

Microsecond-resolved look at the very early stages of quantum dot formation

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To access the very early stages of nucleation and growth of nanoparticles in liquid media, we have developed a novel setup, where the reactants pushed by high power syringe pumps through a Y-shaped micromixer are immediately liberated as a free jet. With synchrotron X-ray scattering as a probe, this provides access to chemical reaction times as short as 10 μs . Diffraction data with CdS as a prototype example for quantum dot formation show a three-step pathway. Between 10 and 2500 μs , the CdS quantum dot formation starts with a rapid formation of primary clusters driven by the fast diffusion of cadmium and sulphur ions. Further particle growth is by cluster attachment. At this early stage, the particles are not yet crystalline. This reaction pathway is supported by ab initio theoretical calculations.