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研究论文

$BaTiO_3$ 纳米颗粒的聚丙烯酰胺凝胶法合成及光催化降解甲基红性能

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摘要 采用聚丙烯酰胺凝胶法合成了 BaTiO3 纳米颗粒, 利用 X 射线衍射、傅里叶变换红外光谱、透射电镜和紫外-可见漫反射光谱对样品进行了表征. 结果表明, 以柠檬酸酸为络合剂、pH = 2 且在 700 ° C 焙烧时可制备出单相 BaTiO3 纳米颗粒, 其形状较为规整, 近似呈球形, 平均粒径约为 55 nm, 光学带隙值为 3.25 eV. 以偶氮染料甲基红为目标降解物, 研究了 BaTiO3 纳米颗粒的光催化性能. 结果表明, 在紫外光照射下该纳米颗粒表现出较高的催化活性, 光催化机理主要为光生空穴的直接氧化.

关键词: 钛酸钡 纳米颗粒 丙烯酰胺凝胶法 光催化 甲基红

Abstract: A polyacrylamide gel method was used to synthesize $BaTiO_3$ nanoparticles. X-ray diffraction, Fourier transform infrared spectroscopy, transmission electron microscopy, and ultraviolet-visible diffuse reflectance spectroscopy were adopted to characterize the sample. The results demonstrate that single-phase $BaTiO_3$ nanoparticles can be prepared at a calcination temperature of 700 ^{o}C when using citric acid as the chelating agent at pH = 2. The prepared particles are regularly shaped like spheres with an average particle size of ~55 nm and have an optical bandgap energy of 3.25 eV. The photocatalytic properties of $BaTiO_3$ nanoparticles were investigated using the degradation of the azo dye methyl red. The experimental results reveal that the nanoparticles exhibit a pronounced photocatalytic activity for the methyl red degradation under ultraviolet light irradiation, and the direct oxidation by the hole is suggested to be the main mechanism responsible for the dye decomposition.

Keywords: barium titanate, nanoparticle, polyacrylamide gel method, photocatalysis, methyl red

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