Transformation of PbS or PbSe quantum dots in the dimetylsulfoxide under acidic conditions

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We demontrate the transformation of PbE (E= S or Se) quantum dots (QDs) in the dimetylsulfoxide (DMSO) under acidic environments at room temperature. In this study, we blended the PbE quantum dots in the DMSO with nitric acid, which was used to adjust pH of solution. Upon mixng, PbSe QDs readily transformed into trigonal-Se nanowires (NWs) at pH 6. We speculate that the transformation is induced by DMSO, which plays a key role such as dispersion solvent, reducing agent of SeO_2 and Pb complexing agent while the acidity promotes the cleavage of Pb-Se bond. In the case of PbS QDs, the crystallinity of the QDs remained relatively intact after DMSO mixing, while aggregated into a porous cluster. The QDs strength of Pb-S (342 kJ/mol) bonding compared to that of Pb-Se (231 kJ/mol) is responsible for the difference in transformation behaviors. The finding from this study provides not only the fundamental understanding of transformation of Pb chalcogenide QDs but also a new synthetic method of Se or Te NWs.