Strategy of temperature gradient in Couette-Taylor crystallizer for uniform crystal size distribution in continuous cooling crystallization

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In order to produce a narrow crystal size distribution (CSD), temperature swing operated by sequential heating and cooling was frequently adopted in batch cooling crystallization. To obtain narrow CSD, temperature gradient strategy by simultaneous heating and cooling at inner (Ti) and outer (To) cylinders of the Couette-Taylor (CT) crystallizer was developed in continuous cooling crystallization. In this strategy, three kinds of temperature gradient modes were available; mode I (Ti=To), mode II (Ti > To) and mode III (Ti < To). It was found that mode II is the most effective for big crystal size and narrow CSD low coefficient of variation (CV)). In addition, temperature difference, rotation speed and mean residence time (τ) were critical to control CSD and recovery. As such, broad CSD of CV 0.48 obtained in mode I was improved as a narrow CSD of CV 0.29 in mode II without a trading-off in the mean crystal size and recovery, although the τ in mode II was five time shorter than in mode I. It was demonstrated that the temperature gradient strategy was highly efficient for the production of uniform CSD.