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硫掺杂纳米 TiO_2的掺杂机理及可见光催化活性的研究

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摘要

用酸催化溶胶一凝胶技术合成了硫掺杂纳米TiO_2光催化剂粉末. 光催化降解亚甲基蓝实验结果表明, 当硫脲与钛酸丁酯摩尔比S/Ti为3.5时, 经500℃热处理后的催化剂的光催化活性最佳. 通过XRD、DRS和XPS等研究表明硫掺杂导致二氧化钛晶粒尺寸细化, 并有效抑制了相变温度. 在热处理过程中硫由S^{2-}被氧化为S^{4+}并进入到二氧化钛的晶格中取代了部分Ti^{4+}位, 导致了晶格的畸变, 带隙变窄, 从而导致对光的吸收发生了向可见光区移动.

关键词 纳米TiO2 硫掺杂 机理 可见光催化降解

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Doping Mechanism and Visible-light Photocatalytic Activity of S-doped TiO2 Nano Powders

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Abstract

S-doped TiO_2 nanopowders were prepared by a sol-gel method with acid as the catalyst. The results of photocatalytic degradation methylene blue demonstrated that the doped TiO_2 exhibited the highest photocatalytic activity when the mole ratio of thiourea and tetrabutyltitanate[Ti(OC4H9)4] was 3.5 and the doped TiO_2 was calcined at 500℃ for 2h. The results from the X-ray diffraction (XRD), diffusion reflectance spectra (DRS) and X ray photoelectron spectroscopy (XPS) showed that sulfur doping controlled the increasing of nano TiO_2 and restrained the transformation from anatase to rutile. S^{2-} was oxidezed to S4+ during the thermal treatment. The trance of sulfur ions (S^{4+}) substitued partially for the lattice titanium ions (Ti^{4+}), which resulted in the localized crystal deformation of TiO_2 and the bandgap between valence band and conduction band narrowed, and the absorption light transferred to visible light region.

Key words nano TiO2 sulfur doping mechanism visible light catalytic degradation

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