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Supporting Information

Sulfur Poisoning and NH_3 Regeneration of Pt/Al_2O_3 Monolith Catalyst

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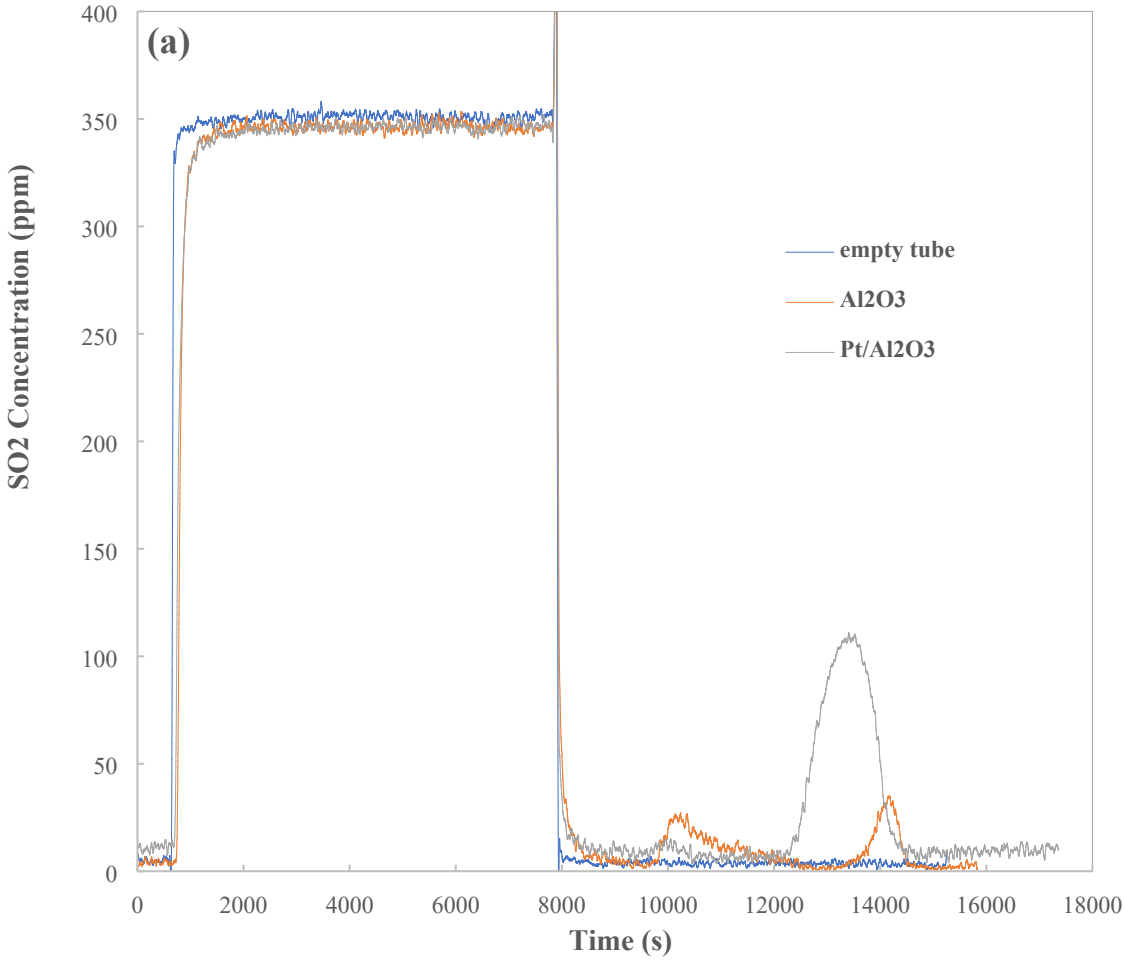


