Colloidal CdSe/PbSe heterojunction Nanorods via direct Cd-to-Pb cation exchange

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Cation exchange is known as a powerful tool to design novel nanocrystals which cannot be synthesized by routine hot-injection or heating-up methods. Driven by difference of lattice energy or solvation energy, Pb2+ and Cd2+ cation can be exchanged with each other in various nanostructures including quantum dots (QDs), nanorods (NRs) and dot-in-rods, showing interesting properties. Here, we report direct Cd-to-Pb cation exchange in CdSe NRs which retain their original anisotropy to form CdSe/PbSe heterojunction nanorods. While PbCl2-oleylamine (OLA) complex induces morphology breakdown, Pb-oleate-OLA lead to direct Cd-to-Pb conversion with retained anisotropy. In contrast to the cation exchange using PbCl2-OLA, Pb-oleate-OLA makes partial conversion possible because of its milder kinetics. The series of results shows that chlorine and OLA play a crucial role in cation exchange process. Our work on the new cation exchange pathway broadens design range of CdSe/PbSe heterojunction nanomaterials potentially with various morphologies, since template CdSe nanocrystals can be prepared in different shapes via facile colloidal synthesis.