Direct Cd-to-Pb Cation Exchange in CdSe Nanorods Retaining Anisotropy

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Cation exchange is known as a powerful tool to design novel nanocrystals which cannot be synthesized by routine hot-injeection or heating-up methods. Driven by difference of lattice energy or solvation energy, Pb^{2+} and Cd^{2+} can be exchanged with each other in various nanostructures including quantum dots (QDs), nanorods (NRs), or dot-in-rods, showing interesting properties. Here, we report direct Cd-to-Pb cation exchange in CdSe NRs which retain their original anisotropy. While $PbCl_2$-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 $PbCl_2$-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 findings will help designing various nanoheterostructures using cation exchange.