高等学校化学学报 2006 27 (10): 1918-1922 ISSN: 0251-0790 CN: 22-1131/O6

研究论文

表面修饰DBS基团对TiO_2气相光催化性能的影响

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收稿日期 2005-12-6 修回日期 网络版发布日期 2006-10-9 接受日期

摘要 采用溶胶-水热法直接获得表面修饰十二烷基苯磺酸钠(DBS)分子基团的TiO_2纳米粒子, 并考察了DBS表面修饰对纳米TiO_2光催化氧化降解气相n-C_5H_{12}反应的活性和寿命的影响, 并利用表面光电压(SPS)谱和光致发光(PL)光谱等方法研究了DBS表面修饰的影响机制. 结果表明, 表面修饰DBS分子基团能够抑制TiO_2纳米微晶生长, 促进纳米TiO_2分散, 增强吸附性和提高光生电荷分离, 使光催化活性显著提高. 但寿命并未下降, 这与TiO_2和DBS基团的光稳定性有关. 动力学研究结果表明, TiO_2光催化氧化n-C_5H_{12}反应遵循Langmuir-Hinshelwood动力学模型, 为准一级反应.

关键词 TiO_2; 表面修饰 DBS 光催化 n-C_5H_{12}

分类号 O643

DOI:

Effects of Surface Modification with DBS Groups on Gas Phase Photocatalytic Performance of Nanosized TiO_2

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Received 2005-12-6 Revised Online 2006-10-9 Accepted

Abstract

Sodium dodecylbenzenesulfonate groups(DBS)-modified TiO_2 nanoparticles were directly prepared by a sol hydrothermal method, the effects of DBS modification on photocatalytic performance, including mainly activity and lifetime, of nanosized TiO_2 in the degradation of gaseous n-C_5H_{12} were studied, together with the affecting mechanism of DBS modification by means of surface photovoltage spectroscopy(SPS) and photoluminescence(PL). The results show that the modification with DBS molecule groups can inhibit the crystallite growth, improve particle dispersibility, enhance the capability to adsorb organic substance, and increase separation rate of photoinduced charges, which are responsible for the increase in the photocatalytic activity. Interestingly, the lifetime of the surface-modified photocatalyst does not decrease, compared with that of unmodified sample, demonstrating that DBS groups are relatively stable. In addition, the photocatalytic reaction of gaseous n-C_5H_{12} on TiO_2 follows a Langmuir-Hinshelwood model, and also is a pseudo-first order reaction.

Key words TiO_2; Surface modification; DBS; Photocatalysis; n-C_5H_{12}

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