

Supporting information

Promotional Effect and Mechanism Study of nonmetal-doped Cr/Ce_xTi_{1-x}O₂ for NO Oxidation: Tuning O₂ Activation and NO Adsorption Simultaneously

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1. Experimental

The N-CeO₂, N-TiO₂ and N-CeTi samples were prepared by the sol-gel method for the confirmation of doping sites.

Synthesis of N-CeO₂. 0.0352 mol Ce(NO₃)₃·6H₂O was added to 0.0704 mol of acetylacetonone (C₅H₈O₂) under continuous stirring. Then, 0.0422 mol cyanamide (CH₂N₂) was diluted with 50 mL ethanolic solution at 50 °C and then was added dropwise into the above solution. After stirring evenly, the solution was heated at 80 °C for 4 h in a water bath and dried at 120 °C for 6 h. Then the dried material was calcined in flowing air at 550 °C for 5 h at a heating rate of 2 °C/min.

Synthesis of N-TiO₂. 0.0352 mol tetrabutyl titanate (C₁₆H₃₆O₄Ti) was added to 0.0704 mol of acetylacetonone (C₅H₈O₂) under continuous stirring. Then, 0.0422 mol cyanamide (CH₂N₂) was diluted with 50 mL ethanolic solution at 50 °C and then was added dropwise into the above solution. After stirring evenly, the solution was heated at 80 °C for 4 h in a water bath and dried at 120 °C for 6 h. Then the dried material was calcined in flowing air at 550 °C for 5 h at a heating rate of 2 °C/min.

Synthesis of N-CeTi. 0.0176 mol tetrabutyl titanate (C₁₆H₃₆O₄Ti) and 0.0176 mol Ce(NO₃)₃·6H₂O were added to 0.0704 mol of acetylacetonone (C₅H₈O₂) under continuous stirring. Then, 0.0422 mol cyanamide (CH₂N₂) was diluted with 50 mL ethanolic solution at 50 °C and then was added dropwise into the above solution. After stirring evenly, the solution was heated at 80 °C for 4 h in a water bath and dried at 120 °C for 6 h. Then the dried material was calcined in flowing air at 550 °C for 5 h at a heating rate of 2 °C/min.

2. Supplementary Figures

Specific surface areas of the different catalysts were determined by N₂ adsorption-desorption measurements at 77 K by employing the Brunauer-Emmet-Teller (BET) method (Gold App V-sorb 2800), and the total pore volume and pore size of the samples were calculated by Barrett-Joyner-Halenda (BJH) method.

