Controlled Growth from ZnS Nanoparticles to ZnS-CdS Nanoparticle Hybrids with Enhanced Photoactivity

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Abstract

Chalcogenide nanostructures and nanocomposites have been the focus of semiconductor nanomaterial research due to their remarkable optoelectronic and photocatalytic properties and potential application in photodegrading enviromental pollutions. However, currently available synthesizing methods tend to be costly and inefficient. In this paper, we propose a facile two-step solution-phase method to synthesize well-defined monodisperse ZnS-CdS nanocomposites. The morphology and size of ZnS nanoparticles can be easily controlled by adjusting the amount of the source of sulfur. After surface modification with tiny CdS nanoparticles through natural electrostatic attraction, uniform ZnS-CdS nanocomposites are obtained, which has been further confirmed by transmission electron microscopy (TEM) and energy dispersive spectrometry (EDS). The photocatalytic activities of various ZnS samples and ZnS-CdS nanocomposites have been investigated by degrading Rhodamine B under UV-light. Compared with pure ZnS nanoparticles and ZnS powders, the as-obtained ZnS-CdS nanocomposites exhibit excellent photocatalytic performances due to the effective charge separation and increased specific surface area by the attachment of CdS. Moreover, resulting from the effective passivation of surface electronic states, the photoluminescence intensity of the ZnS-CdS nanocomposites is also significantly improved relative to plain ZnS.

Keywords

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