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Fabrication of g-C₃N₄/SnS₂/SnO₂ nanocomposites for promoting photocatalytic reduction of aqueous Cr(VI) under visible light

Yue Yang ^a, Xin-An Yang ^a, Di Leng ^a, Shang-Bing Wang ^b and Wang-Bing Zhang ^{a*}

^aDepartment of Applied Chemistry, Anhui University of Technology, Maanshan, Anhui 243002, P. R. China

^bAnalysis and Testing Central Facility, Anhui University of Technology, Maanshan, Anhui, 243002, P. R. China

ABSTRACT: A kind of g-C₃N₄/SnS₂/SnO₂ nanocomposite was firstly prepared by solvothermal method at 140°C for 4h after 30min ultrasonic irradiation. X-ray photoelectron spectroscopy (XPS), electron spin resonance (ESR), transmission electron microscopy (TEM) and electrical/optical testing techniques confirmed that the oxygen atoms in SnO₂ might be doped in the g-C₃N₄ in the synthesizing process, resulting to a good combination of SnS₂/SnO₂ nanosheets and g-C₃N₄ nanoparticles by Sn-O-C bond, which would have an influence on the light adsorption, carriers transfer, and electron-hole separation efficiency of g-C₃N₄/SnS₂/SnO₂. Additionally, the ultrasonic assisted solvothermal reaction could also promote the formation of oxygen vacancies on the surface of the material, which leads to the up-shift of valence band. The photocatalytic properties of the g-C₃N₄/SnS₂/SnO₂ were studied by the reduction of aqueous Cr(VI). The data clearly indicated that the photocatalytic activity of as-synthesized composites depends on their compositions, and reaction rate constant of Cr(VI) on the composite-C (with the mass ratio of 1:3) with visible light ($\lambda > 420$ nm) driven can be improved 41.7- and 4.0-time compared with pure g-C₃N₄ and SnS₂/SnO₂, respectively. Additionally, more than 90% lost photocatalytic activity of composite-C can be regenerated by water-washing and drying treatment. The present study provided an efficient method for removing toxic Cr(VI) ions via photoreduction utilizing visible light irradiation ($\lambda > 420$ nm).

Keywords: g-C₃N₄/SnS₂/SnO₂; ultrasonic irradiation; photocatalytic reduction; heavy metal ions; washing regeneration

*Corresponding author. Tel: +86 5552311807; fax: +86 5552311552

E-mail address: ahutwbzh@163.com (W. Zhang).

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