Supplementary Information

Efficient inhibition of N_2O during NO absorption process using $CuO\&(NH_4)_2SO_3$ mixed solution

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Pages: 15.
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Table 1

Text S1 Preparation and characterization of CuO-dc and CuO-p

CuO-dc was prepared as single phase by a calcination process of $Cu(NO_3)_2$. In detail, $Cu(NO_3)_2$ was firstly heated thermal annealing at 600 ℃ for 3 h at a heating rate of 2.5 ℃ min^{-1} in the atmosphere of nitrogen. After cooling down to room temperature, the powdered catalyst was was obtained after being washed with deionized water and dried at 120 ℃ for 12 h in a vacuum oven.

CuO-p was synthesized by the coprecipitation method. The Cu precursor ($Cu(NO_3)_2$*$5H_2O$) was dissolved in deionized water. The pH of the solution was adjusted by slowly adding ammonia. The precipitation of Cu was separated by centrifugation and washing with deionized water, and then dried at 120 ℃ for 12 h in a vacuum oven. For CuO-p obtained, the treatment of the dried precipitation was carried out as CuO-dc.

The crystal phase composition of the samples was determined by XRD (Cu Kα, Purkinje XD-3) at room temperature, as shown in Fig. S2.

Figures

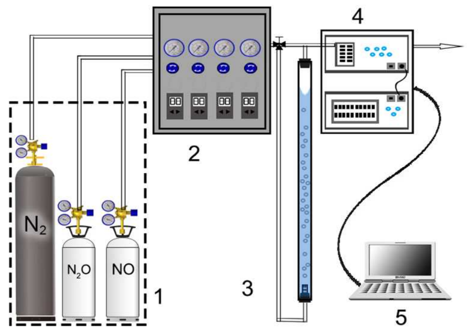

Fig. S1. The reaction system and the analysis system of flue gas (1. Gas cabinet 2. Intake system 3. Bubbling reactor 4. Flue gas analyzer 5. Computer)

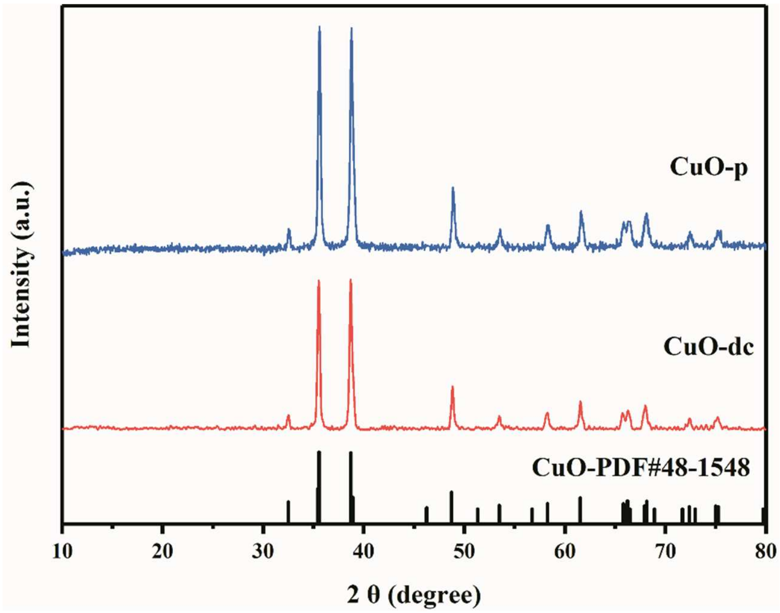

Fig. S2. XRD pattern of CuO-p and CuO-dc

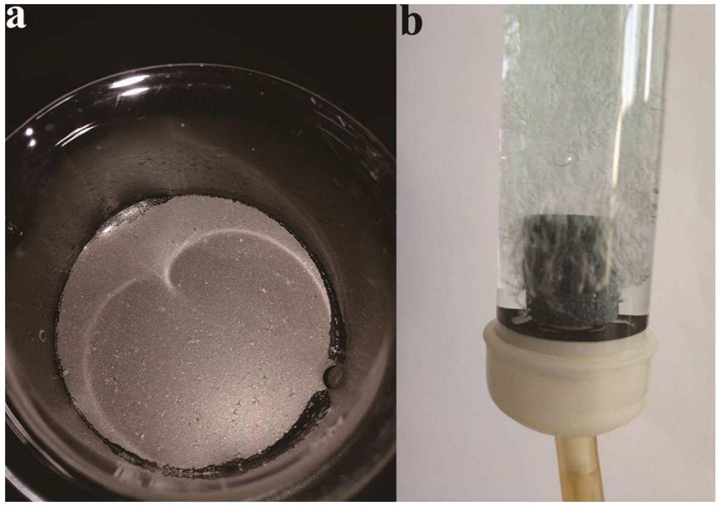

Fig. S3. The floating (a) and sinking (b) copper oxide during the experiment

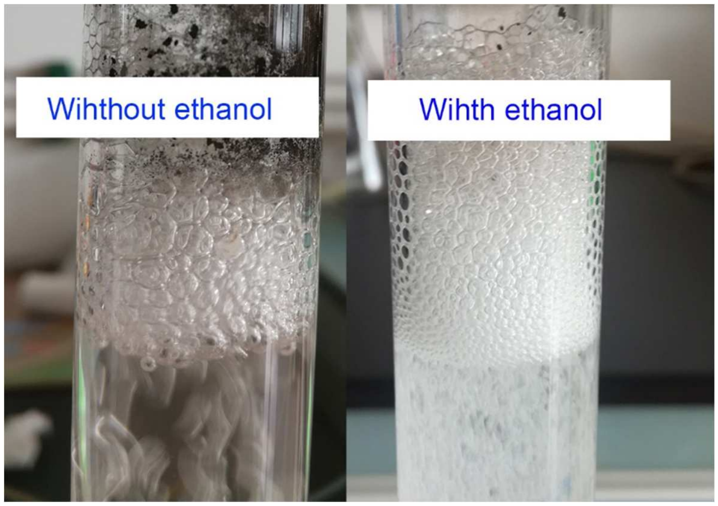

Fig. S4. The effect of ethanol

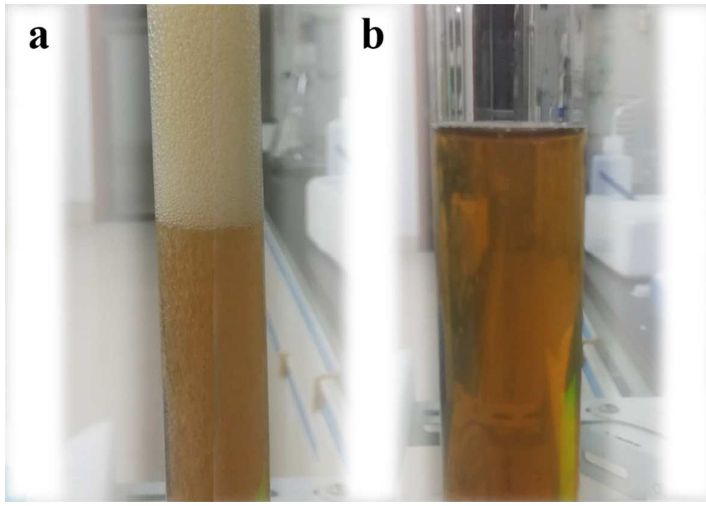

Fig. S5. The red-brown precipitate with H_2O_2 added

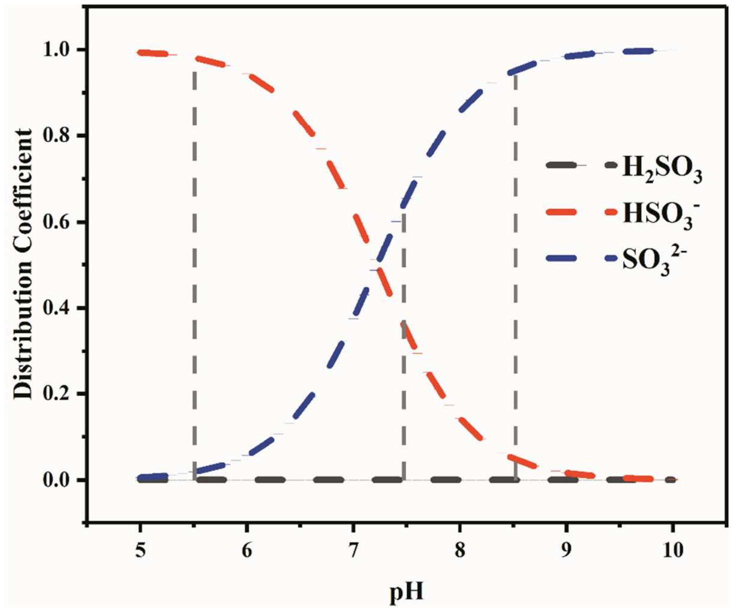

Fig. S6. The distribution of sulfite under different pH

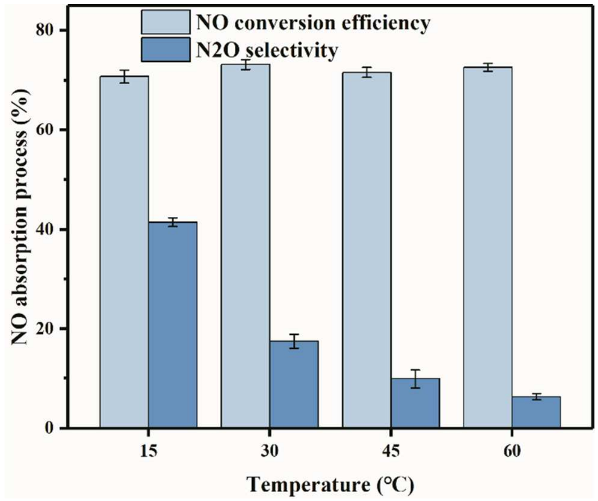

Fig. S7. Influences of temperature. Condition: [CuO-dc] = 0.1 g, [NS] = 50 mM, [E] = 1 vol.%, [NO] = 950 ppm, v (NO) = 100 ml/min.

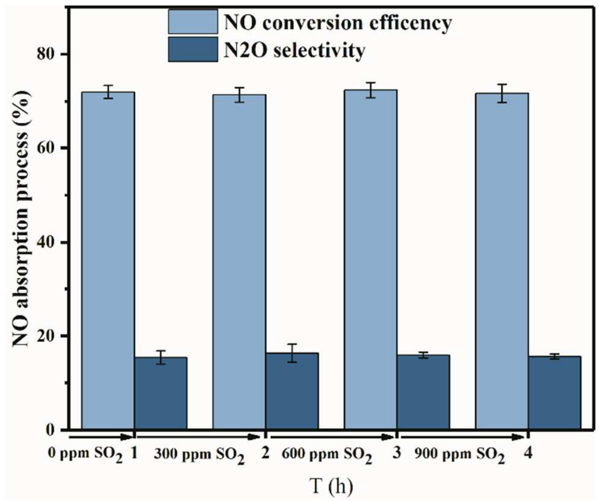

Fig. S8. Influences of SO_2. Condition: [CuO-dc] = 0.1 g, [NS] = 50 mM, [E] = 1 vol.%, [NO] = 950 ppm, v (NO) = 100 ml/min.

