

Supplementary Information

Activity and SO₂ Resistance of Amorphous Ce_aTiO_x catalysts for the Selective Catalytic Reduction of NO with NH₃: In-situ DRIFT studies

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Catalyst preparation

Crystalline phases Ce-Ti oxides catalysts with the Ce/Ti ratio of 0.3 were prepared by
impregnation method and sol-gel method which were denoted as Ce_{0.3}Ti-CP-1 and Ce_{0.3}Ti-
CP-2, respectively.

Impregnation method

Ce_{0.3}Ti-CP-1 catalyst with the Ce/Ti ratio of 0.3 was prepared by Impregnation method.
The commercial TiO₂ (P25) was used as the catalyst support. The catalyst was impregnated
by incipient wetness with an aqueous solution containing cerium nitrate. The obtained
mixture was stirred for 3 h, 40 °C rotary evaporateion, then the sample was dried for 12 h at
105 °C and calcined in muffle furnace for 4 h at 500 °C to obtain the Ce_{0.3}Ti-CP-1 catalyst.

Sol-gel method

Ce_{0.3}Ti-CP-2 catalyst was prepared by a sol-gel method. Briefly, butyl titanate (0.10 mol)

and ethanol (0.50 mol) were mixed under vigorous stirring, and formed a transparent yellow solution. Cerium nitrate (0.03 mol) was dissolved in water (0.60 mol), acetic acid (0.30 mol) and ethanol (0.50 mol), and then added drop wisely to the above yellow solution. The obtained mixture was stirred for 6 h and placed for about three days at room temperature to form gel. Then the gel was dried for 24 h at 105 °C to remove organic solution and then calcined in muffle furnace for 4 h at 700 °C to obtain the $Ce_{0.3}Ti$ -CP-2 catalyst

