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Effect of Ti or Sn doping on the catalytic performance of MnOx/CeO_2 catalyst for low temperature selective catalytic reduction of NO with NH3

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Abstract Text

The abatement of nitrogen oxides (NO_x) emission from exhaust gases of diesel and stationary sources is a significant challenge for economic and social development. Ceria-based solid solutions were synthesized and used as supports to prepare MnOx/Ce0.8Ti0.2O_2 and MnOx/Ce0.8Sn0.2O_2 catalysts (Mn/CeTi and Mn/CeSn) for low temperature selective catalytic reduction of NO by NH3 (NH3-SCR). The effects of Ti or Sn doping on the catalytic performance of MnOx/CeO_2 catalyst were investigated. Experimental results show that doping of Ti or Sn increases the NO removal efficiency of MnOx/CeO_2. The NO conversion of Mn/CeTi catalyst is more than 90 % at temperature window of 175 $\sim$ 300 °C under a gas hour space velocity of 60,000 mL•g–1•h–1. Modified catalysts are also found to exhibit greatly improved resistance to sulfur-poisoning. NH3-TPD results suggest that NH3 desorption on the catalysts is observed over a wide temperature range, due to the variability of adsorbed NH3 species with different thermal stabilities. Doping of Ti and Sn into Mn/CeO_2 greatly increased the NH3 adsorption ability of the composites which could promote the SCR reaction. Characterization results also indicate that doping of Ti or Sn brings about catalysts with higher BET surface area, enhanced oxygen storage capacity and increased surface acidity. X-ray photoelectron spectroscopy (XPS) analysis of spent catalysts following SCR reaction in the presence of SO_2 verify that the loss of surface Mn species was inhibited by doping of Ti, which contributes to extend the catalyst durability.