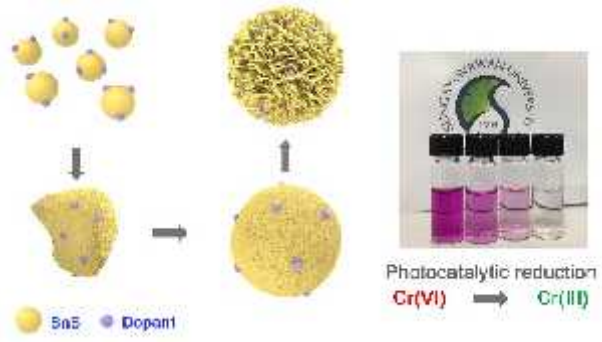
Non-stoichiometric SnS Microspheres with Highly Enhanced Photoreduction Efficiency for Cr(VI) Ions

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Abstract

Self-doped semiconductors have recently attracted extensive interest as highly efficient photocatalytic materials because the electronic properties can be modulated without sacrificing the chemical stability of the parent material. In this report, we report facile synthesis of Sn2+ self-doped SnS microparticles via a simple template-free hydrothermal route. Because of the ability to successful tune band structure while minimizing defect generation, self-doped SnS could potentially serve as an efficient photocatalyst of waste water. Here, Sn2+ self-doping results in insertion of an energy level slightly below the conduction band of SnS, thereby decreasing the photoexcitation energy. Furthermore, dopant sites can act as charge trapping sites, which can consequently minimize problematic charge recombination. Synthesized materials were characterized by various spectroscopic, microscopic, and surface characterization techniques, all of which confirmed the formation of self-doped SnS. Sn2+ self-doped SnS photocatalyst successfully reduced carcinogenic Cr(VI) to the water-insoluble Cr(III) form under visible light illumination. The best photocatalytic efficiency was obtained from an optimal balance between increased numbers of trapping sites leading to longer charge carrier lifetime, and decreased distance between trapping sites, favoring charge recombination. We anticipate that similar methodologies can be applied to other non-stoichiometric semiconducting photocatalysts with tunable electronic properties and enhanced photocatalytic efficiency.

Image



Recent Publications

1. Rauf, A.; Sher Shah, M. S. A.; Lee, J. Y.; Chung, C.; Bae, J. W.; Yoo, P. J. Non-Stoichiometric SnS Microspheres with Highly Enhanced Photoreduction Efficiency for Cr(VI) Ions. RSC Adv. 2017, 7, 30533–30541. (IF= 3.10)
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3. Rauf, A.; Sher Shah, M. S. A.; Choi, G. H.; Humayoun, U. Bin; Yoon, D. H.; Bae, J. W.; Park, J.; Kim, W.-J.; Yoo, P. J.Facile Synthesis of Hierarchically Structured Bi2S3/Bi2WO6 Photocatalysts for Highly Efficient Reduction of Cr(VI). ACS Sustainable Chemistry & Engineering 2015, 3, 2847–2855. (IF= 5.95)
4. Shah, M. S. A. S.; Kim, Y. H.; Park, A. R.; Rauf, A.; Yoo, P. J. Self-Supported Ag/AgCl Nanoparticles Incorporated Polymeric Multilayer Films for Reusable Electrophotocatalyst. Materials Express 2015, 5, 401–409. (IF=2.06)
5. Rauf, A.; Ming, M.; Kim, S.S.; Sher Shah, M. S. A.; Park, J.H.; Yoo, P. J. Mediator and Co-catalysts-Free Direct Z-Scheme Composite of Bi2WO6/Cu3P for Solar-water splitting. Nanoscale 2018, 10, 3026-3036. (IF= 7.367)



Biography

Ali Rauf is currently working at Department of Chemistry and chemical engineering, LUMS. . He joined Sungkyunkwan University in South Korea, one of the distinguished institutes in chemical engineering in fall 2013. He successfully completed his Ph.D. in December 2017 He completed his undergraduate from the University of the Punjab in 2012.. His research interests include photocatalysts for water treatment and water splitting, energy storage devices.

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Notes/Comments: