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光Fenton反应的Ce-Fe/Al₂O₃催化剂超声制备及性能表征

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摘要:采用超声浸渍法和普通浸渍法制备具有相同铁负载量的Ce-Fe/Al₂O₃催化剂, 以解决光Fenton反应过程中催化剂活性低的问题。通过扫描电镜(SEM)、氢程序升温还原(H₂-TPR)、紫外可见漫反射(DRS)、比表面积分析(BET)及XPS等手段分别表征催化剂的表面形貌、还原性能、光吸收特性、比表面积特性及活性组分铁的价态和表面分布, 利用媒介黄的光Fenton脱色反应考察催化剂的活性和稳定性。结果表明: 超声浸渍20 min使活性组分Fe₂O₃分散均匀, 有效抑制Fe₂O₃颗粒的长大, 增加催化剂对光的吸收; 比表面积从221.3 增大到247.8 m²/g, 改善了催化剂的微孔结构; 催化剂表面铁含量从0.24%提高到0.38%, 提高了催化剂的催化活性。在pH6.0条件下, 60 min内可使200 mg/L媒介黄完全脱色。

关键字: 水处理; 高级氧化; 光Fenton反应; 非均相催化剂; 超声

Ultrasonic preparation and characterization of CeO₂ doped with Fe/Al₂O₃ catalyst in photo-Fenton reaction

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Abstract: Abstract: Ce-Fe/Al₂O₃ catalysts possessing the same iron load amount were prepared with and without ultrasonic assistant during the impregnation step to solve the problem of low activity of catalyst in the process of photo-Fenton reaction. The surface morphology, reduction property, optical absorption characteristic, BET surface area and valency of Fe and surface distribution of catalysts were characterized through SEM, H₂-TPR, DRS, BET and XPS analysis respectively. Activity and stability of catalysts were estimated by utilizing photo-Fenton decoloration reaction of medium yellow (MY10). The results show that catalyst prepared by ultrasonic treatment for 20 min causes activated component Fe₂O₃ to be highly dispersed. The growth of Fe₂O₃ particles is inhibited and the optical absorption increases. BET surface area increases from 221.3 to 247.8 m²/g and micropore structure is improved. The Fe content in catalyst surface increases from 0.24% to 0.38% and the catalytic activity of catalyst is improved. This catalyst can cause discoloring of MY10 under the condition of

pH 6.0 in 60 min.

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

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