Supporting Information

Inhibitory role of excessive NH$_3$ in NH$_3$-SCR on CeWO$_x$ at low temperatures

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S1 Experimental

A homogeneous precipitation method was applied to prepare $CeWO_x$ (Ce:W molar ratio 1:1), as reported in the literature.[1] In brief, an aqueous solution of ammonium tungstate $((NH_4)_{10}W_{12}O_{41})$, oxalic acid $(H_2C_2O_4)$, cerium nitrate $(Ce(NO_3)_3)$, and urea was stirred vigorously, and then heated overnight, following by filtration, washing, drying and calcination.

The adsorption amounts of NH_3 and NO were studied by a transient response method (TRM) quantitatively at room temperature as described in our previous studies.[2,3] Standard and fast SCR activities were tested at atmospheric pressure in a quartz flow reactor as described in a previous report,[1] applying 100 mg $CeWO_x$ (40~60 mesh). The reaction conditions were: flow rates 500 mL min^{-1}, 500 ppm NO, 500 ppm or 1000 ppm NH_3, 5 vol.% O_2, 5% H_2O (when used) and balance N_2 for standard SCR, and 250 ppm NO, 250 ppm NO_2, 500 ppm or 1000 ppm NH_3, 5 vol.% O_2, 5% H_2O (when used) and balance N_2 for fast SCR. NH_3, NO_2, NO, and N_2O in the effluent gas were determined by a NEXUS 670-FTIR spectrometer quantitatively. The data were recorded under steady state and the NO_x conversion percentages were calculated based on the following equation:[4]

