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光Fenton反应催化剂Ce-Fe/Al₂O₃的 等离子体制备及其性能表征

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摘要: 利用等离子体制备光Fenton催化剂Ce-Fe/Al₂O₃, 运用扫描电镜(SEM)、紫外-可见漫反射光谱(DRS)、氢程序升温还原(H₂-TPR)及光电子能谱(XPS)手段分别表征催化剂表面形貌、光吸收特性、还原性能及活性组分价态特性, 同时, 通过媒介黄的光Fenton脱色反应考察催化剂的活性和稳定性。研究表明: 等离子体过程使活性组分Fe₂O₃分散均匀, 有效抑制Fe₂O₃颗粒的长大, 增强催化剂对光的吸收; 催化剂表面铁摩尔分数从0.34%提高到0.72%, 铁的首次溶出率从0.41%降低到0.28%; 催化剂Ce-Fe/Al₂O₃在pH=6.0时, 于60 min内可将质量浓度为200 mg/L的媒介黄完全脱色, 反应速率常数为普通催化剂的2.8倍; 采用等离子体技术能提高活性组分氧化铁在催化剂表面的分散性, 增加活性位点, 从而有利于有机污染物的吸附和催化氧化。

关键字: 水处理; 高级氧化; 光Fenton; 非均相催化剂; 等离子体

Preparation and characterization of Ce-Fe/Al₂O₃ catalyst by plasma in photo-Fenton reaction

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Abstract: Ce-Fe/Al₂O₃ catalysts were prepared by plasma apparatus. The surface morphology, optical absorption characteristic, reduction property and valency of activated component of catalysts were characterized through SEM, DRS, H₂-TPR and XPS analysis, respectively. Activity and stability of catalysts were estimated utilizing photo-Fenton decolorization reaction of medium yellow (MY10). The results show that plasma process causes uniform dispersion of the activated component Fe₂O₃, inhibits the growth of Fe₂O₃ particles, increases the optical absorption and iron molar fraction on the surface of catalyst from 0.34% to 0.72%, and decreases the iron dissolving for the first time from 0.41% to 0.28%. This catalyst can cause complete decolorization of MY10

under the condition of pH 6.0 in 60 min. The reaction rate constant is 2.8 times of that of conventional catalyst. It is benefit to adsorption and catalytic oxidation of organic pollutant for enhancing the dispersion of active component iron oxide on the catalyst surface and increasing active site using plasma technique.

Key words:water treatment; advanced oxidation; photo-Fenton; heterogeneous catalyst; plasma

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