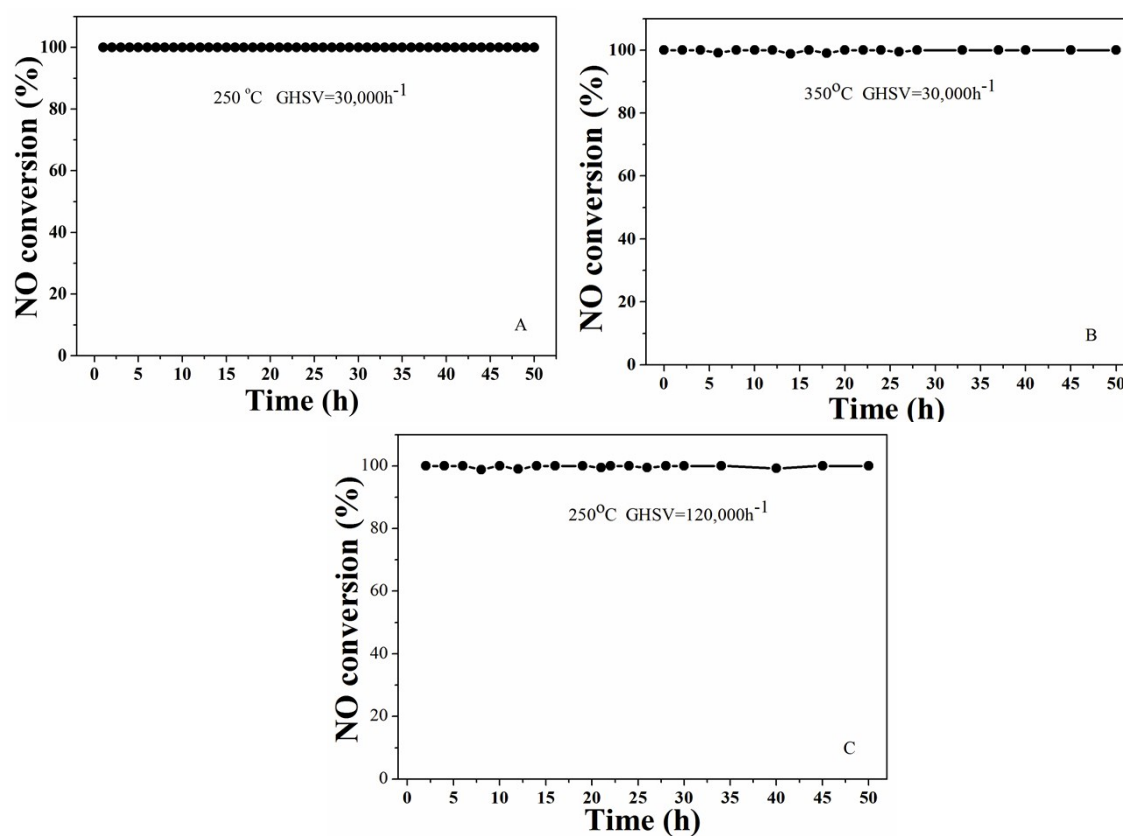


Fig. S1 Activity stability test results of the $Ce_{0.3}TiO_x$ catalyst. (1000 ppm of NO, 1000 ppm of NH_3 , 3% O_2 , balance N_2)

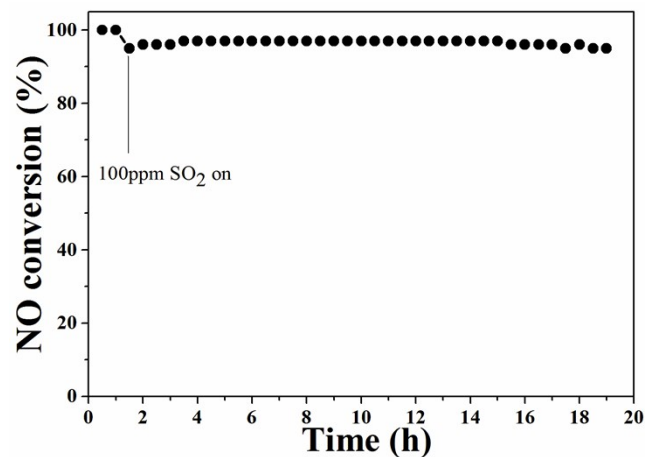


Fig. S2 SO₂ tolerance of the Ce_{0.3}TiO_x catalyst at 250 °C. (1000 ppm of NO, 1000 ppm of NH₃, 3% O₂, balance N₂, GHSV=30,000 h⁻¹)

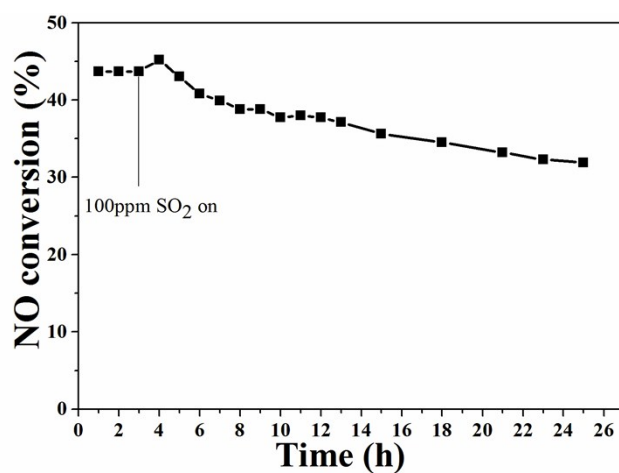


Fig. S3 SO₂ tolerance of the Ce_{0.3}TiO_x catalyst at 150 °C. (1000 ppm of NO, 1000 ppm of NH₃, 3% O₂, balance N₂, GHSV=30,000 h⁻¹)

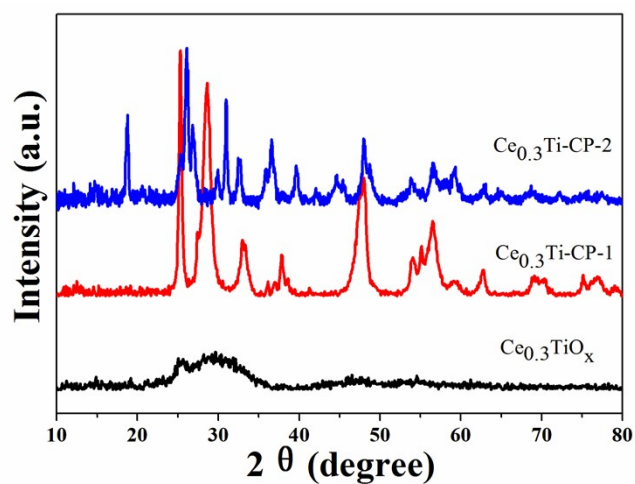


Fig. S4 XRD patterns of the Ce-Ti mixed-oxide catalysts.

