

Supporting Information

A Rational Design for Enhanced Catalytic Activity and Durability: Strongly Coupled N-doped $\text{CrO}_x/\text{Ce}_{0.2}\text{Zr}_{0.8}\text{O}_2$ Nanoparticle Composites

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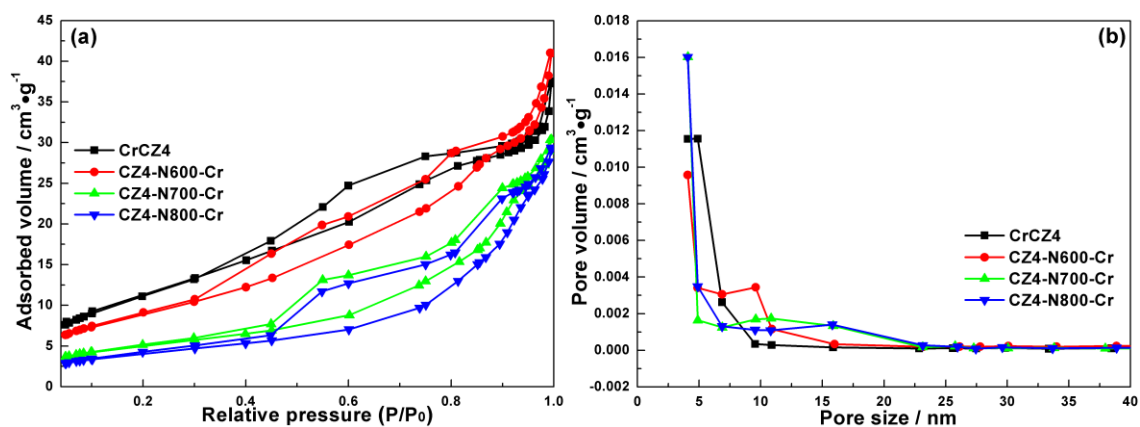


Figure S1. N_2 adsorption-desorption isotherms (a) and pore size distributions (b) of the CrCZ4 and CZ4-N(x)-Cr catalysts.

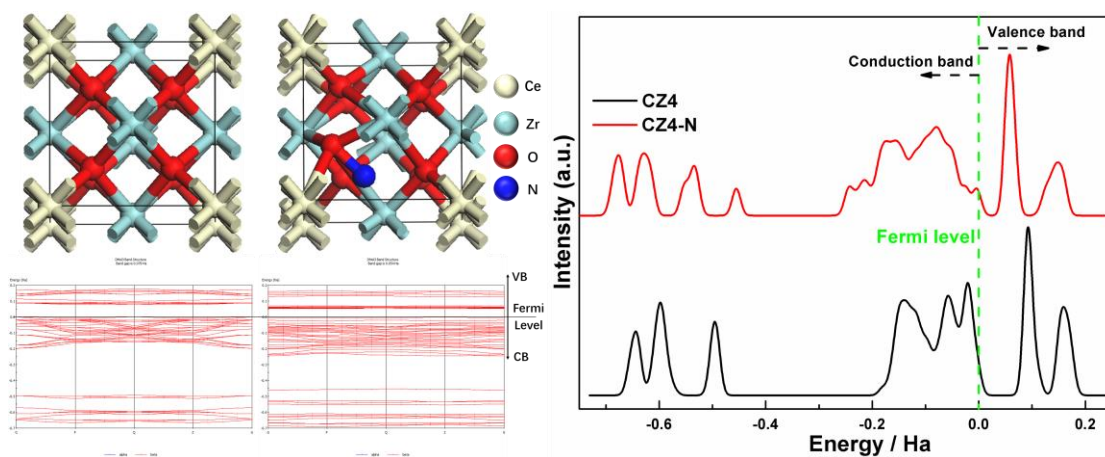


Figure S2. Theoretical calculation on the band structure of CZ4 and N-doped CZ4 samples.

