



ZnPc/ZnO、ZnTSPc/ZnO的原位自组装合成及可见光光催化 ZnPc/ZnO, ZnTSPc/ZnO: Synthesis by *In situ* and Self-assembly Process and Photocatalytic Activity under Visible-light Irradiation

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中文关键词: 酞菁/ZnO; 原位合成; 电子转移; 可见光光催化

英文关键词: Metallophthalocyanine (MPC)/ZnO; *in situ* synthesis; electron transfer; photocatalysis under visible-light irradiation

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中文摘要:

本文采用原位合成方法制备了不同物质的量配比的zinc phthalocyanine (ZnPc)/ZnO、zinc tetrasulfonated phthalocyanine (ZnTSPc)/ZnO复合材料, 通过UV-Vis、FTIR和荧光光谱等表征手段, 确定了ZnPc、ZnTSPc在ZnO表面的原位形成及两者之间的键合方式, 采用荧光光谱仪及单光子计数的方法测定复合前后ZnPc、ZnTSPc荧光强度、寿命的变化, 并对其敏化光催化机理进行研究。结果表明, ZnPc与ZnO之间不存在电子转移, 而ZnTSPc通过磺酸基与ZnO表面Zn²⁺形成-SO₃-Zn键, 有利于其激发态向半导体ZnO导带注入电子; 在1.0mol%(ZnTSPc与ZnO物质的量比)ZnTSPc/ZnO复合材料中, ZnTSPc与ZnO之间的电子转移速率 $k_{et}=6.1 \times 10^7 \text{ s}^{-1}$; ZnPc经能量转移产生单线态氧, 可提高ZnO可见光光降解效率, 而ZnTSPc键合于ZnO后, ZnTSPc既可通过能量转移产生单线态氧, 亦可通过电子转移产生超氧负离子自由基, 获得更高的光催化效率。

英文摘要:

Zinc phthalocyanine (ZnPc)/ZnO and zinc tetrasulfonated phthalocyanine (ZnTSPc)/ZnO were synthesized by an *in situ* process. The products were characterized by XRD, UV-Vis, FTIR, and Fluorescence spectroscopy techniques. The results show that ZnPc, ZnTSPc are synthesized on the surface of ZnO particles during the *in-situ* process. The changes of fluorescence intensity and lifetime indicate that there is no electron transfer between ZnPc and ZnO, while the electrons of the excited state of ZnTSPc are easily injected into the ZnO conduction band by means of sulfonated group (-SO₃-Zn), and the rapid electron transfer rate of k_{et} between ZnTSPc and ZnO is equal to $6.1 \times 10^7 \text{ s}^{-1}$ in 1.0mol% (ZnTSPc: ZnO in mol) ZnTSPc/ZnO. Compared with pure ZnO, ZnPc/ZnO shows high photocatalytic activity for the photocatalytic decolorization of RhB under visible-light irradiation by transferring energy from ZnPc to oxygen molecule and forming ¹O₂, while ZnTSPc/ZnO reveals higher photocatalytic activity due to ¹O₂ formed by means of transferring energy from ZnTSPc to oxygen molecule and O₂⁻ formed by transferring electron from ZnTSPc to ZnO.

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