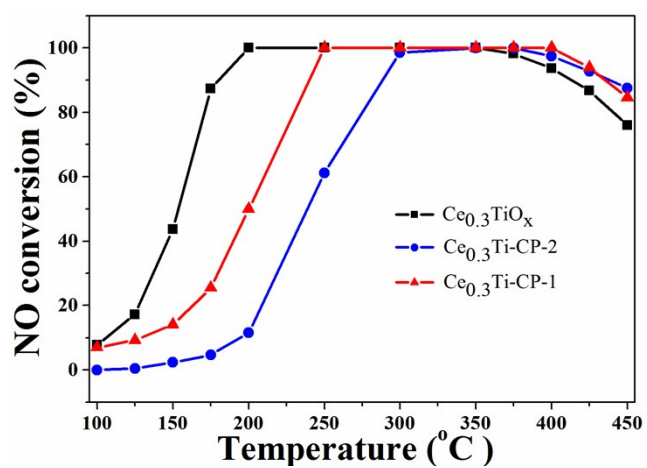


Fig. S5 NH₃-SCR activity over the Ce-Ti mixed-oxide catalysts (1000 ppm of NO, 1000 ppm of NH₃, 3% O₂, balance N₂, GHSV=30,000 h⁻¹).

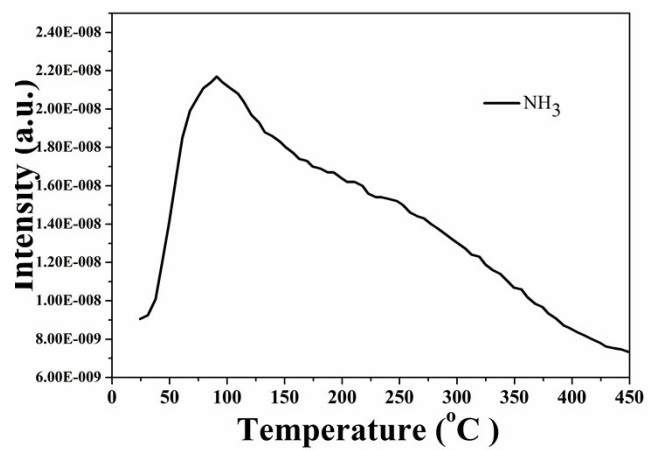


Fig. S6 NH₃-TPD-MS profiles of Ce_{0.3}TiO_x catalyst.

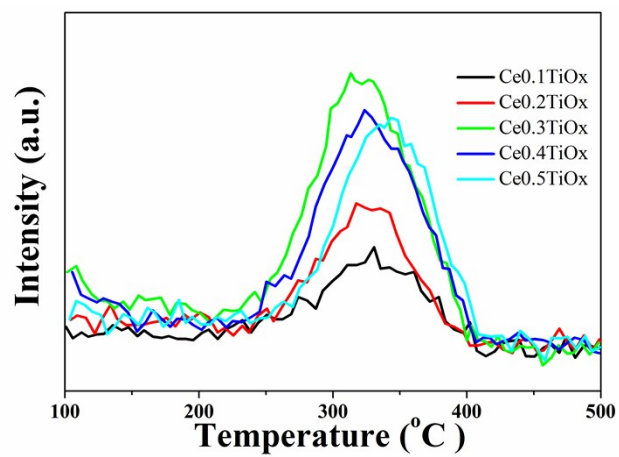


Fig. S7 NO+O₂-TPD-MS curves of the Ce_aTiO_x series catalysts.

