Effect of metal ions doping (M = Ti^{4+}, Sn^{4+}) on the catalytic performance of $MnOx/CeO_2$ catalyst for low temperature selective catalytic reduction of NO with NH_3

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Background

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. It has been proved that ceria can enhance the NO*x* adsorption, provide stronger Brønsted acid sites, enhance the oxidization of NO to NO_2, which was beneficial for the NH_3-SCR reaction. Ceria-based solid solutions were synthesized and used as supports to prepare $MnOx/Ce_{0.8}Ti_{0.2}O_2$ and $MnOx/Ce_{0.8}Sn_{0.2}O_2$ catalysts (Mn/CeTi and Mn/CeSn) for low temperature selective catalytic reduction of NO by NH_3. The effects of Ti or Sn doping on the catalytic performance were investigated.00

Results and discussion

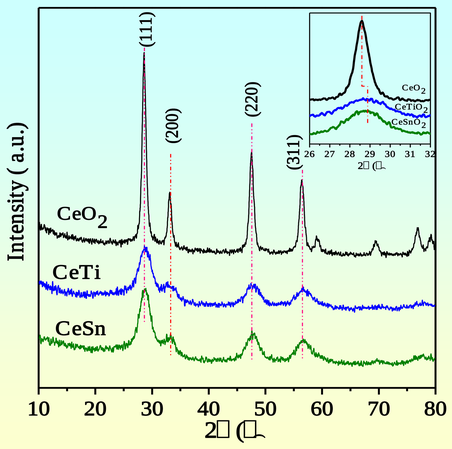

Fig 1. XRD results of the suupports

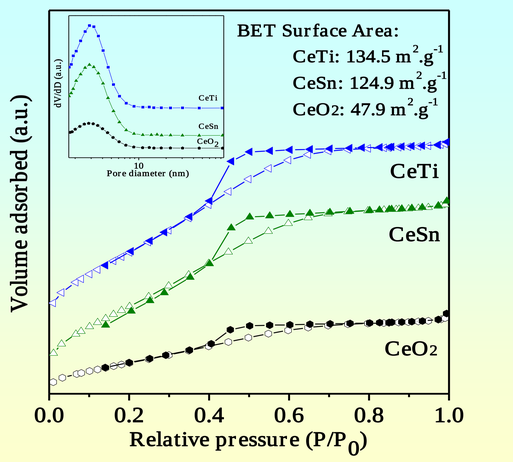

Fig 2. The N_2 adsorption-desorption isotherms of the supports

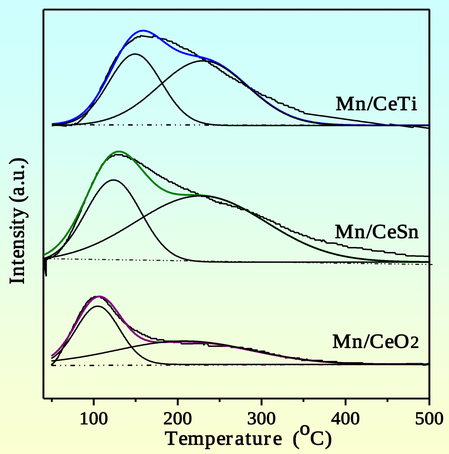

Fig 3. NH_3-TPD results

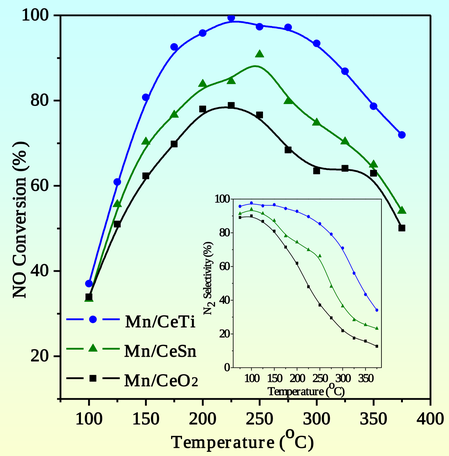

Fig 4. NO conversion and N_2 selectivity of the catalysts

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 ~ 300 °C under a gas hour space velocity of 60,000 $mL \cdot g^{-1} \cdot h^{-1}$. Modified catalysts are also found to exhibit greatly improved resistance to sulfur-poisoning (Fig 4). NH_3-TPD results suggest that NH_3 desorption on the catalysts is observed over a wide temperature range, due to the variability of adsorbed NH_3 species with different thermal stabilities. Doping of Ti and Sn into Mn/CeO_2 greatly increased the NH_3 adsorption ability of the composites which could promote the SCR reaction (Fig 3). Characterization results also indicate that doping of Ti or Sn brings about catalysts with higher BET surface area (Fig 2)., enhanced oxygen storage capacity and increased surface acidity.

References

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Acknowledgment

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