

研究论文

自组装合成纳米复合TiO₂-ZnO介孔材料及其光催化性能

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摘要 以TiCl₄, ZnSO₄·7H₂O为原料, 尿素为沉淀剂, 利用可溶性淀粉大分子链的空间位阻效应和高分子网络的阻隔作用, 以纳米级碳黑为模板, 采用微波加热、均相沉淀法合成出了一系列纳米TiO₂-ZnO复合介孔材料. XRD分析证明反应前驱体为非晶态, 500 °C以上转变为锐钛矿结构的TiO₂和ZnTiO₃, 当Ti: Zn=1(摩尔比)时, 产物全部为ZnTiO₃ (TiO₂·ZnO).

TEM形貌观察结合N₂吸附表明, 基本粒子为球形, 粒径15~20 nm. 最可几孔径8~10 nm.

EDS分析证明产品中Ti: Zn的分析测定值与实际的投料值基本一致, 并且掺杂均匀性好.

光吸收及光催化实验发现Zn含量为50%时, 光催化效果最好, 在日光照射90 min后, 此TiO₂-

ZnO复合材料对藏蓝染料溶液降解率可达到100%, 其光催化反应符合一级动力学方程.

关键词 [纳米TiO₂-ZnO](#) [微波合成](#) [自组装](#) [介孔材料](#) [光催化](#)

分类号

Self-assembled Synthesis and Photocatalysis of Nano-TiO₂-ZnO Mesoporous Material

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Abstract Nanometric TiO₂-ZnO compound mesoporous material was prepared by microwave irradiation self-assembled method, using ZnSO₄ and TiCl₄ as raw material and nanometric carbon black as template. This method utilizes the positional hindrance effect of the long chain of soluble starch in space and the separation of macromolecule network. XRD analysis shows that the precursor is amorphous which transforms to TiO₂ or the mixture of TiO₂ and ZnTiO₃ above 500 °C. When the Ti: Zn molar ratio is 1, the product is ZnTiO₃. TEM measurement indicates that the TiO₂-ZnO is spherical particles, and the average diameter of the particles is 15~20 nm. The size of most of the pores is about 8 nm in diameter. EDS measurement indicates that the found Ti: Zn value of the sample agrees with the original mixing ratio and the uniformity is good. The light absorption and photocatalytic experiment show that the material has the best photocatalytic reactivity when the content of Zn is 50%. After being irradiated under the sunlight for 90 min, the compound can completely degrade the blue dye. The photocatalytic reaction follows first-order kinetics.

Key words [nano-TiO₂-ZnO](#) [microwave synthesis](#) [self-assembled](#) [mesoporous](#) [photocatalysis](#)

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