Supporting materials

The effects of 100 ppm SO_2 and 1 vol% H_2O on NO reduction over three catalysts at 200℃ were investigated, as shown in Fig. S1. The introduction of H_2O and SO_2, the NO conversion on Zr-Ce and Cr-Zr-Ce decreased, and recovered after H_2O and SO_2 were cut off. While the SCR activity of Mn-Zr-Ce hardly affected by SO_2 and H_2O. Previous study indicated that surface sulfates were first formed on ceria during the SCR reaction in the presence of SO_2, and a portion of Lewis acid sites on MnO_x were preserved to fulfill the SCR cycle [a].

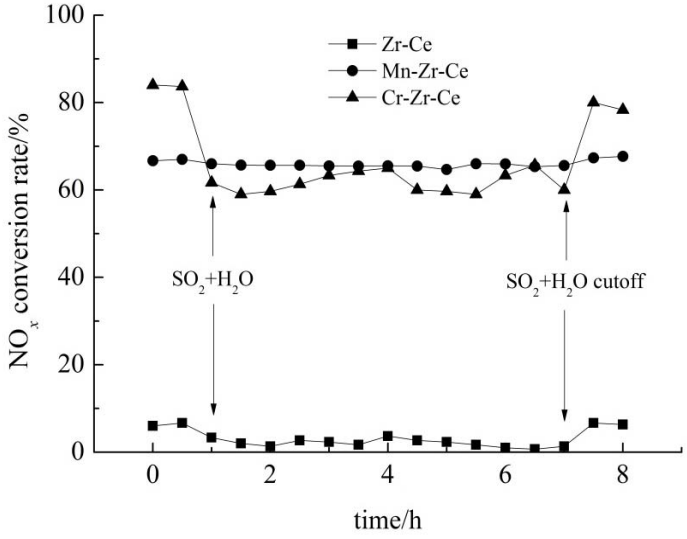
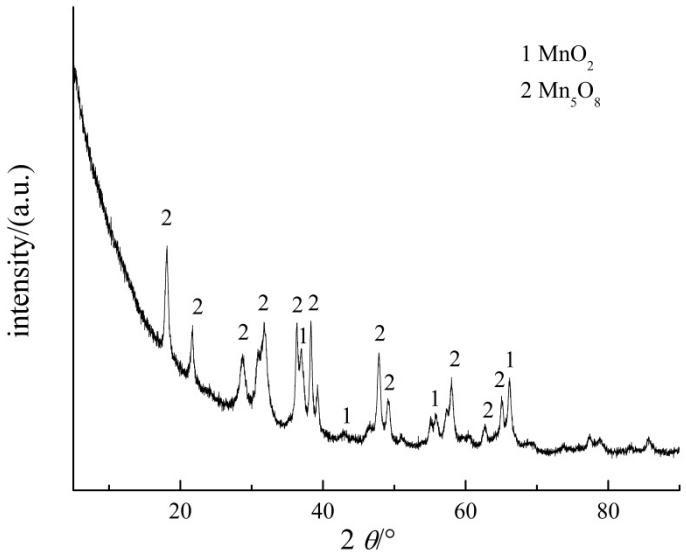
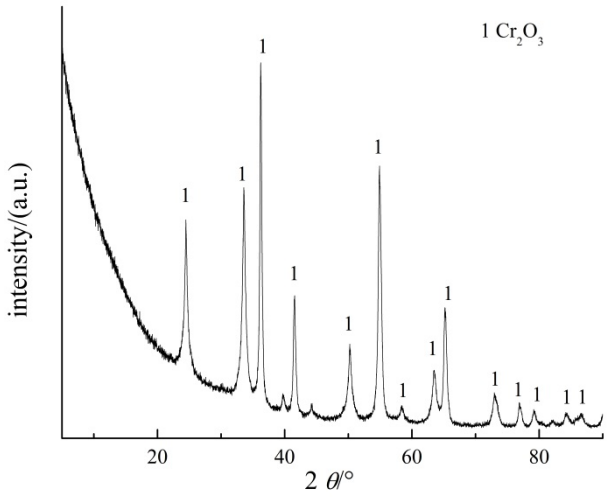


Fig. S1 SCR activity of Zr-Ce, Mn-Zr-Ce and Cr-Zr-Ce in the presence of SO_2 and H_2O

The XRD pattern (Fig. S2(a)) of MnO_x can be assigned to Mn_5O_8 (JCPDS 39-1218) and MnO_2 (JCPDS 30-0820). The XRD pattern (Fig. S2(b)) of CrO_x can be assigned as Cr_2O_3 (JCPDS 38-1479).



(a)



(b)

Fig. S2 XRD patterns of (a) MnO_x and (b) Cr_2O_3 prepared from co-precipitation method

Pure MnO_x exhibited more than 60% NO_x conversion in the temperature range of 150℃–300℃, similar to previous reports [b]. While the catalytic activity of pure Cr_2O_3 was about 60% in the temperature range of 250℃–300℃, and decreased sharply when temperature declined (Fig. S3).

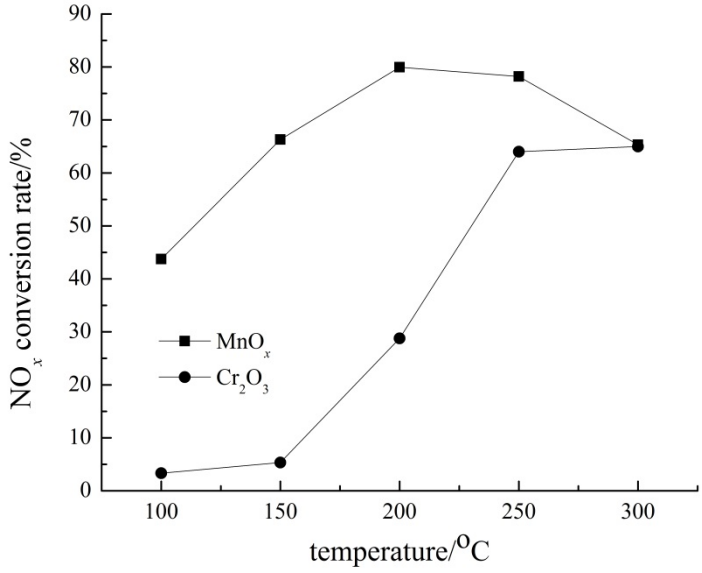


Fig. S3 SCR activity of MnO_x and Cr_2O_3

References

a. Jin R, Liu Y, Wang Y, Cen W, Wu Z, Wang H, Weng X. The role of cerium in the improved SO_2 tolerance for NO reduction with NH_3 over Mn-Ce/TiO_2 catalyst at low temperature. Applied Catalysis B: Environmental, 2014, 148–149: 582–588 doi:10.1016/j.apcatb.2013.09.016

b. Qi G, Yang R T, Chang R. MnO_x-CeO_2 mixed oxides prepared by co-precipitation for selective catalytic reduction of NO with NH_3 at low temperatures. Applied Catalysis B: Environmental, 2004, 51(2): 93–106 doi:10.1016/j.apcatb.2004.01.023