

## Electronic Supplementary Information

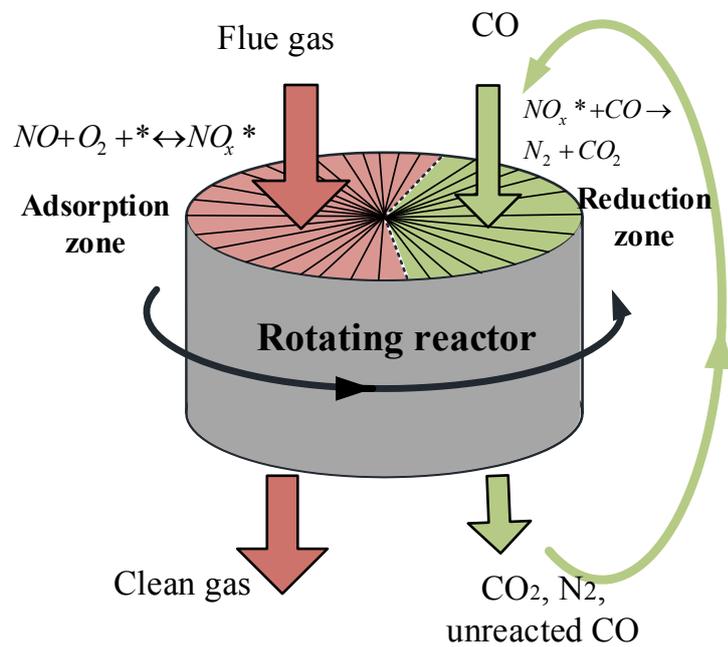


Fig. S1 Schematic diagram of the rotary denitration reactor.

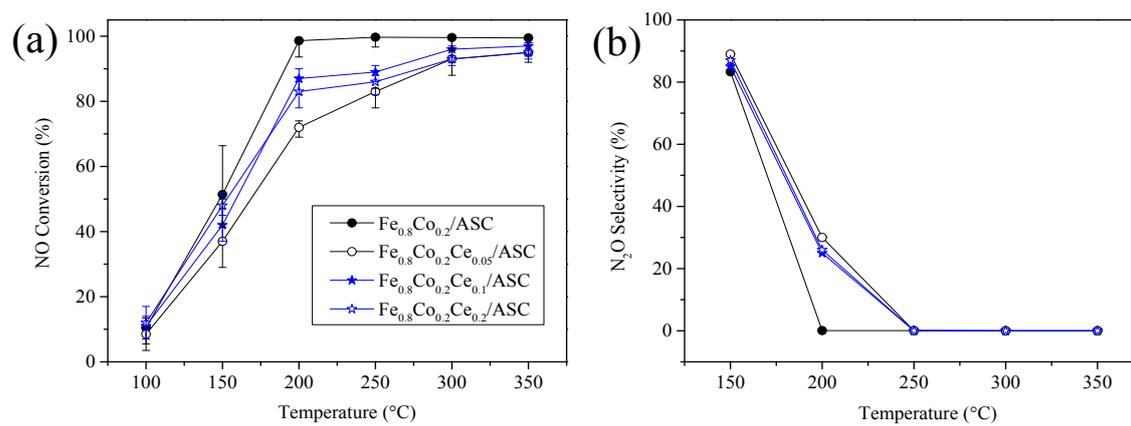


Fig. S2 NO conversion (a) and  $\text{N}_2\text{O}$  selectivity (b) of catalysts in the reduction of NO. Reaction conditions: 2000 ppm CO, 1000 ppm NO and balance  $\text{N}_2$ , GHSV=6,000  $\text{h}^{-1}$ .

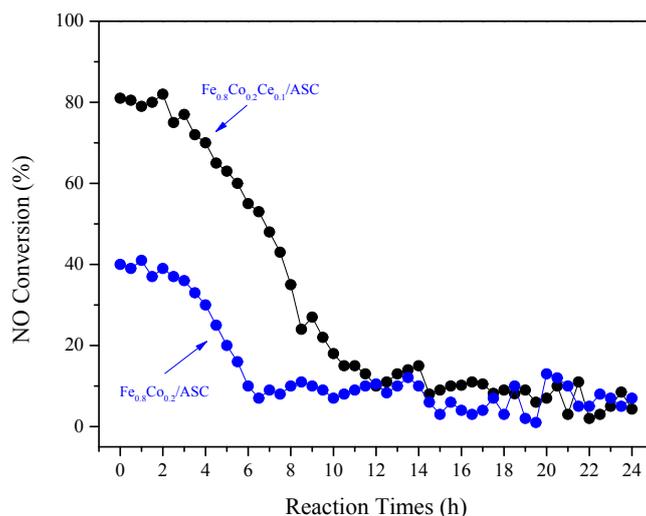


Fig. S3 NO conversion of catalysts. Reaction conditions: 2000 ppm CO, 1000 ppm NO, 200 ppm SO<sub>2</sub> and balance by N<sub>2</sub>, at 250 °C, GHSV=6,000 h<sup>-1</sup>.

It can be found in Fig. S3, the NO conversion decreases with the reaction times for the two catalysts. This demonstrated that the SO<sub>2</sub> in the flue gas can deactivate severely the catalytic performance of the ASC-based catalysts. However, we can find that the addition of Ce enhances the SO<sub>2</sub> tolerance. When SO<sub>2</sub> was introduced into the flue gas, the NO conversion kept at 40% in the time range of 0-2h for Fe<sub>0.8</sub>Co<sub>0.2</sub>/ASC, while this value for Fe<sub>0.8</sub>Co<sub>0.2</sub>Ce<sub>0.1</sub>/ASC was approximate 80%, and the activity continued about 3h. As for the deactivation time point, it is 6 h for Fe<sub>0.8</sub>Co<sub>0.2</sub>/ASC, fortunately, it reached to approximate 12h for the Ce-doped catalysts.

Table S1 ICP results of the prepared catalysts.

Samples	Fe loading wt. %	Co loading wt. %
Fe <sub>0.8</sub> Co <sub>0.2</sub> /ASC	5.58	1.49
Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.05</sub> /ASC	3.81	1.03
Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.1</sub> /ASC	4.22	1.12
Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.2</sub> /ASC	3.52	1.07

Table S2 Binding energies of Ce 3d 5/2 and 3d 3/2 spin-orbit doublets.

Peak assignment	Ce species	Binding energy (eV)
V <sub>0</sub>	Ce <sup>3+</sup>	881.0
V	Ce <sup>4+</sup>	882.7
V'	Ce <sup>3+</sup>	885.6
V''	Ce <sup>4+</sup>	888.7
V'''	Ce <sup>4+</sup>	898.4
U <sub>0</sub>	Ce <sup>3+</sup>	899.1
U	Ce <sup>4+</sup>	901.3
U'	Ce <sup>3+</sup>	904.0
U''	Ce <sup>4+</sup>	907.2
U'''	Ce <sup>4+</sup>	916.9

Table S3 XPS results of the prepared catalysts under different pretreatment.

Samples	Surface Components				
	Fe <sup>3+</sup> (%)	Co <sup>3+</sup> (%)	O <sub>α</sub> (%)	Ce <sup>3+</sup> (%)	SO <sub>4</sub> <sup>2-</sup> (%)
Fresh Fe <sub>0.8</sub> Co <sub>0.2</sub> /ASC	46.49	45.19	55.27		
SO <sub>2</sub> -pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> /ASC	39.31	42.99	47.46		82.69
SO <sub>2</sub> +NO-pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> /ASC	45.39	43.79	48.26		95.57
Fresh Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.05</sub> /ASC	56.89	51.45	59.84	38.71	
SO <sub>2</sub> -pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.05</sub> /ASC	44.44	48.41	60.73	46.08	71.75
SO <sub>2</sub> +NO-pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.05</sub> /ASC	43.50	51.39	61.80	41.51	88.99
Fresh Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.1</sub> /ASC	53.02	51.41	53.64	43.91	
SO <sub>2</sub> -pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.1</sub> /ASC	46.49	50.43	56.22	47.13	51.80
SO <sub>2</sub> +NO-pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.1</sub> /ASC	42.40	47.14	54.28	47.95	52.08
Fresh Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.2</sub> /ASC	44.93	49.93	45.90	35.73	
SO <sub>2</sub> -pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.2</sub> /ASC	52.96	48.42	41.66	37.99	69.19
SO <sub>2</sub> +NO-pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.2</sub> /ASC	42.40	50.29	49.02	36.83	75.21

Table S4 XRF results of prepared catalysts under different conditions.

Samples	Surface SO <sub>3</sub> (%)	StdErr(%)
Fresh Fe <sub>0.8</sub> Co <sub>0.2</sub> /ASC	0.45	0.09
SO <sub>2</sub> -pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> /ASC	2.46	0.11
SO <sub>2</sub> +NO-pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> /ASC	1.87	0.07
Fresh Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.05</sub> /ASC	0.74	0.15
SO <sub>2</sub> -pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.05</sub> /ASC	2.95	0.21
SO <sub>2</sub> +NO-pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.05</sub> /ASC	2.61	0.12
Fresh Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.1</sub> /ASC	0.65	0.09
SO <sub>2</sub> -pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.1</sub> /ASC	3.41	0.13
SO <sub>2</sub> +NO-pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.1</sub> /ASC	2.56	0.15
Fresh Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.2</sub> /ASC	0.81	0.17
SO <sub>2</sub> -pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.2</sub> /ASC	3.94	0.13
SO <sub>2</sub> +NO-pretreated Fe <sub>0.8</sub> Co <sub>0.2</sub> Ce <sub>0.2</sub> /ASC	2.99	0.18

Where, all the sulfates were presented as SO<sub>3</sub>.

To further investigate the surface sulfates after exposure to NO and SO<sub>2</sub>, X-ray fluorescence (XRF) testing was performed. It can be found that for the fresh samples, the percentage of the surface sulfates is 0.4-0.8 wt.%, this is because there is S element in the ASC. As the introduction of SO<sub>2</sub> into the feed gas, the amount of surface sulfates gets increasing. Besides, the percentage is increasing with the loading amount of Ce. We speculate this is ascribed to the fast generation of cerium sulfates. When NO and SO<sub>2</sub> are co-added into the reaction flue, the slight decreasing is observed. It is reasonable to demonstrate there is some interactions between NO and SO<sub>2</sub> on the surface of catalysts.