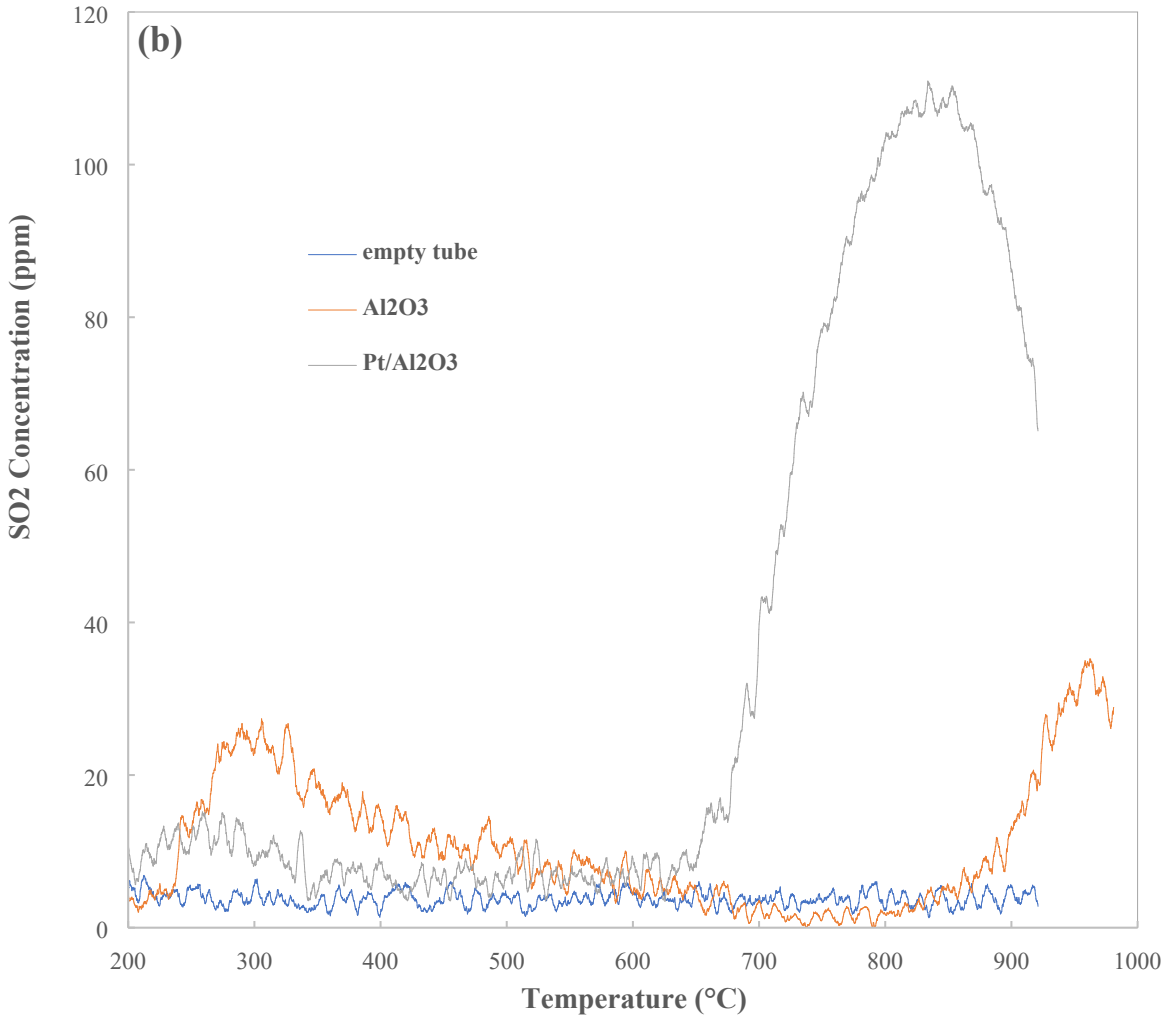
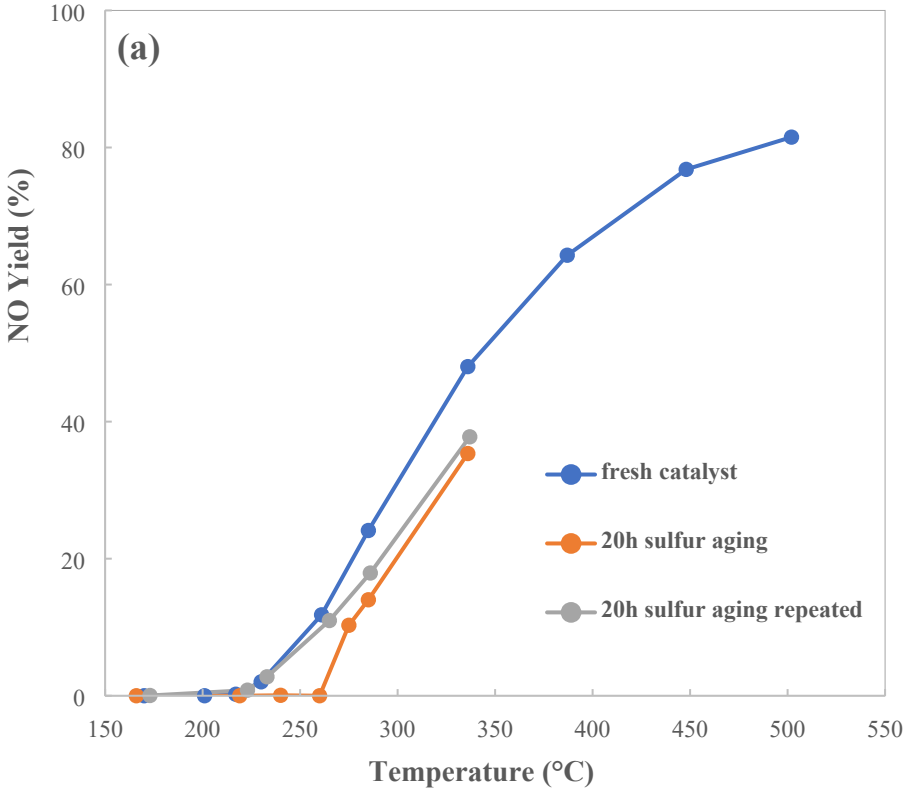
