

Supplementary data

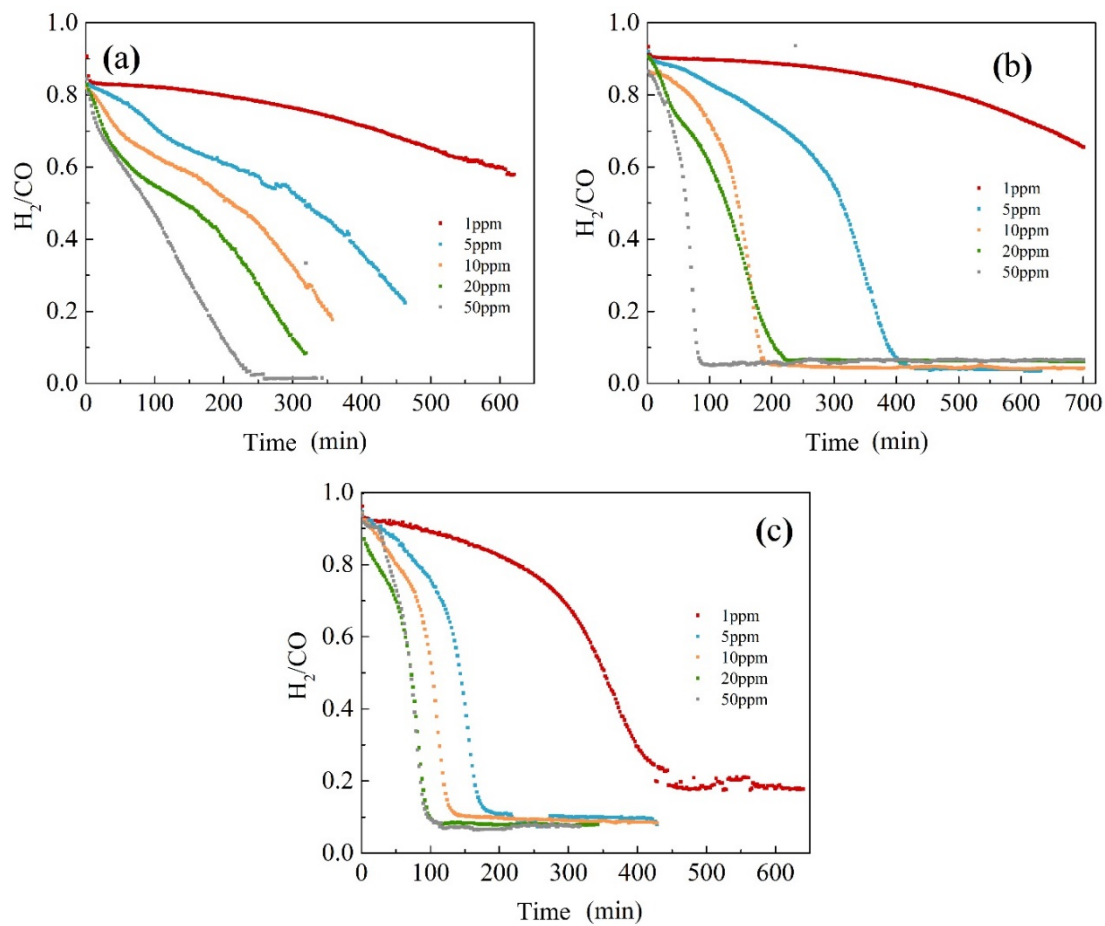


Fig. S1 H_2/CO ratios with the presence of H_2S . (a) 700°C; (b) 750°C; (c) 800°C, GHSV=15000 mL/(g_{cat}·h).