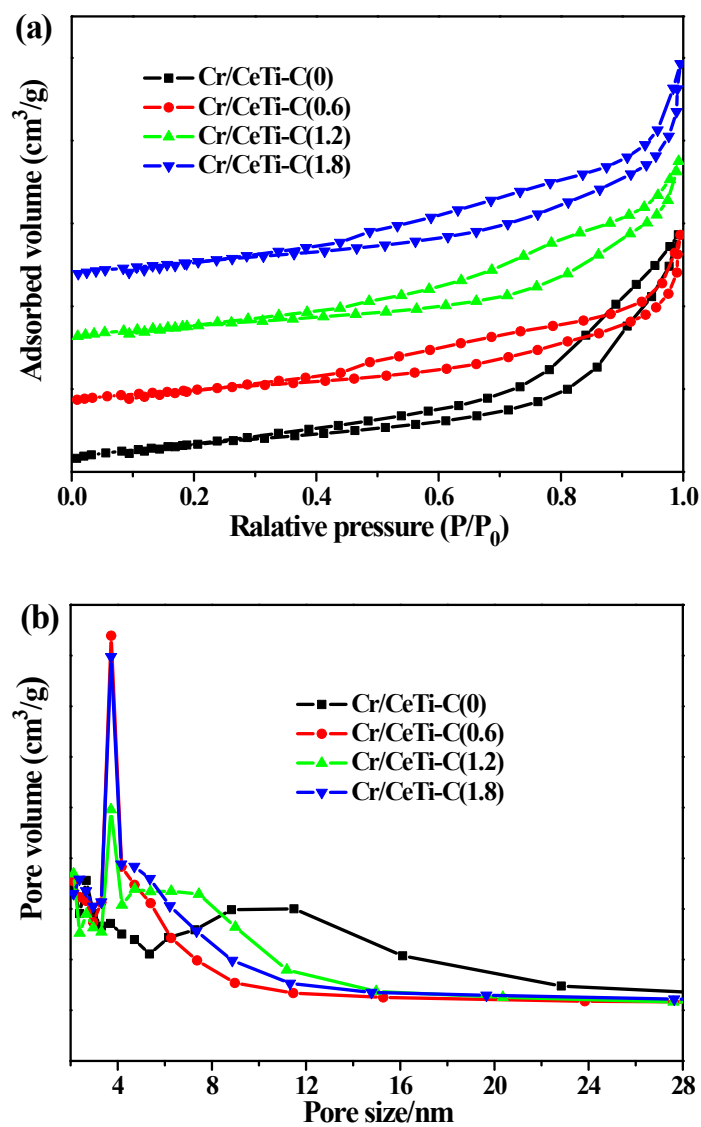


Fig. S1 N₂ adsorption-desorption isotherms (a) and BJH pore distribution curves (b) of the Cr/CeTi-C(x) catalyst.

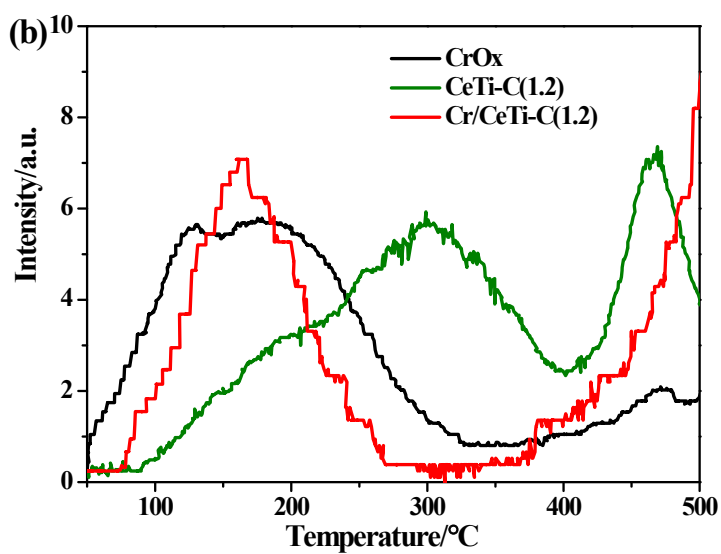
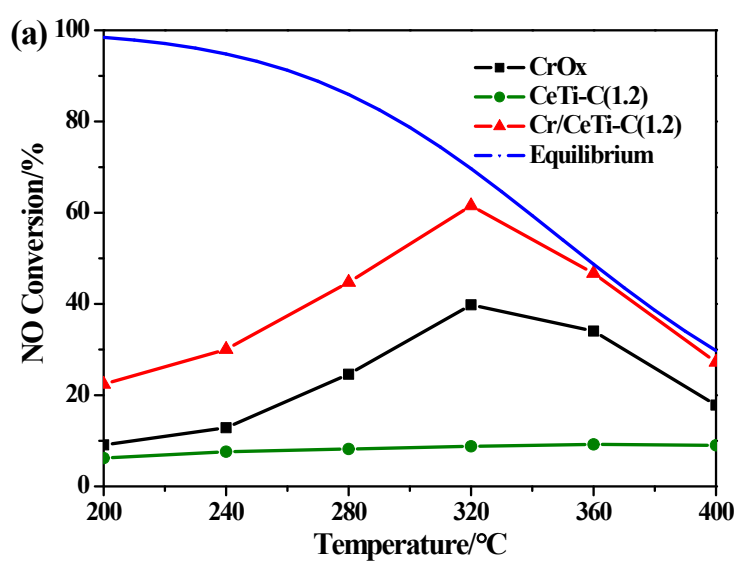
Table S1 Physical properties of the Cr/CeTi-C(x) catalysts.