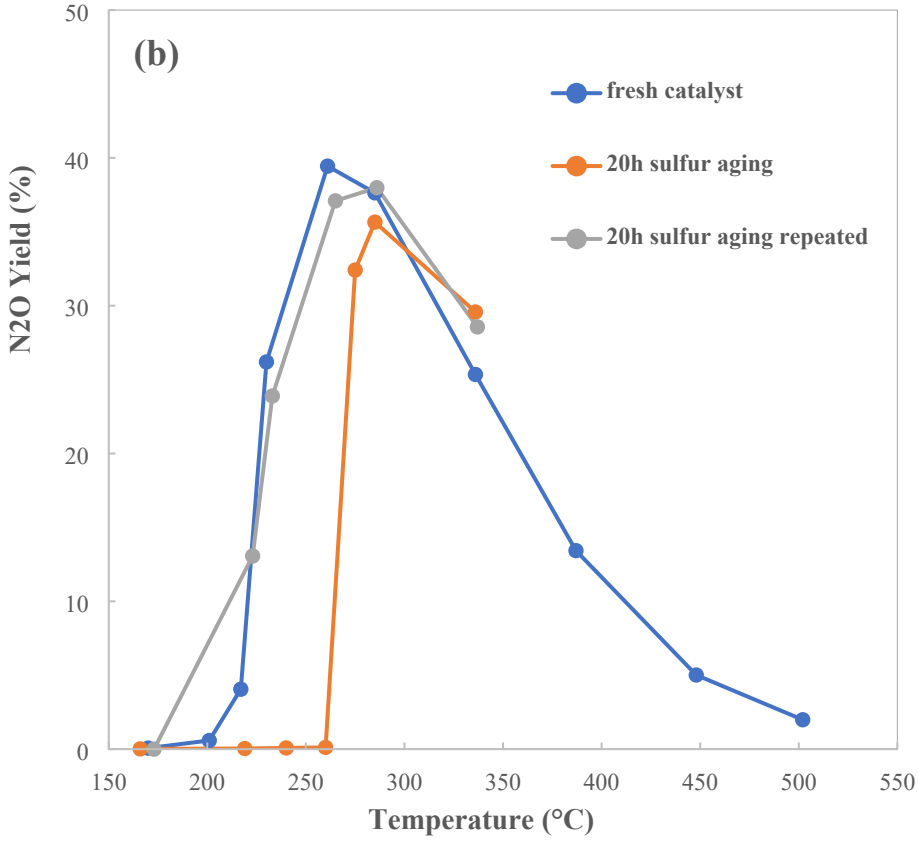


