Large Quantity One Pot Synthesis of CdSe Tetrapods by Controlling Branching Kinetics as Well as Surface Ligands

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Cadmium selenide (CdSe) tetrapods prepared by conventional approaches have represented some limitations to realize practical optoelectronic devices mainly due to expensive alkylphosphonic acid ligands and complex synthetic procedures for mass production. In order to overcome such limitations, we developed a "continuous precursor injection" approach using cheap alkylammonium halides substituting alkylphosphonic acids. The CdSe tetrapods prepared with the new synthetic approach exhibit exceptional shape selectivity (> 90 %) as well as finely tunable arm dimensions varying from 1 to above 20 in aspect ratio. This superior quality clearly originates from the minimal fluctuation of concentration and temperature that would maximize the complete branching of wurtzite arms at four-equivalent {111}-facets of zincblende seeds. Based on the investigation on the binding states of Cd atoms through XPS measurement, it is noted that the halogen ion exchanged with X-type oleate ligands plays a key role in the shape evolution of CdSe tetrapods.