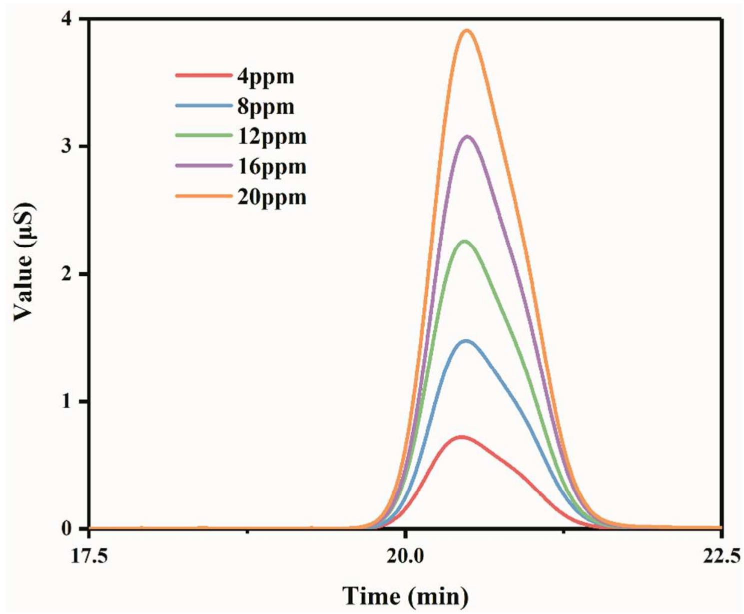

Fig. S9. The ion chromatography curve of Na_2SO_4 standard solution with 0.15 vol.% formaldehyde.

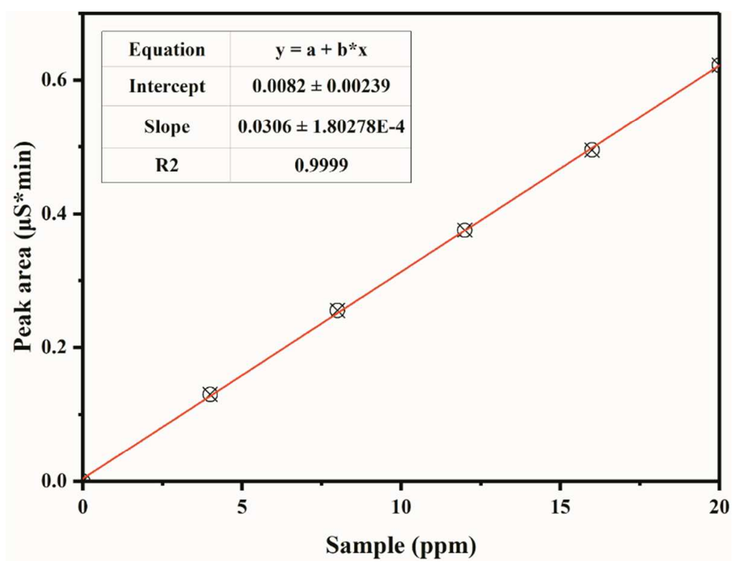

Fig. S10. The calibration curve used for estimation of $(NH_4)_2SO_4$ by Na_2SO_4 concentration. The fitting curve shows good linear relation of absorbance with SO_4^{2-} ion concentration (y = 0.0306x + 0.0082, R^2 = 0.999) of three times independent calibration curves.

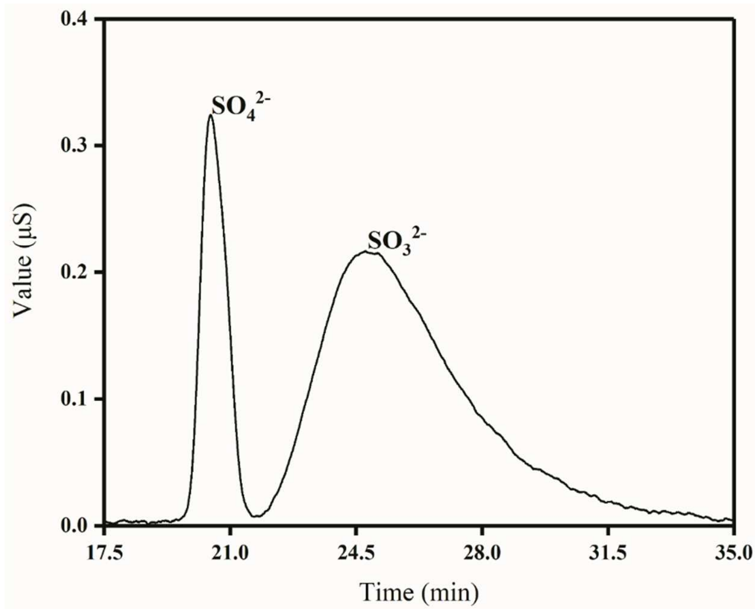

Fig. S11. The ion chromatography curve of $(NH_4)_2SO_4$ standard solution with 0.15 vol.% formaldehyde. The curve shows that sulfate and sulfite can be completely separate under the effect of formaldehyde,