Fig. S1 SO_2 TPD profiles for Al_2O_3 and Pt/Al_2O_3 (a) concentration versus time and (b) concentration versus temperature.

Table S1 Amount of SO_2 adsorbed and desorbed during SO_2 TPD in Ar

Sample	SO_2 adsorbed (μmol)	SO_2 desorbed (μmol)
Al_2O_3	4.66	4.29
Pt/Al_2O_3	8.78	8.7


(a)
NO Yield (%)
100
80
60
40
20
0
150
200
250
300
350
400
450
500
550
Temperature (°C)
fresh catalyst
20h sulfur aging
20h sulfur aging repeated


(b)
N2O Yield (%)
50
40
30
20
10
0
150
200
250
300
350
400
450
500
550
Temperature (°C)
fresh catalyst
20h sulfur aging
20h sulfur aging repeated

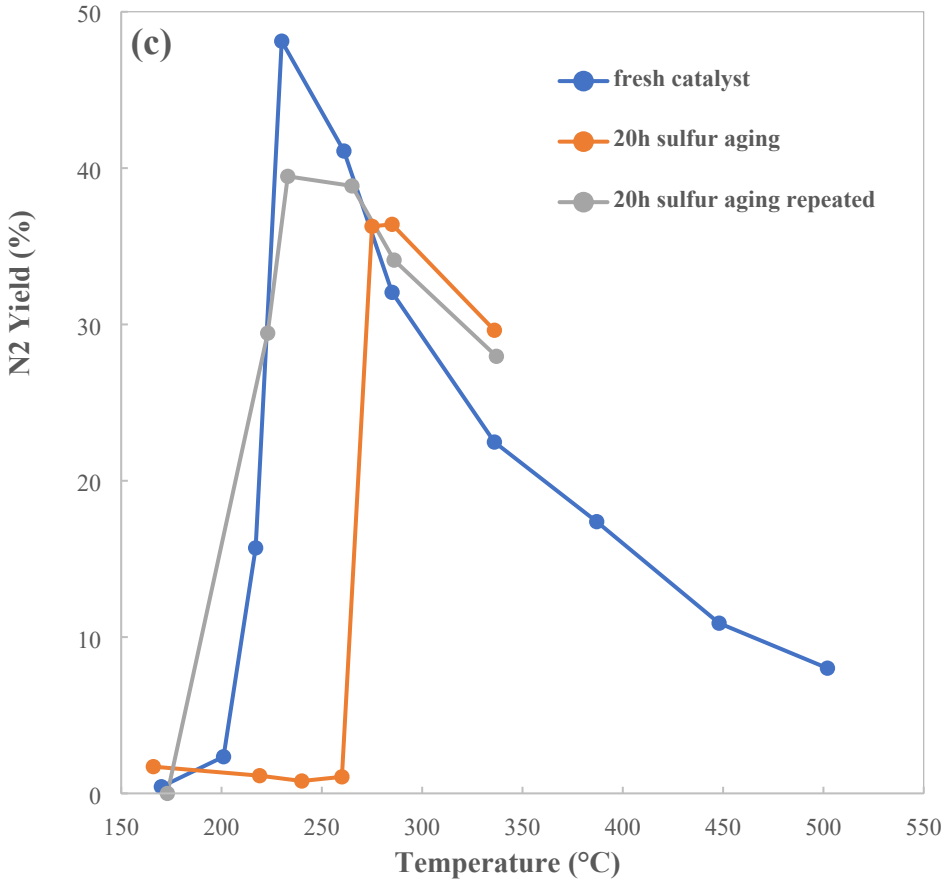
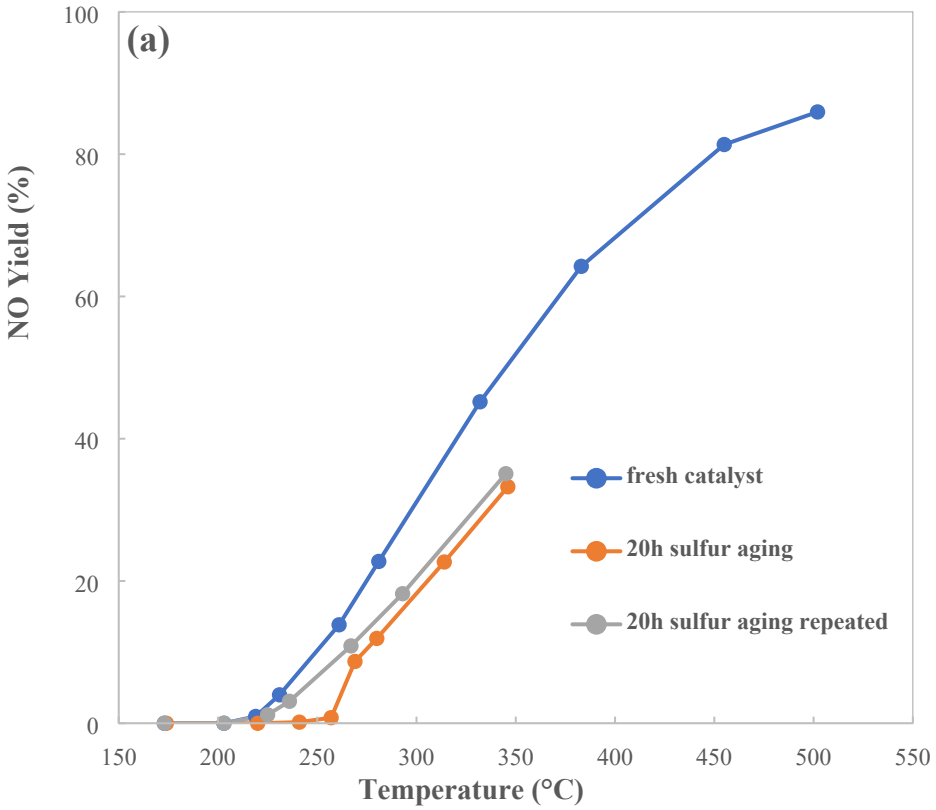
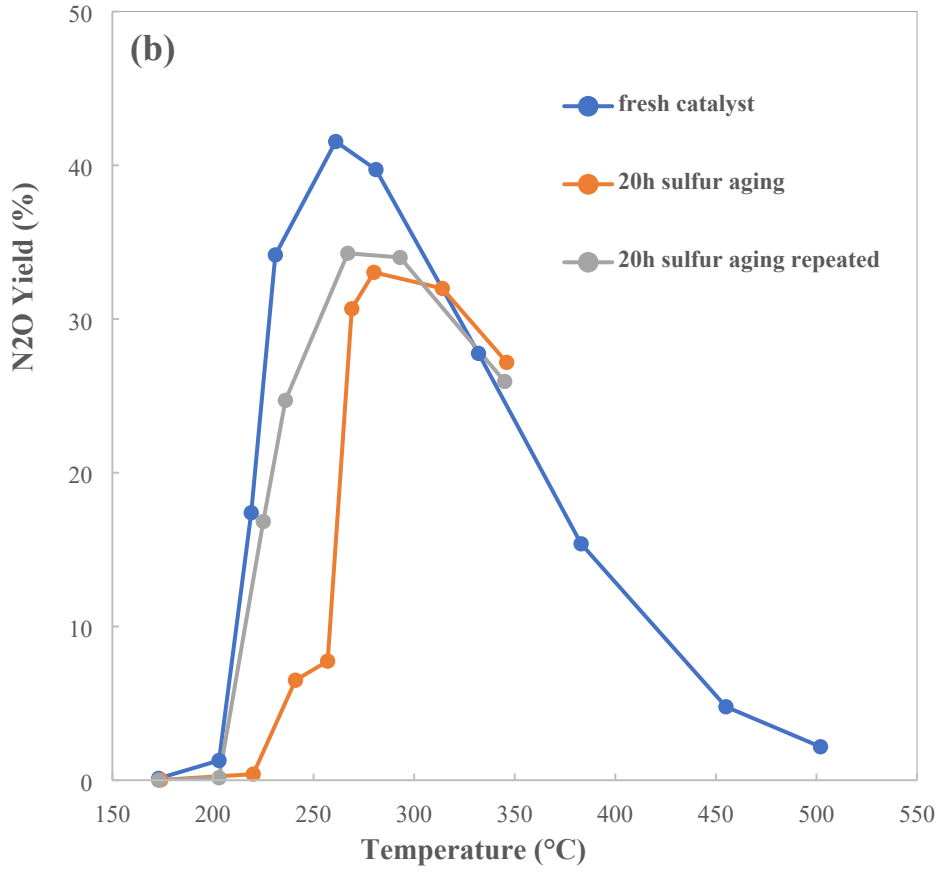


Fig. S2 Steady-state (a) NO yield, (b) N_2O yield, (c) N_2 yield over fresh and poisoned Pt/Al_2O_3 catalyst which is sulfur poisoned in the absence of water.


