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RESEARCH PROGRESS ON MANGANESE-CERIUM-BASED SCR CATALYST FOR DENOX AND ITS RESISTANCE TO SO_2 POISONING

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Abstract

Excess nitrogen oxides (NOx) emissions lead to severe environmental problems such as acid rain, photochemical smog, and ozone layer depletion, while also contributing to PM2.5 and O3 formation, posing risks to human health and ecosystems. Among available technologies, ammonia selective catalytic reduction (NH_3-SCR) is the most effective approach for NOx control, with catalyst performance determining its overall efficiency. This paper reviews the NH_3-SCR denitrification mechanism, the impact of sulfur dioxide (SO2) poisoning, and the interrelationship between SO2 deactivation and catalyst activity. Emphasis is placed on advances in the design and development of manganese-cerium-based catalysts with enhanced sulfur resistance, recognized for their high low-temperature activity and potential for industrial application. Recent studies are summarized from three perspectives: elucidation of the denitrification and SO_2 poisoning mechanisms; strategies to inhibit ammonium bisulfate (ABS) formation on catalyst surfaces; and improvements in sulfur resistance achieved through metal element doping (Fe, Cu, Pr, Co, Ni, Sn, Ti), optimized preparation methods (co-precipitation, hydrothermal, sol-gel), and structural innovations (core–shell and hollow architectures). These developments collectively enhance redox performance, oxygen storage capacity, and acid site availability, improving both activity and stability under SO_2-rich conditions. The review concludes that while manganese-cerium-based catalysts exhibit promising denitrification performance at low temperatures, their long-term industrial use remains limited by incomplete sulfur resistance and deactivation recovery. Continued research is required to refine catalyst structures, elucidate poisoning mechanisms, and integrate protective designs that ensure durability and cost-effectiveness in industrial flue gas applications. This work provides insights into future directions for the rational design of sulfur-tolerant, low-temperature NH3-SCR catalysts aimed at sustainable air pollution control.

Key words: manganese-cerium-based catalyst, NO_x, selective catalytic reduction, SO_2 poisoning resistance

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