Sample	Surface area (m ² /g) ^a		Pore volume	Pore diameter ^b
	A _{BET}	A _{Langmuir}	V _p (mm ³ /g)	D _p (nm)
Cr/CeTi-C(0)	24.8	33.6	96.3	9.0

Cr/CeTi-C(0.6)	19.7	26.6	78.6	7.2
Cr/CeTi-C(1.2)	18.1	24.7	74.9	7.0
Cr/CeTi-C(1.8)	21.5	29.3	93.8	7.7

^a Surface areas calculated by the BET method and Langmuir method.

^b Pore sizes obtained from the N₂ adsorption isotherms by the BJH method.



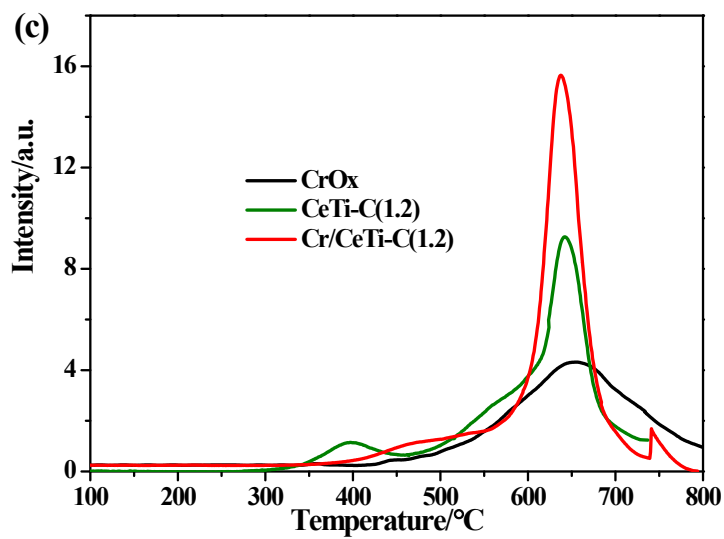


Fig. S2 The NO conversion (a), NO-TPD profiles (b) and O₂-TPD profiles (c) of the CrO_x, CeTi-C(1.2) and the Cr/CeTi-C(1.2) samples.

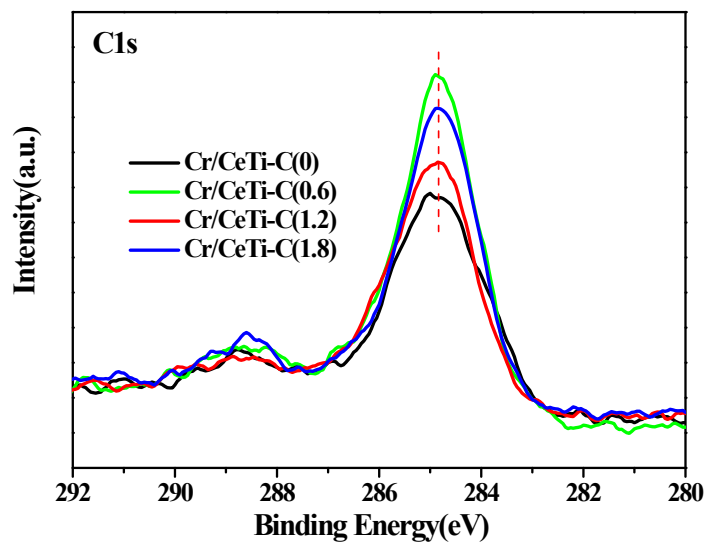


Fig. S3 High resolution XPS spectra of C1s for four Cr/CeTi-C(x) catalysts.