(a)
NO Yield (%)
100
80
60
40
20
0
150
200
250
300
350
400
450
500
550
Temperature (°C)
fresh catalyst
20h sulfur aging
20h sulfur aging repeated


(b)
N2O Yield (%)
50
40
30
20
10
0
150
200
250
300
350
400
450
500
550
Temperature (°C)
fresh catalyst
20h sulfur aging
20h sulfur aging repeated

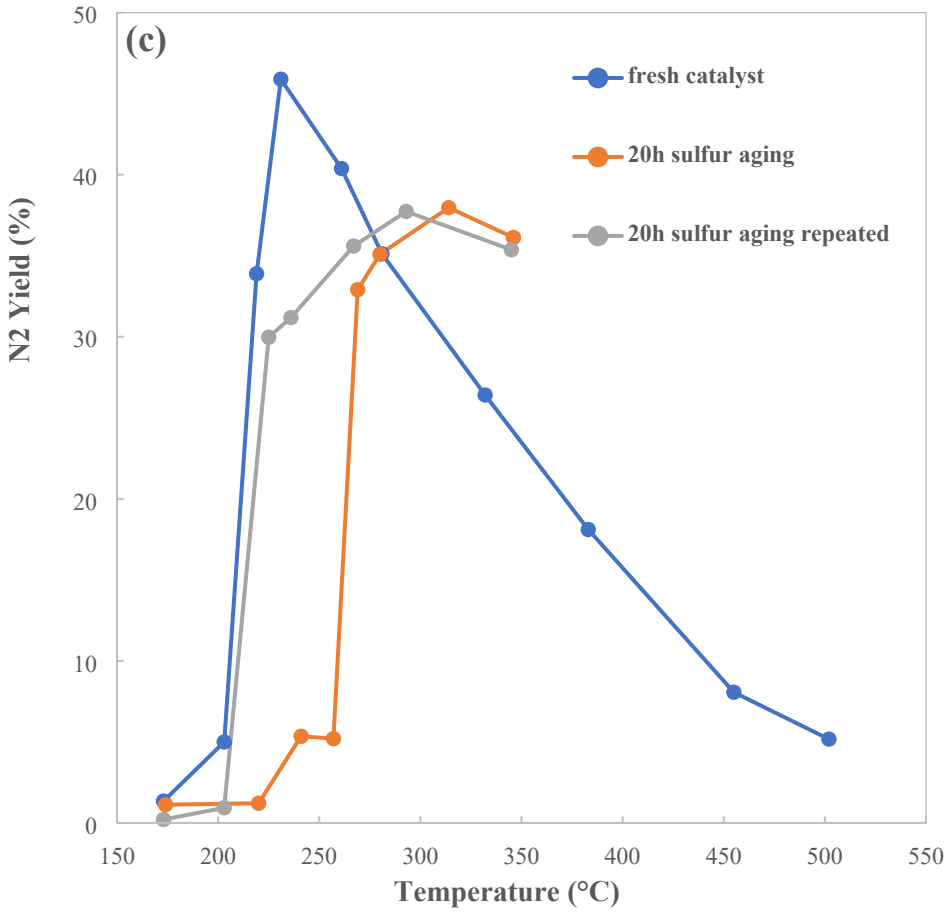


Fig. S3 Steady-state (a) NO yield, (b) N_2O yield, (c) N_2 yield over fresh and poisoned Pt/Al_2O_3 catalyst which is sulfur poisoned in the presence of water.

