Quantum dot-decorated semiconductor micro- and nanoparticles: A review of their synthesis, characterization and application in photocatalysis

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Abstract

Quantum dot (QD)-decorated semiconductor micro- and nanoparticles are a new class of functional nanomaterials that have attracted considerable interest for their unique structural, optical and electronic properties that result from the large surface-to-volume ratio and the quantum confinement effect. In addition, because of QDs' excellent light-harvesting capacity, unique photoinduced electron transfer, and up-conversion behaviour, semiconductor nanoparticles decorated with quantum dots have been used widely in photocatalytic applications for the degradation of organic pollutants in both the gas and aqueous phases. This review is a comprehensive overview of the recent progress in synthesis methods for quantum dots and quantum dot-decorated semiconductor composites with an emphasis on their composition, morphology and optical behaviour. Furthermore, various approaches used for the preparation of QD-based composites are discussed in detail with respect to visible and UV light-induced photoactivity. Finally, an outlook on future development is proposed with the goal of overcoming challenges and stimulating further research into this promising field.

KEYWORDS: quantum dots, photocatalysts, nanocomposite synthesis, semiconductor particles, heterogeneous photocatalysis

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