Development of Colloidal Dual-Diameter Quantumrods

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Quantumrods (QRs) have received lots of attention due to their unique properties arising from 1-dimensional geometry. Potential of QRs can be extended with the control of composition and morphology. Especially, delicate control of QR diameter, which determines band states of the QR structure, is desired for a wide range of optical and electrical application. Here, we firstly present dual-diameter QR structure which has two portions with different diameters along long axis of a single rod. For a distinct diameter formation, nanoparticle seed was used as a template for thick-diameter QR part. After the formation of thick QR, growth rate was abruptly increased by exposing unstable (000-1) surface, which makes thin-diameter QR grow from the one end of thick-diameter QR. Both of the diameters are under quantum confinement regime, therefore band alignment and exciton dynamics can be engineered in the single QR structure. We expect that this novel structure enables effective optical collection and directional charge transport. And, the understanding of its growth mechanism gives insights for designing complex NR morphology at the nanometer-scale.