In-situ EXAFS study of nucleation process of CdSe nanoparticles

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Nowadays it is still challenging to probe the nucleation process of nanocrystals due to the short nucleation time [1]. We developed an in-situ EXAFS method for studying the nucleation as well as growth progresses by using a microreactor which can convert the time-dependence to the position-dependence. As an example, we measured the Se *K*-edge EXAFS spectra for CdSe nanoparticles along a microreactor channel and indicated the strong time-dependence of the nucleation growth at the beginning of the reaction. We observed a rapid increase of the reaction yield of CdSe nanoparticles within several seconds starting from TOP-Se solution at 240 °C. It is found that after injection of starting materials, the nucleation occurs abruptly and the CdSe nuclei concentration reaches a maximum and then declines rapidly. The results show the promising capability of in-situ EXAFS combined with a microreactor for investigations of nucleation and growth processes of various nanoparticles synthesized in solution.

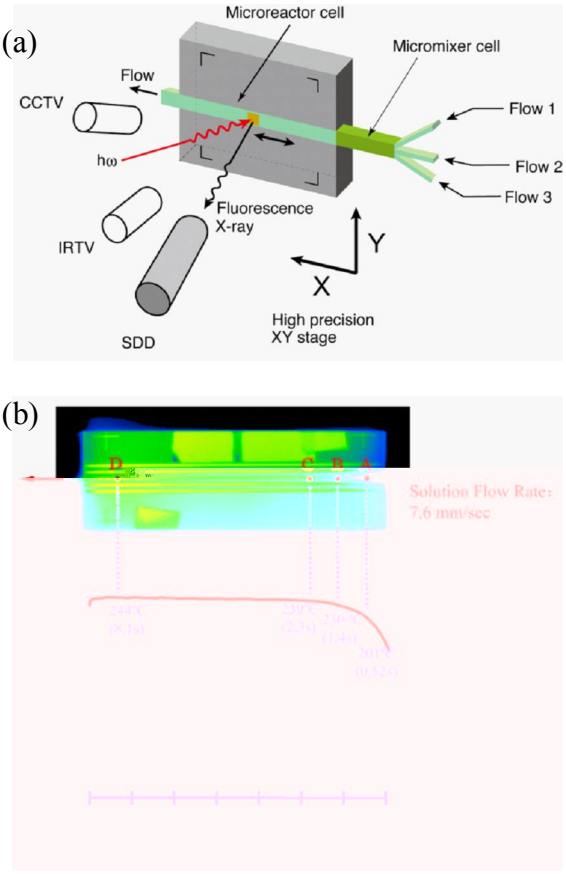

Fig. 1 (a) Schematic presentation of the experimental setup. The microreactor was mounted on a high precision XY stage on a Huber 410 goniometer. Fluorescence x-ray was detected by a compact silicon drift diode detector. Flow 1-3 correspond to TOP-Se, Cd stock solution, and DDA, respectively. (b) The positions and temperatures of four points along the microreactor channel as measured in the EXAFS experiment.

References

[1] J. Park *et al.*: *Angew. Chem. Int. Ed.* 46, 4630-4660 (2007).