

论文

钴铝复合氧化物同时催化去除碳烟和氮氧化物

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摘要:

以稳态共沉淀法合成的含Co类水滑石为前驱物, 制备了具有介孔结构的复合氧化物催化剂(CAO), 采用程序升温反应技术评价了催化剂同时去除碳烟和氮氧化物的性能, 并用ICP, BET, SEM和XPS等手段分析了材料结构和催化性能的关联. 结果表明, 催化剂呈现钴尖晶石相, 材料表面除了存在与金属键合的晶格氧外, 还有大量的吸附氧. Co/Al摩尔比和焙烧温度影响催化剂的活性, 当Co/Al摩尔比为4和焙烧温度为800 °C时制备的4CAO-800是一种综合性能良好的催化剂, 具有较低的起燃温度($t_i=290$ °C), 生成 N_2 的选择性较高($S_{N_2/C}=3.5\%$). 在同时去除碳烟和 NO_x 反应中, 碳烟的催化燃烧过程可能存在溢流机理和氧化还原机理协同作用.

关键词: 水滑石; 复合氧化物; 碳烟颗粒; 氮氧化物; 催化去除

Cobalt-containing Hydrotalcites Derived Catalysts for Simultaneous Removal of NO_x and Soot

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Abstract:

Cobalt-containing mixed oxides(CAO) were prepared by thermal decomposition of hydrotalcite-like precursors with Co/Al molar ratio varying from 2 to 7. The catalytic activity of the CAO was investigated for the simultaneous catalytic removal of NO_x and diesel soot particulates by temperature-programmed reaction(TPR) technique in a fixed-bed flow reactor. The relationship between the catalyst structure and performance were clarified through ICP, BET, SEM and XPS measurements. The results show that all catalysts exhibit a nonstoichiometric spinel phase. Oxygen species present on the catalyst surface included lattice oxygen, the adsorbed oxygen and(or) the surface hydroxyl species, which acted for different mechanisms in soot oxidation. The catalytic activity was influenced by both Co/Al ratio and calcinations temperature. 4CAO-800 with the Co/Al molar ratio of 4 and calcinations temperature of 800 °C show the best activity with a low ignition temperature($t_i=290$ °C) and high selectivity to N_2 formation ($S_{N_2/C}=3.5\%$). During the NO_x -soot reactions, a re-dox mechanism and a spillover mechanism may occur simultaneously for the catalytic soot oxidation.

Keywords: Hydrotalcite; Mixed oxide; Soot particle; NO_x ; Catalytic removal

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