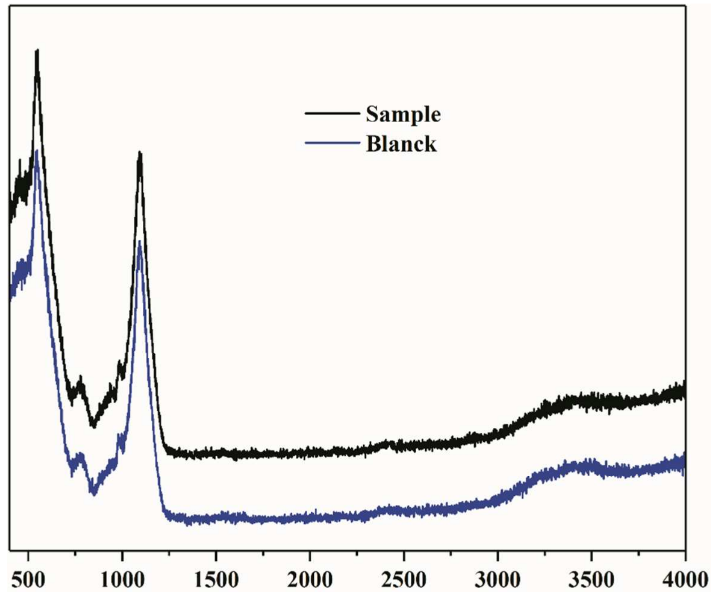

Fig. S12. Raman absorption spectra of the absorption solution before and after reaction.

Table S1. Summary of the adsorbents reported on NO absorption process

Adsorbent	Absorption system	Research content
With Sulfite	$NO + Na_2SO_3$	Kinetics of the reaction of nitric oxide with sulfite.[10]
	$NO_x + Na_2SO_3/NaHSO_3$	Kinetics of the reaction of NO/NO_2 with sodium sulfite and bisulfite.[11]
	$NO + Fe^{2+}$-EDTA/Na_2SO_3	Chemical reactions of NO absorption in Fe^{2+}-EDTA/Na_2SO_3 mixed solution.[18]
	$NO + Na_2SO_3/NaHSO_3$	Kinetics of the reaction of nitric oxide with sulfite and bisulfite ions.[19]
	$NO_x + (NH_4)_2SO_3$	Kinetics of NOx Absorption into $(NH_4)_2SO_3$ Solution.[13]
	$NO/SO_2 + Fe^{2+}$-EDTA/Na_2SO_3	Simultaneous absorption of NO and SO_2 by Fe^{2+}-EDTA in Na_2SO_3 solution.[9]
	$NO + Fe^{2+}$-EDTA/$(NH_4)_2SO_3$	Effects of some process parameters on NO removal efficiency.[12]
	$NO + Fe^{2+}$-Cit/$(NH_4)_2SO_3$	Effects of some process parameters on NO removal efficiency.[24]
Without Sulfite	$NO/SO_2 + Fe^{2+}$-EDTA	Simultaneous absorption of nitric oxide and sulphur dioxide in Fe^{2+}-EDTA solutions.[S1]
	$NO/O_2 + Fe^{2+}$-EDTA	Studies on the simultaneous absorption of NO and in aqueous iron chelate solutions.[S2]
	$NO + Fe^{2+}$-EDTA	Kinetic study on regeneration of Fe^{2+}-EDTA in the wet process of NO removal.[S3]
	$NO/SO_2 + Fe^{2+}$-EDTA/ activated carbon	Absorption of NO&SO_2 into Fe^{2+}-EDTA solution catalyzed by activated carbon.[S4]
	$NO + Na_2S_2O_8/CaO_2$	A wet process for oxidation-absorption of nitric oxide by persulfate/calcium peroxide.[S5]
	NO/ NO_x + oxidants	Wet oxidation and absorption procedure for NO_x removal.[S6, 7]
	$NO + Co(en)_3^{3+}$	Kinetics of Gas−Liquid Reaction between NO and $Co(en)_3^{3+}$.[S8]

References

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