Residence time distribution in the continuous type Taylor-Couette flow reactor

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In the preparation of nanocrystaline materials, it is crucial to obtain desired size and distribution. Batch system usually has a broad distribution of particle size and microfluidic system with narrow size distribution has an production rate problem. In this work, we suggest a continuous Taylor-Couette flow reactor which has many advantages, such as a simple structure of the device, homogeneous mixing, and enhanced heat and mass transfer. As residence time is a critical factor in preparing nanoparticles, study on the residence time distribution of continuous TC flow device was conducted using red ink injection, and the results were compared with numerical simulation data. RTD with rotation was narrower in vortex flow regimes than RTD without rotation due to the incomplete mixing between vortices. When the rotational speed is high, distribution was broader and peak time of RTD came earlier due to the increased axial velocity. Based on the RTD study, metal oxide nanoparticles were prepared in the continuous TC flow device with a 5 mL/s of feed rate and various rotational speed (0-1000 rpm), which showed improved size distribution at the peak time of RTD compared to the batch system.