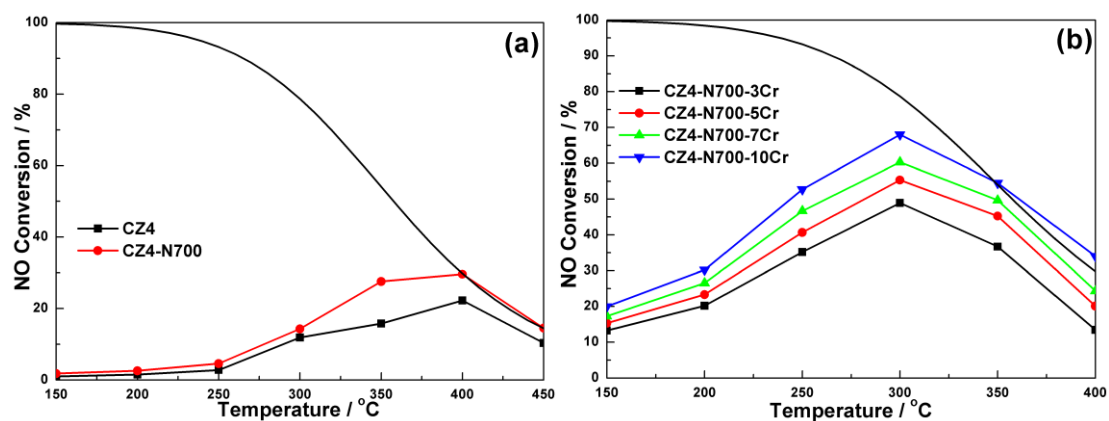


Figure S3. Catalytic oxidation of NO over the CZ4 and CZ4-N700 support (a) and CZ4-N700- x Cr ($x=3, 5, 7, 10$) series catalysts (b).

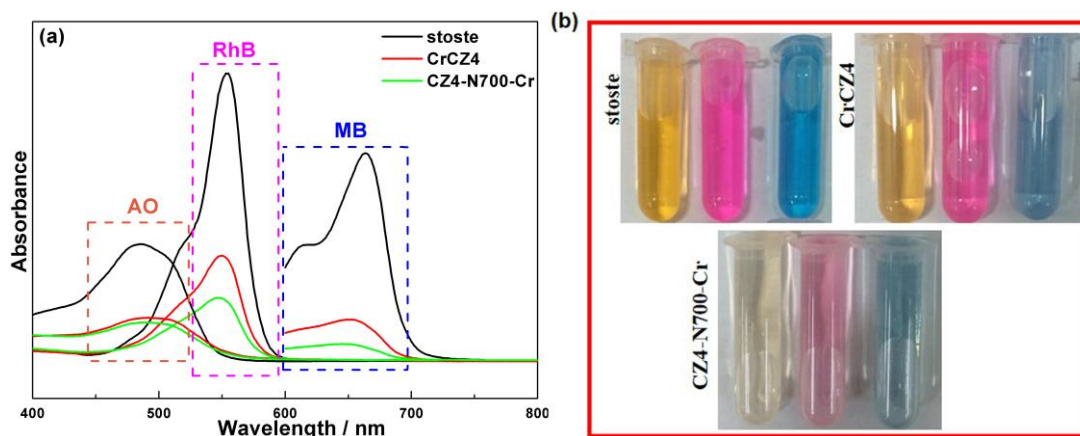


Figure S4. Photodegradation profiles (a) and visual pictures (b) of acid orange (AO), rhodamine B (RhB) and methylene blue (MB) over the CrCZ4 and CZ4-N700-Cr catalysts.

