two different suspension densities. Results show a very limited variation in the overall mass deposition rate, and reductions in the mean FBRM chord length not exceeding 5 μm for the highest investigated gas hold-up (12%). Studying the effect of impeller speed under the same conditions, we found that an increased mixing intensity has a similar impact as gas dispersion, with a mean chord length reduction of 4 μm when the impeller speed was increased from 800 to 950 rpm. These results suggest that the promotion of nucleation kinetics with gas dispersion is limited to systems where crystallization kinetics can be significantly affected by mixing, and demonstrate a limited applicability for crystal size distribution control in continuous MSMPR crystallizers.

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