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研究论文

活性炭负载Cu离子掺杂纳米TiO_2颗粒的制备及光催化性能

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摘要 采用溶胶-凝胶法在活性炭(AC)表面负载掺杂Cu离子的TiO_2纳米颗粒, 制备负载型掺杂Cu^{2+}-TiO_2/AC复合光催化剂, 采用XRD, ESR, FS, UV-Vis和BET等手段对其进行了表征, 通过罗丹明B的光催化降解试验, 分析活性炭载体的比表面积和Cu离子掺杂量对负载型掺杂催化剂光催化活性的影响. 结果表明, Cu以+2价存在, Ti以少量的+3价存在; TiO_2纳米颗粒具有量子尺寸效应, 吸光阈值显著蓝移, 并使光谱相应范围向可见光区拓展; 另外, 适量Cu离子的掺杂降低了负载型TiO_2/AC的荧光强度. 负载和高温处理没有改变活性炭载体的微观结构. 以AC_3为载体和质量分数为3%的Cu离子掺杂所制备的3%Cu^{2+}-TiO_2/AC_3催化剂的活性最高, 并且该催化剂便于回收, 在重复使用中也表现出很高的光催化活性.

关键词 氧化钛纳米颗粒 掺杂 铜离子 活性炭 光催化

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Preparation and Photocatalytic Properties of Activated Carbon Supported TiO_2 Nanoparticles with Cu Ions Doping

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Abstract Composite photocatalysts(Cu^{2+}-TiO_2/AC) were prepared *via* a sol-gel method by means of activated carbon(AC) supported TiO_2 nanoparticles with copper ions doping. The photocatalysts were characterized by XRD, ESR, FS, UV-Vis and BET analysis. The effects of specific surface area of AC and amount of Cu ions doping on the photoactivity of the as-prepared samples were analyzed by photodegradation of Rhodamine B(RB). The results show that Cu ions exist in a form of the Cu^{2+} ions and there are a few of Ti^{3+} ions state in titanium dioxide. The TiO_2 nanoparticles show the quantum size efficiency, the notablely blue shifting of absorption threshold and the optic response range expanding to visual light. Additionally, the FS intensity of TiO_2/AC decreases *via* proper amount of Cu ions doping. The microcosmic structure of AC is changed by coating and heat treatment at a high temperature. Photocatalysts(3%Cu^{2+}-TiO_2/AC_3) show the highest photoactivity by using AC_3 as the carrier with 3% Cu^{2+} ions doping, meanwhile, they can be easily recovered from the reaction solution and reused with a high photoactivity.

Key words Titanium dioxide nanoparticle Doping Cu ion Activated carbon Photocatalysis

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