

高性能 $Ce_{0.5}Zr_{0.5}O_2$ 稀土储氧材料的制备及其负载的单 Pd 三效催化剂

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摘要 以碳酸铵水溶液为沉淀剂, 改变前驱体盐溶液的浓度, 采用共沉淀法制得了一系列 $Ce_{0.5}Zr_{0.5}O_2$ 固溶体材料. 以此系列材料为载体制备了负载型单 Pd 三效催化剂, 并利用 N_2 吸附-脱附、X 射线衍射、储氧量测定和程序升温还原等技术对材料进行了表征. 结果表明, 所制 $Ce_{0.5}Zr_{0.5}O_2$ 材料具有优异的抗高温老化性能和氧化还原性能, 且盐溶液的浓度对材料及其负载型 Pd 三效催化性能的影响较大. 当盐溶液浓度为 0.3 mol/L 时, 制备材料的结构性能最佳, 经 1000 °C 老化 5 h 后其比表面积和孔体积分别为 $53.0 \text{ m}^2/\text{g}$ 和 $0.17 \text{ cm}^3/\text{g}$. 所制得的三效催化剂对 CO, NO 和 C_3H_8 具有低的起燃温度和完全转化温度, 表现出最佳的催化性能, 具有良好的应用前景.

关键词: 铈-锆固溶体共沉淀 碳酸铵 高温稳定性 氧化还原性能 钯 三效催化剂

Abstract: A series of $Ce_{0.5}Zr_{0.5}O_2$ oxygen storage material samples were prepared by co-precipitation using ammonium carbonate as precipitant. The effect of the concentration of the salt solution on the performance of the target materials and its supported Pd-only catalyst was investigated. The samples were characterized by N_2 adsorption, X-ray diffraction, oxygen storage capacity, and temperature-programmed reduction. The results showed that the prepared material exhibited high thermal stability and perfect redox properties. When the concentration of the salt solution was 0.3 mol/L, the obtained material presented the best textural properties with a surface area of $53.0 \text{ m}^2/\text{g}$ and pore volume of $0.17 \text{ cm}^3/\text{g}$ after calcination at 1000 °C for 5 h. The corresponding catalyst exhibited higher catalytic activity with relative low light-off and full conversion temperature, showing potential application in automotive catalysts.

Keywords: cerium-zirconium solid solution, co-precipitation, ammonium carbonate, high thermal stability, redox property, palladium, three-way catalyst

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