化学学报 2006 64 (13): 1329～1333 ISSN: 0567-7351 CN: 31-1320/06

研究论文

热处理温度对铬掺杂二氧化钛表面结构和性质的影响

高碧芬[1,2]，马颖[1]，曹亚安[3]，姚建年*,[1]

([1]中国科学院化学研究所 光化学重点实验室 北京100080)

([2]中国科学院研究生院 北京100039)

([3]南开大学物理学院 天津300071)

收稿日期 2005-11-1 修回日期 2006-3-2 网络版发布日期 接受日期

摘要 采用溶胶-凝胶法制备了铬掺杂二氧化钛(Cr-TiO_2), 并对经过不同温度烧结的Cr-TiO_2的结构、吸收光谱及样品中铬的氧化态等进行了表征. 实验结果表明, 在不高于723 K的温度烧结后, 铬以Cr^{3+}的氧化物和Cr^{6+}的铬酸盐或重铬酸盐的形式存在于TiO_2表面. 随着热处理温度的提高, Cr^{6+}的含量逐渐增多. Cr-TiO_2在可见区400～550 nm的吸收带是由Cr^{3+}的$^4A_2\rightarrow{}^4T_1$跃迁和O→Cr^{6+}的$1t_1\rightarrow 2e$电荷转移等引起的, 620～800 nm的吸收则是Cr^{3+}的$^4A_2\rightarrow{}^4T_2$跃迁的结果. 前者随着烧结温度的升高而增强, 后者则随着温度升高而下降.

关键词 半导体 掺杂 二氧化钛 铬 可见光吸收

分类号

Effect of Annealing Temperature on the Surface Structure and Properties of Chromium Doped Titania

GAO Bi-Fen[1,2], MA Ying[1], CAO Ya-An[3], YAO Jian-Nian*,[1]

([1] *Key Laboratory of Photochemistry, Institute of Chemistry, Chinese Academy of Sciences, Beijing 100080*)

([2] *Graduated School of Chinese Academy of Sciences, Beijing 100039*)

([3] *College of Physics, Nankai University, Tianjin 300071*)

Abstract Chromium doped titanium dioxide Cr-TiO_2 was prepared by the sol-gel method. The effects of annealing temperature on the crystal structure, oxidation states of chromium, and UV-vis absorption properties of Cr-TiO_2 were investigated in details. Experiment results showed that chromium mainly existed on TiO_2 surface as Cr_2O_3 and chromate or dichromate of Cr^{6+} in Cr-TiO_2 annealed at temperature no higher than 723 K. The content of Cr^{6+} was increased with the increase of temperature. The visible light absorption of Cr-TiO_2 within 400～550 nm should be attributed to the $^4A_2\rightarrow{}^4T_1$ transition of Cr^{3+} and the O→Cr^{6+} charge transfer ($1t_1\rightarrow 2e$). The absorption within 620～800 nm was due to the $^4A_2\rightarrow{}^4T_2$ transition of Cr^{3+}. The former was strengthened with the increase of annealing temperature, whereas the latter was weakened.

Key words semiconductor doping titanium dioxide chromium visible light absorption

DOI:

通讯作者 姚建年 jnyao@iccas.ac.cn