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论文

Fe_2O_3-TiO_2磁性复合材料的制备及可见光催化性能

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摘要:

以$FeCl_3$和$Ti(C_4H_9O)_4$为前驱体, 通过复合溶胶法制备了Fe_2O_3-TiO_2磁性复合光催化剂, 并用 XPS, XRD, SEM, EDS及BET进行了表征. 对亚甲基蓝的降解实验证明, Fe_2O_3的引入将复合材料的光响应范围扩展至可见光区, 且掺杂的Fe_2O_3摩尔分数为1.0%时, 样品可见光催化性能最高. 磁强计的测试结果显示, 复合光催化剂具有一定的磁性, 可在反应结束后利用磁场从体系分离, 使催化剂得到回收再利用.

关键词: Fe2O3-TiO2; 复合催化剂; 可见光; 磁分离

Preparation of Magnetic Fe2O3-TiO2 Nanocomposite and Its Photocatalytic Activity Under Visible Light Irradition

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Abstract:

The composite photocatalysts of Fe_2O_3-TiO_2 were prepared using $FeCl_3$ and $Ti(C_4H_9O)_4$ as precursors by sol-gel method. The photocatalysts were characterized by means of X-ray photoelectron spectroscopy(XPS), X-ray diffraction(XRD), scanning electron microscopy(SEM), and energy-dispersive X-ray spectroscopy(EDS), and nitrogen adsorption-desorption isotherms using the Brunauer-Emmett-Teller(BET) method. The results show that the composite consists of pure anatase TiO_2 and Fe_2O_3 with a diameter of about 15 nm. The photocatalytic activity of the Fe_2O_3-TiO_2 composite was confirmed through the photodegradation of methyl blue dye under visible light irradiation(λ>420 nm). The experimental results show that the composite photocatalysts have highly enhanced the photocatalytic efficiency in visible region when compared with each of the two pure semiconductor. The removal rate could reach the highest value under the molar fraction of Fe at 1.0 %. More importantly, the magnetic properties are measured using a vibrating sample magnetometer, and the results show that the Fe_2O_3-TiO_2 photocatalyst could be separated from the solution in magnetic field after reaction and then could be recycled.

Keywords: Fe2O3-TiO2; Nanocomposite; Visible light; Magnetic separation

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参考文献:

[1]SHI Jin-E(石金娥), YAN Ji-Chang(闫吉昌), SHANG Shu-Xia(尚淑霞), et al.. Chem. J. Chinese Universities(高等学校化学学报)[J], 2007, 28(7): 925—928
[2]Guo H. X., Zhao X. P., Guo H. L., et al.. Langmuir[J], 2003, 19: 9799—9803
[3]Villacres R., Ikeda S., Torimoto T., et al.. J. Photochem. Photobiol. A[J], 2003, 160: 121—126
[4]Vogel R., Hoyer P., Weller H.. J. Phys. Chem.[J], 1994, 98: 3183—3188
[5]CHENG Ping(程萍), GU Ming-Yuan(顾明元), JIN Yan-Ping(金燕萍). Progress in Chemistry(化学进展)[J],

2005, 17: 8—14
[6]Dhananjeyan M. R., Mielczarski E., Thampi K. R., et al.. J. Phys. Chem. B[J], 2001, 105: 12046—12055
[7]Khedr M. H., Sobhy M. S., Tawfik A.. Mater. Res. Bull.[J], 2007, 42: 213—220
[8]HOU Tian-Yi(侯天意), JIANG Yin-Shan(蒋引珊), LI Fang-Fei(李芳菲), et al.. Chem. J. Chinese Universities(高等学校化学学报)[J], 2006, 27(1): 100—103
[9]Mrowetz M., Balcerski W., Colussi A. J., et al.. J. Phys. Chem. B[J], 2004, 108: 17269—17273
[10]JIANG Hong-Quan(姜洪全), WANG Peng(王鹏), LU Dan-Dan(卢丹丹), et al.. Chinese Journal of Inorganic Chemsitry(无机化学学报)[J], 2006, 22(1): 73—78
[11]Bond G. C., Flamerz S.. Appl. Catal.[J], 1989, 46: 89—102
[12]Tan B. J., Klabunde K. J., Sherwood P. M. A.. Chem. Mater.[J], 1990, 2: 186—191
[13]Cannas C., Musinu A., Peddis D., et al.. J. Nanoparticle Res.[J], 2004, 6: 223—232
[14]Zhang Y. F., Li J. Q., Liu Z. F.. J. Phys. Chem. B[J], 2004, 108: 17143—17152
[15]Patrizia F., Thomas B., Marco B., et al.. J. Mater. Chem.[J], 2002, 12: 619—630

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