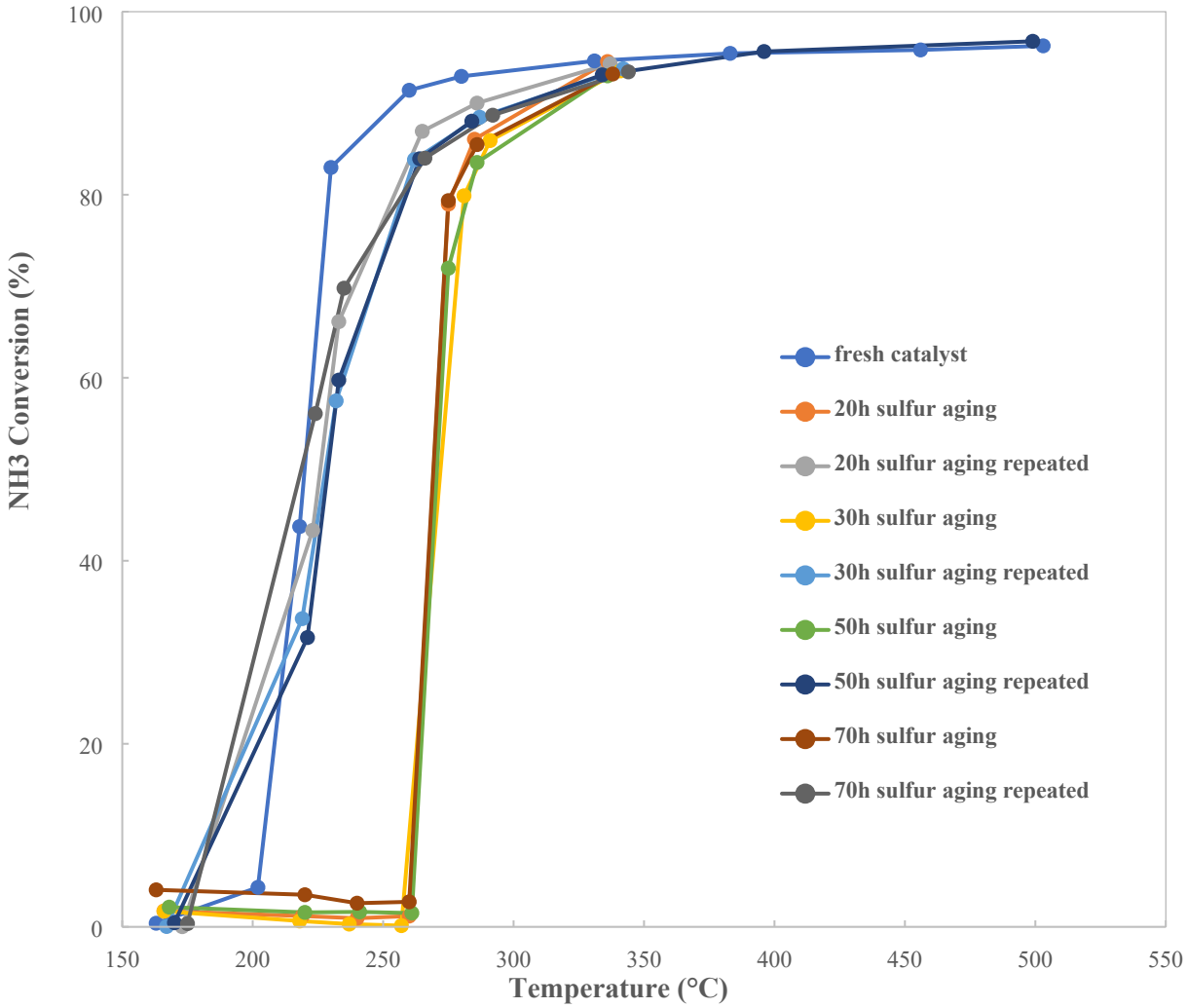


Fig. S4 Steady-state NH_3 oxidation over fresh and various sulfur aged catalyst.

S5. Adiabatic temperature rise for NH_3 oxidation

In this section, the adiabatic temperature rise for NH_3 oxidation taking place during typical light-off experiments is estimated. Considering the following reaction of NH_3 oxidation over Pt:

$4\ NH_3 + 3\ O_2 \rightarrow 2\ N_2 + 6\ H_2O$ $\Delta H = -2.26 \times 10^5$ J/mole NH_3

The adiabatic temperature rise is determined from:

$$\Delta T = \frac{(-\Delta H) C_{0,NH3}}{\rho_g C_{pg}} \Delta X$$

where

ΔH = enthalpy of reaction (kJ/mole NH_3)

$C_{0,NH3}$ = Molar concentration of NH_3 (mole/m^3)

ρ_g = Density of reacting gas (kg/m^3)

C_{pg} = Specific heat of the reacting gas (kJ/kg/K)

ΔX = NH_3 conversion

We evaluate the case of high NH_3 concentration feed at complete NH_3 conversion.

Case 1: 5000 ppm NH_3, 10 vol. % O_2, balance Argon @ 100% ammonia conversion for washcoated monolith

$$\Delta T = \frac{(-\Delta H) C_{0,NH3}}{\rho_g C_{pg}} \Delta X = \frac{(226) * 0.22}{1.7307 * 0.61} * 1 = 48\ K$$