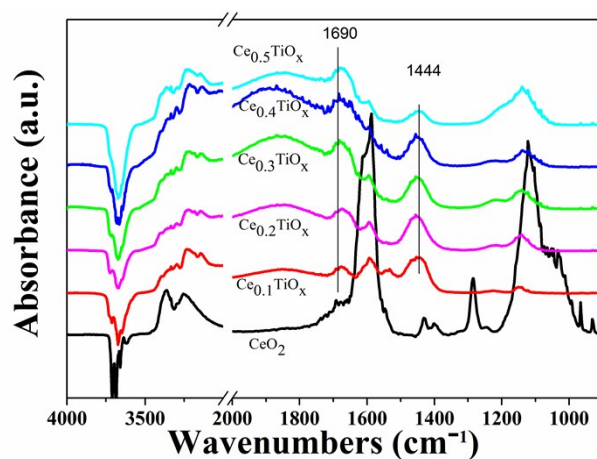


Fig. S8 DRIFTS of the NH_3 adsorption of the Ce_aTiO_x catalysts at 50 °C.

DRIFTS of the NH_3 adsorption of was performed over the Ce_aTiO_x catalysts on a Bruker Vector FTIR spectrometer (6700) with in situ diffuse reflectance pool and high sensitivity MCT detector which cooled by liquid N_2 . The DRIFTS spectra were recorded by accumulating 64 scans with a resolution of 4 cm^{-1} . Firstly, catalyst was heated to 300 °C under N_2 flow $40 \text{ cm}^3/\text{min}$ for 60 min to remove adsorbed impurities and then cooled to 50 °C. Secondly, the sample spectra was collected by subtracting the background spectrum that was collected under a N_2 atmosphere. Finally, 0.8% NH_3/N_2 was introduced into diffuse reflectance pool at least 30 min to get to adsorption saturation, and the total flow rate of the feed gas was kept $25 \text{ cm}^3/\text{min}$.

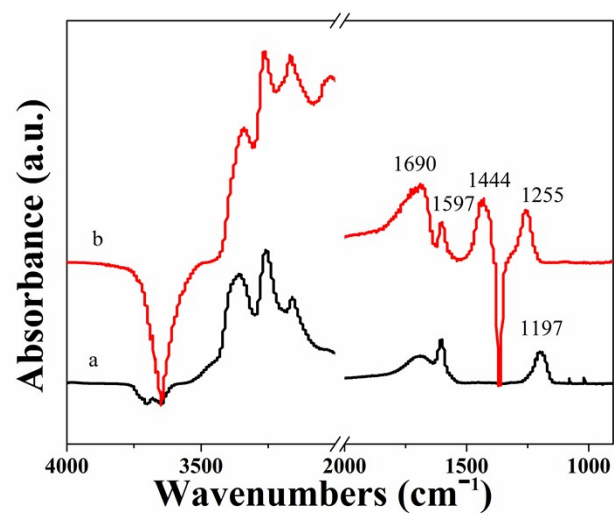


Fig. S9 In situ DRIFTS of the $\text{Ce}_{0.3}\text{TiO}_x$ catalyst under different conditions (a) $\text{NH}_3 + \text{O}_2$ -60 min
(b) $\text{NH}_3 + \text{O}_2$ -60 min (the sample pretreated by SO_2)

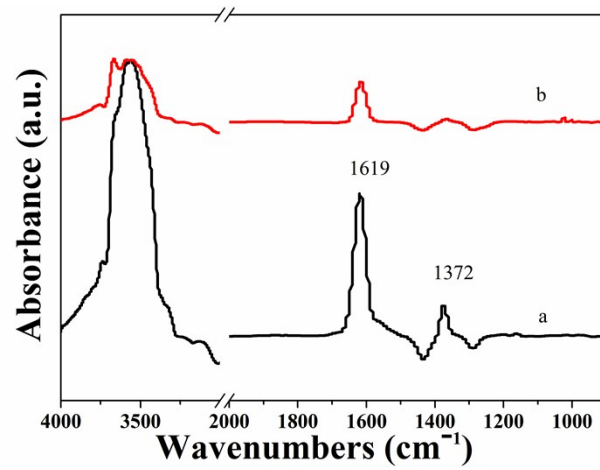


Fig. S10 In situ DRIFTS of the $\text{Ce}_{0.3}\text{TiO}_x$ catalyst under different conditions (a) $\text{NO} + \text{O}_2$ -60 min
(b) $\text{NO} + \text{O}_2$ -60 min (the sample pretreated by SO_2)