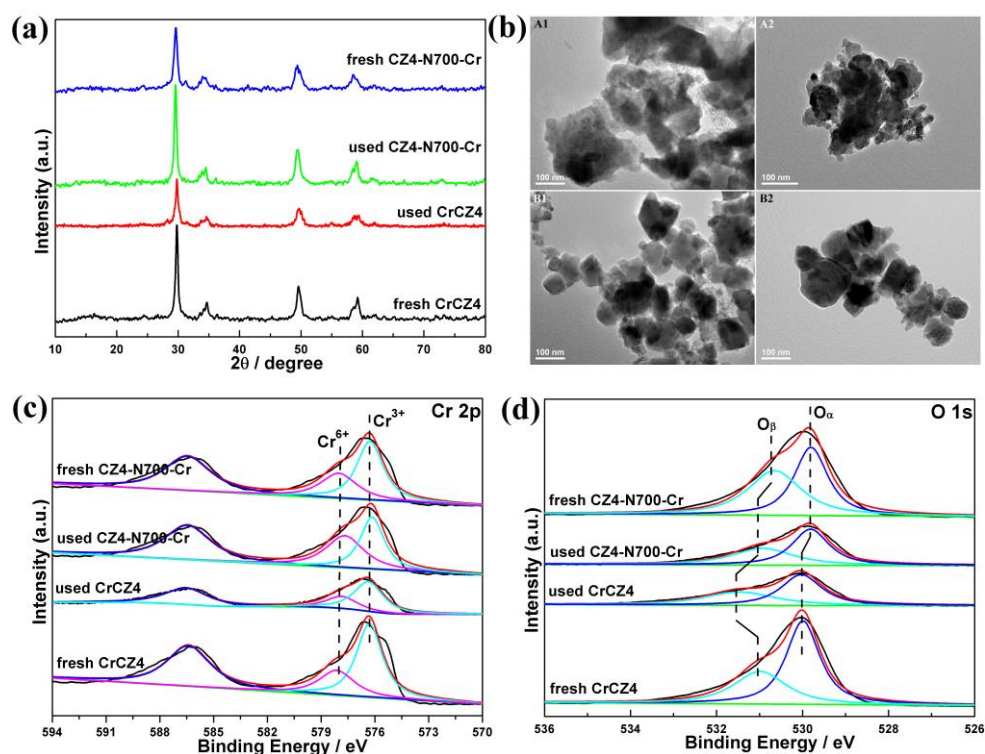


Figure S5. XRD patterns (a), TEM images (b), Cr 2p (c) and O 1s (d) XPS spectra of the fresh (A1&B1) and used (A2&B2) CrCZ4 (A1&A2) and CZ4-N700-Cr (B1&B2) catalysts.

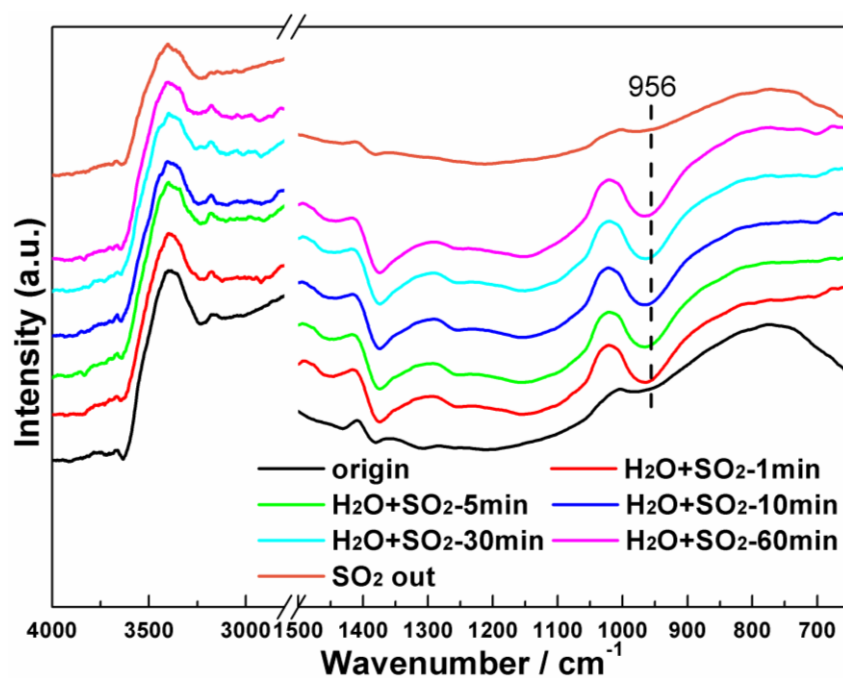


Figure S6. *In situ* DRIFTS spectra of CZ4-N700-Cr upon exposure to 500 ppm NO, 8 vol.% O₂, 6 vol.% H₂O and 400 ppm SO₂ at 250 °C for various times.

Table S1. XPS elementary cation surface concentration of the fresh and used CrCZ4 and CZ4-N700-Cr catalysts.

Samples	Cation ratios	
	$\text{Cr}^{6+}/\text{Cr}_{(\text{total})}$	$\text{O}_{\beta}/(\text{O}_{\alpha}+\text{O}_{\beta})$
fresh-CrCZ4	31.7%	38.0%
used-CrCZ4	30.7%	36.2%
fresh-CZ4-N700-Cr	37.1%	51.1%
used-CZ4-N700-Cr	36.4%	51.3%