$$NO_x \text{ conversion} = \left(1 - \frac{[NO]_{out} + [NO_2]_{out}}{[NO]_{in} + [NO_2]_{in}}\right) \times 100\%$$
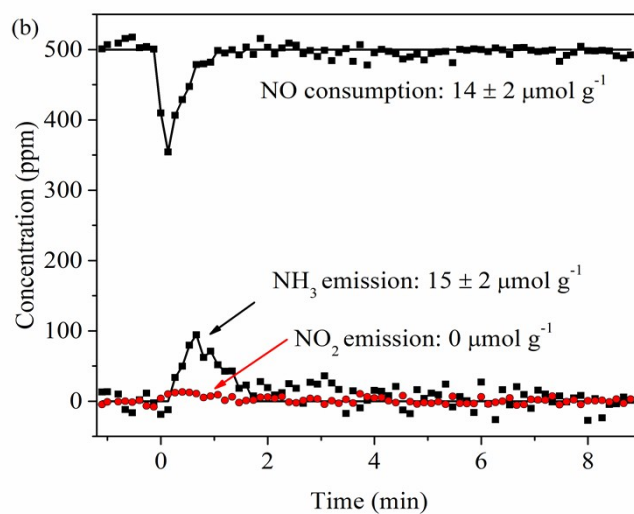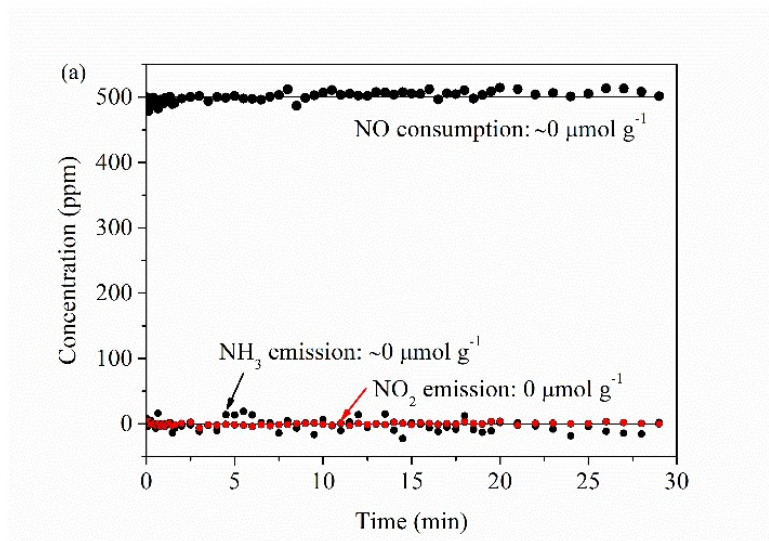
Figure S1 (a) NO adsorption at room temperature over CeWO$_x$ pre-treated in flowing 500 ppm NH$_3$ in N$_2$ until saturation and then purged by N$_2$, and (b) NO and 2 vol.% H$_2$O adsorption at room temperature over CeWO$_x$ pre-treated in 2 vol.% H$_2$O and then flowing 500 ppm NH$_3$ in N$_2$ until saturation and then purged by N$_2$.
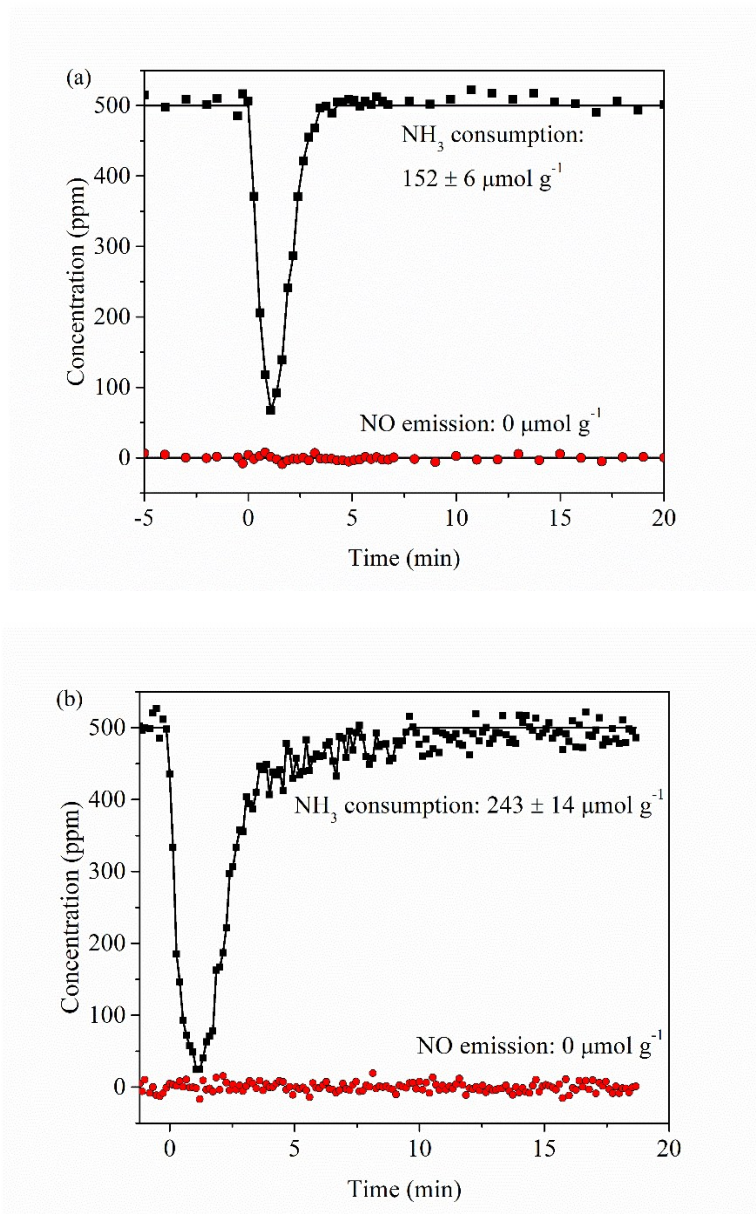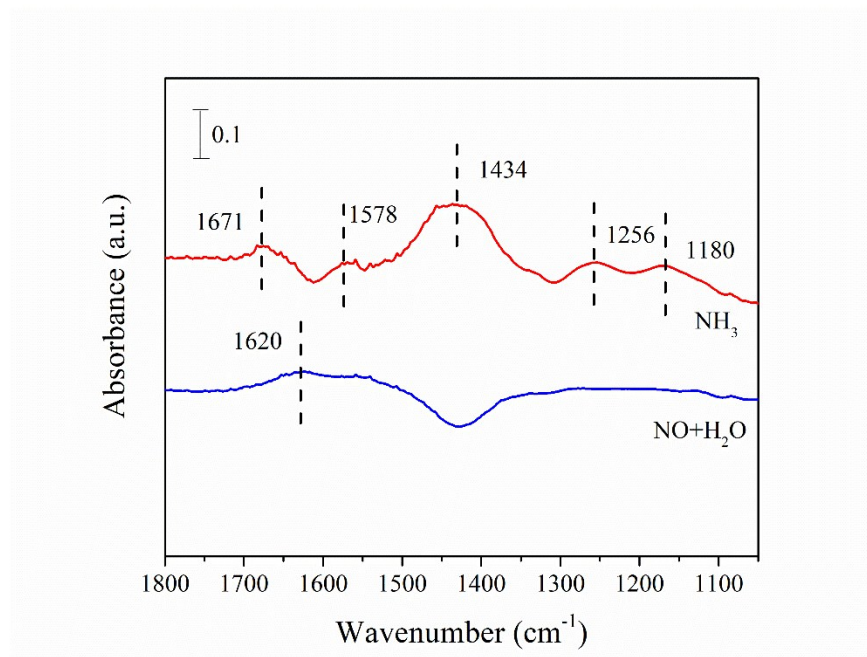
Figure S2 NH$_3$ adsorption at room temperature over CeWO$_x$ pre-treated (a) in flowing 500 ppm NO in N$_2$ until saturation and then purged by N$_2$ and (b) in flowing 500 ppm NO and 2 vol% H$_2$O in N$_2$ until saturation and then purged by N$_2$.
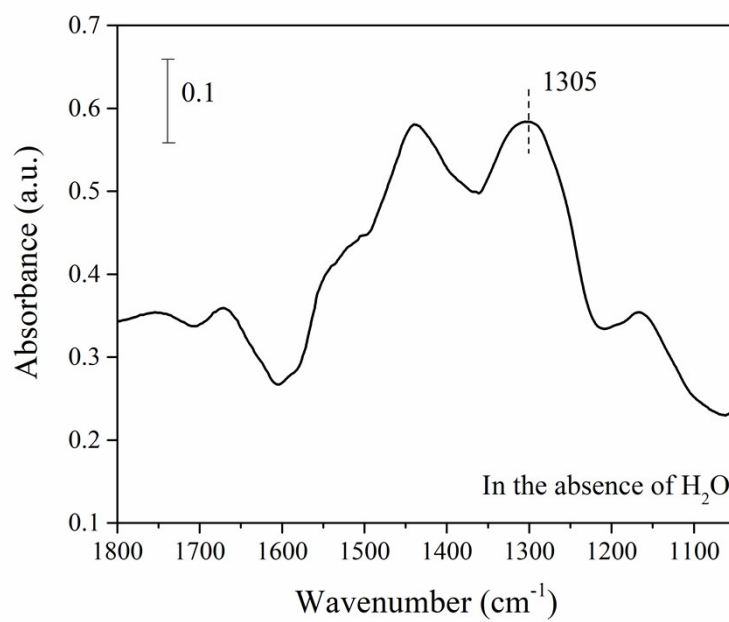
Figure S3 In situ DRIFTS results of 500 ppm NO-pretreated CeWO$_x$ treated by NH$_3$ at 30 °C.
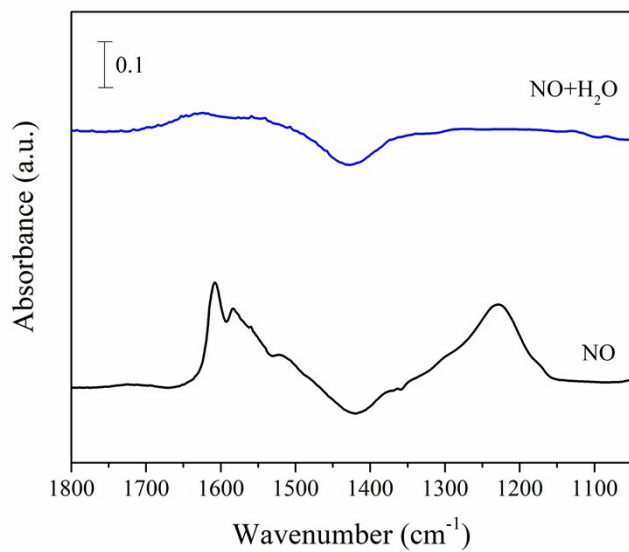
Figure S4 In situ DRIFTS results of CeWO$_x$ treated in 500 ppm NO and 500 ppm NO + 2 vol.% H$_2$O after N$_2$ purge, respectively, at 150 ^{o}C.

