

Fe/Ti/Si复合微粒的表面结构与催化活性

余锡宾,王桂华,罗衍庆,李和兴

上海师范大学化学系,上海(200234)

收稿日期 修回日期 网络版发布日期 接受日期

摘要 利用UV-vis,FT-

IR,XRD,XPS,Raman等手段研究了Ti/Si,Fe/Ti,Fe/Ti/Si复合微粒的表面结构与催化活性。研究表明:Ti/Si复合微粒的光催化活性明显高于TiO₂微粒,TiO₂微粒以晶化度较低的锐钛矿相高度分散在SiO₂网络中,粒径约为10nm;并与SiO₂形成Si-O-Ti桥氧结构;提高了TiO₂微晶的热稳定性、比表面积和表面缺陷;有利于吸附降解有机污染物、半导体光生电子-空穴的分离及提高催化剂的光催化活性。Fe/Ti复合微粒具有Ti-O-Fe网络结构,粒径约为12nm,样品呈晶化度较低的锐钛矿和金红石混晶形式,这种结构有利于促进半导体光生电子-空穴的分离与活性.OH基团的生成;并能在半导体TiO₂中形成杂质中间能级,扩大光响应范围及提高半导体的光催化活性。但是,杂质Fe³⁺的掺入促进了TiO₂微粒的晶格畸变,晶粒增大。所研究的复合微粒中,Fe/Ti/Si体系具有最高的光催化活性。这种体系兼有Ti/Si,Fe/Ti复合微粒的优点,包含Si-O-Si,Si-O-Ti,Ti-O-Ti,Ti-O-Fe多种网络结构的Fe₂O₃,Fe₃O₄,FeO多种物种,具有很高的比表面积和表面缺陷;大大提高了半导体的光催化活性。是一种极具有实用价值的新型光催化剂。

关键词 [复合物](#) [光催化剂](#) [铁化合物](#) [钛化合物](#) [硅化合物](#) [光降解](#) [掺杂](#) [四环素](#) [微粒](#) [表面结构](#) [催化活性](#)

分类号 [O614](#)

Characterization of Fe/Ti/Si complex particles prepared by the sol-gel method and their photocatalytic reactivity for liquid-phase oxidation of tetracycline

Yu Xibin,Wang Guihua,Luo Yanqing,Li Hexing

Shanghai Normal Univ, Dept Chem,Shanghai(200234)

Abstract Ti/Si, Fe/Ti, Fe/Ti/Si complex particles of different Ti and Fe contents were prepared by the sol-gel method and used as photocatalysts. The photocatalytic reactivity of these catalysts were investigated as a function of the Ti and Fe contents during the liquid-phase oxidation of tetracycline, which showed a dramatic enhancement at low Fe content. The UV-vis, FT-IR, XRD, XPS and Raman spectra investigation indicated that the titanium oxide particles anchored onto Si-O-Si tetrahedral network were highly dispersed with the size being about 10nm to 12nm in the Ti/Si, Fe/Ti/Si complex particles. The Fe/Ti/Si complex particles were proved to be the optimum photocatalysts in the present reaction. The promoting effects were attributed to the cooperation function of the multi-components, the generation of active .OH radicals and the intermediate midgap in the titanium oxide semiconductor caused by Fe³⁺. The TiO₂ particles existed in the low crystalline anatase phase and formed Si-O-Ti, Ti-O-Fe tetrahedral coordination network due to the inclusion of Ti⁴⁺ and Fe³⁺ ions into the SiO₂ matrix. These catalysts had significant surface defects, large specific surface area and high photocatalytic reactivity related to fast electron and hole separation. It was found that titanium oxide semiconductor particles of low crystalline anatase-rutile mixed phases of about 16nm in size and existed in the Ti-O-Fe tetrahedral coordination network due to the inclusion of Fe³⁺ ions into the TiO₂ matrix in the Fe/Ti complex particles. The titanium oxide semiconductor doped with Fe³⁺ enhanced UV light absorption and activity in the degradation of organic pollutants due to the highly surface defects and the formation of intermediate gap state. But, these particle size increased and stabilization was lower as compared to Ti/Si complex particles. The highly dispersed and highly stable Fe/Ti/Si complex particles existed in the Fe₂O₃, Fe₃O₄, FeO species and Si-O-Si, Ti-O-Ti, Si-O-Ti, Ti-O-Fe tetrahedFe/Ti/Si复合微粒的表面结构与催化活性

Key words [COMPLEX](#) [PHOTOCATALYST](#) [IRON COMPOUNDS](#) [TITANIUM COMPOUNDS](#) [SILICON COMPOUNDS](#) [LIGHT DEGRADATION](#) [DOPE](#) [TETRACYCLINUM](#) [PARTICLES](#) [SURFACE STRUCTURE](#) [CATALYTIC ACTIVITY](#)

DOI:

通讯作者

扩展功能	
本文信息	
▶ Supporting info	
▶ PDF(0KB)	
▶ [HTML全文](0KB)	
▶ 参考文献	
服务与反馈	
▶ 把本文推荐给朋友	
▶ 加入我的书架	
▶ 加入引用管理器	
▶ 复制索引	
▶ Email Alert	
▶ 文章反馈	
▶ 浏览反馈信息	
相关信息	
▶ 本刊中 包含“复合物”的 相关文章	
▶ 本文作者相关文章	
· 余锡宾	
· 王桂华	
· 罗衍庆	
· 李和兴	