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研究论文

稀土负载钛-硅沸石 ETS-10 的制备及其光催化性质

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- 摘要
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摘要 以水玻璃和四氯化钛为原料, 在不使用有机模板剂、氟离子和晶种的条件下, 用水热法合成了钛-硅沸石 ETS-10, 将 La、Ce、Pr 和 Nd 四种稀土元素负载到合成的 ETS-10 上. 通过 X 射线粉末衍射、N2 吸附-脱附、29Si 魔角旋转核磁共振、紫外漫反射光谱、X 射线荧光光谱等表征手段对负载前后的 ETS-10 进行了表征. 以有机染料甲基橙为底物, 考察了负载各种稀土及氢氟酸腐蚀对 ETS-10 的光催化活性的影响. 结果表明, 四种稀土元素的引入均可有效提高 ETS-10 的光催化活性. 反应活性提高的程度与稀土元素负载量有关. 对 ETS-10 同时进行氢氟酸腐蚀和稀土元素的负载, 可以将 ETS-10 的光催化活性提高近一倍, 与锐钛矿相 TiO2 相当, 但前者更易分离.

关键词： 钛硅沸石 微孔钛硅分子筛 (ETS-10) 稀土 光催化反应 甲基橙

Abstract： The three dimensional microporous titanosilicate, ETS-10, was synthesized by a hydrothermal synthesis route using $TiCl_4$ and a sodium silicate aqueous solution as starting materials. Lanthanide (La, Ce, Pr, Nd) loaded ETS-10 catalysts were prepared by the impregnation method. The catalysts were characterized by X-ray diffraction, ^{29}Si magic angle spinning NMR, UV-Vis diffuse reflectance spectroscopy, N_2 adsorption-desorption measurement, and X-Ray fluorescence spectroscopy. The degradation of methyl orange under near-UV light was used to investigate the photocatalytic activity of the catalysts in aqueous suspensions. The lanthanide loaded ETS-10 catalysts exhibit higher activity than the unmodified ETS-10. The combination of loading lanthanide and increasing the surface defects of ETS-10 by a HF treatment gave an enhancement of the photocatalytic activity, which became comparable with that of anatase TiO_2.

Keywords： microporous titanosilicate, Engelhard titanosilicate material number 10 (ETS-10), lanthanide, photocatalysis, methyl orange

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