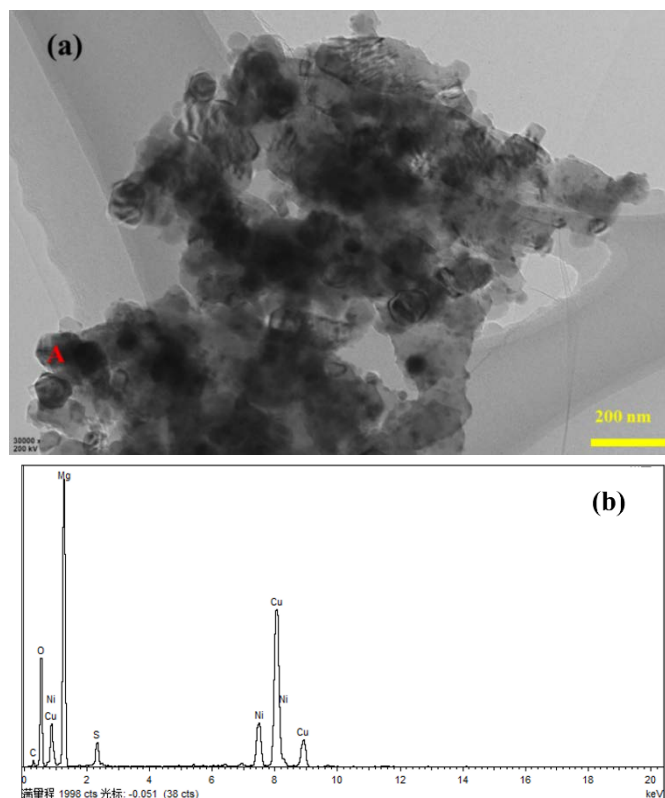


Fig. S2 (a) Representative TEM and (b) EDS diagram of point A after 12-hour reaction at 750°C in the presence of 20 ppm H₂S.

Table S1 Surface area and pore structure parameters of deactivated catalyst after 12-hour reaction at 750°C in the presence of different concentrations of H₂S.

Samples	S _{BET} (m ² /g)	Pore volume (cm ³ /g)	Average pore size (nm)
Fresh catalyst	9.9	0.10	27.4
Reduced catalyst	9.7	0.07	34.5
In 1 ppm H ₂ S	8.0	0.08	46.4
In 5 ppm H ₂ S	7.9	0.08	71.2
In 10 ppm H ₂ S	7.8	0.08	73.8
In 20 ppm H ₂ S	7.9	0.08	71.0
In 50 ppm H ₂ S	7.8	0.07	72.9