Figure S5 In situ DRIFTS results of CeWO$_x$ treated in 500 ppm NO + 2 vol.% H$_2$O at 150 ^{o}C, and then treated in 500 ppm NH$_3$.

Table S1 NO and NH_3 adsorption at room temperature over $CeWO_x$

	NH_3 adsorption (µmol g^{-1})	NO adsorption after NH_3 adsorption (µmol g^{-1})	NO adsorption (µmol g^{-1})	NH_3 adsorption after NO adsorption (µmol g^{-1})
In the absence of H_2O	160 ± 5 [a]	~0	~10 ± 2 [a]	~152 ± 6
In the presence of H_2O	245 ± 6 [a]	~14 ± 2	~20 ± 3 [a]	~243 ± 14

[a] data from the literature.[2]

References:

1. W.P. Shan, F.D. Liu, H. He, X.Y. Shi and C.B. Zhang, *Chem. Commun.* 2011, **47**, 8046-8048.

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3. K. Liu, Z.D. Yan, H. He, Q.C. Feng and W.P. Shan, *Catal. Sci. Technol.* 2019, **9**, 5593-5604.

4. K. Liu, F.D. Liu, L.J. Xie, W.P. Shan and H. He, *Catal. Sci. Technol.* 2015, **5**, 2290-2299.