

光电系统与工程

掺Fe3+对载Ag纳米TiO2光催化性能的改良

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摘要:

为研究掺杂不同mol分数的Ag⁺, Fe³⁺对TiO₂薄膜光催化性能的影响, 采用溶胶-凝胶法分别制备了掺杂不同质量分数的Ag⁺, Fe³⁺及其共掺杂的纳米TiO₂光催化杀菌膜。以大肠杆菌为光催化抗菌的反应模型, 对TiO₂薄膜光催化性能进行了评价。进而采用XRD, Uv-Vis对复合掺杂薄膜的特性进行了测试, 以分析Ag⁺, Fe³⁺对影响TiO₂薄膜的光催化杀菌性能的内在机理。结果表明: 在荧光灯照射下, 以Ag⁺, Fe³⁺各自最佳掺杂量Ag/Ti⁺=0.05%, Fe/Ti=0.1%, 共同掺入TiO₂中时, 共掺杂杀菌率最高, 并且共掺杂有良好的光催化分解能力。所得TiO₂晶型基本为锐钛矿型, 通过Uv-Vis可以看出共掺杂在可见光区具有良好的吸收性能。Fe³⁺是由于拓展了TiO₂的吸收范围, 而Ag⁺是由于正离子有效地抑制光生电子空穴的复合, 它们二者共同合作从而提高了TiO₂薄膜的光催化性能。共掺杂相对于单掺杂有着更优异的性能, 是进一步的研究方向。

关键词: 溶胶-凝胶 光催化 杀菌 银、铁共掺杂

Doping Fe3+ to nano-Ag TiO2 for photocatalytic performance improvement

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Abstract:

The effects of Ag and Fe doping contents on photocatalytic performance of the TiO₂ thin film were studied. Ag and Fe doping and co-doping contents on nano-TiO₂ photocatalytic bactericidal films were prepared by sol-gel method. The photocatalytic activity of TiO₂ films was evaluated by the sterilizing rate of the E.coli. The microstructure and UV absorb ability of films were measured by using XRD and Uv-Vis technology so as to analyze the intrinsic mechanism of Ag and Fe doping the photocatalytic TiO₂ thin films. Results show that, for fluorescent light irradiation, optimal doping amounts for Ag/TiO₂ and Fe₃/TiO₂ are 0.05%, 0.1%, respectively. The co-doping of them shows a good photocatalytic effect on the fluorescent light irradiation. And co-doping has a good ability of photocatalytic decomposition. The as-prepared particles had content of anatase phase. By Uv-Vis, we can see co-doping in the visible area has a good absorption property. Fe³⁺doping expanding the scope of the absorption of TiO₂ and Ag⁺ effecti-cnvely inhibits the photo-generated electron hole recombination. All this makes films'photocatalytic ability enhanced. Co-doped's superiority over the single-doped is to be investigated in the future.

Keywords: sol-gel photocatalysis sterilization Ag+ and Fe3+ co-doping

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