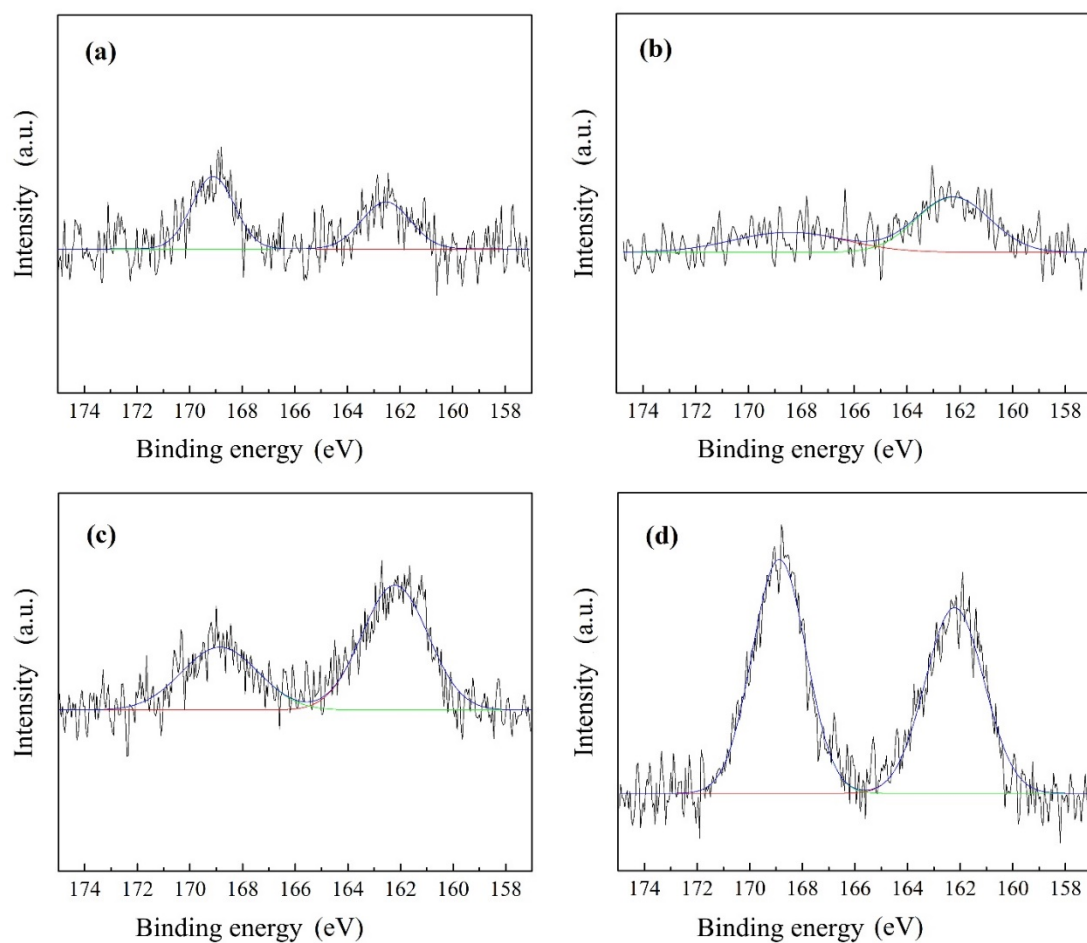


Fig. S3 XPS (S 2p) fitting for catalysts after 12-hour reaction at 750 °C with different concentrations of H₂S: (a) 5 ppm; (b) 10 ppm; (c) 20 ppm; (d) 50 ppm.

Table S2 Surface area and pore structure parameters of fresh, spent (with 20 ppm H₂S) and regenerated catalysts.

Samples	S _{BET} (m ² /g)	Pore volume (cm ³ /g)	Average pore size (nm)
Fresh	9.9	0.10	27.4
Spent	7.9	0.08	71.0
Regenerated after 700 °C reaction	8.1	0.08	61.4
Regenerated after 750 °C reaction	8.1	0.07	49.9
Regenerated after 800 °C reaction	7.5	0.06	66.1

Table S3 Decline rate of CH₄ conversion with the presence of NH₃ at 700 °C–800 °C.

NH ₃ (ppm)	Decline rate of CH ₄ conversion (%/min)		
	700 °C	750 °C	800 °C
50	0.0124	0.0122	0.0074
100	0.0263	0.0261	0.0216
500	0.0324	0.0263	0.0197
2000	0.0378	0.0207	0.0152
10000	0.0404	0.0254	0.0324

Table S4 Surface area and pore structure parameters of fresh catalyst and spent catalysts affected by NH₃.

NH ₃ concentration	S _{BET} (m ² /g)	Pore volume (cm ³ /g)	Average pore size (nm)
0	9.9	0.10	27.4
50 ppm	13.4	0.09	30.0
100 ppm	10.2	0.08	41.8
500 ppm	8.5	0.06	43.0
2000 ppm	14.0	0.08	22.5
10000 ppm	10.9	0.10	44.5

Table S5 Surface atomic percentage of spent catalysts (under 750 °C and 800 °C, 1 ppm H₂S+0.5% NH₃) and regenerated catalyst.

Samples	Ni (%)	Mg (%)	O (%)	C (%)	N (%)	S (%)
Under 750 °C	5.7	23.4	49.7	17.5	2.9	0.8
Under 800 °C	6.0	34.0	44.6	13.1	1.8	0.6
Regenerated	4.9	31.0	46.5	14.7	2.3	0.6

Table S6 XPS (O 1s) peak calculation data of spent catalysts (under 750 °C and 800 °C, 1 ppm H₂S+0.5% NH₃) and regenerated catalyst.

Samples	Area of peak 1	Area of peak 2	Total area	r ²	O _α /O _β
Under 750 °C	26215.9	72859.2	99075.1	0.9984	0.36
Under 800 °C	22072.1	73567.5	95639.6	0.9974	0.30
Regenerated	19884.1	79894.0	99778.1	0.9972	0.25