

具有{110}面的锐钛矿 TiO₂ 单晶的可控合成与光催化性能

吴谦 1,2, 吴志娇 1, 李永良 2, 高洪涛 3, 朴玲钰 1,* , 张天慧 1, 杜利霞 1

1 国家纳米科学中心, 北京 100190; 2 北京师范大学, 北京 100875; 3 青岛科技大学, 山东青岛 266042

WU Qian^{1,2}, WU Zhijiao¹, LI Yongliang², GAO Hongtao³, PIAO Lingyu^{1,*}, ZHANG Tianhui¹, DU Lixia¹

1 National Center for Nanoscience and Technology, Beijing 100190, China; 2 Beijing Normal University, Beijing 100875, China; 3 Qingdao University of Science and Technology, Qingdao 266042, Shandong, China

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摘要 采用水热法合成了同时具有最高表面能{110}和{001}晶面的锐钛矿 TiO₂ 单晶, 通过 X 射线衍射、扫描电镜和激光拉曼光谱等手段对样品的形貌和结构进行了表征, 并系统考察了过氧化氢、氢氟酸和反应温度等关键因素对所得样品中{110}面比例的影响, 实现了持续提高{110}面比例的过程. 在光催化降解亚甲基蓝反应中, 具有{110}面的锐钛矿 TiO₂ 单晶的光催化活性显著高于无{110}面的单晶.

关键词: 二氧化钛 高表面能晶面 {110}面 水热法 光催化

Abstract: Anatase TiO₂ single crystals with a high percentage of the high surface energy {110} facets have been successfully synthesized in a simple and economical way using a modified hydrothermal technique in the presence of hydrogen peroxide and hydrofluoric acid. The morphology and structure of the TiO₂ single crystals were characterized by X-ray diffraction, scanning electron microscopy, and Raman spectroscopy. The photocatalytic activity of the TiO₂ crystals for the degradation of methylene blue dye was investigated by ultraviolet light irradiation. The effects of the amounts of HF and H₂O₂ on the morphology of TiO₂ have been studied. The reaction time and temperature have also been investigated. In the TiO₂ single crystals, the {001} and {110} facets are present at the same time. The results indicated that a high yield of single crystals with exposed {110} and {110} facets could be obtained by adjusting the reaction time, reaction temperature, and amounts of HF and H₂O₂. The anatase TiO₂ single crystals with exposed {110} facets showed higher photocatalytic activities than those without.

Keywords: titania, facet with high surface energy, {110} facets, hydrothermal technique, photocatalysis

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