

Fig. S1. N₂ adsorption-desorption isotherm of the catalysts.

(a) Al₂O₃, 0Si, 1Si, 3Si; (b) 5Si, 7Si, 9Si, 11Si.

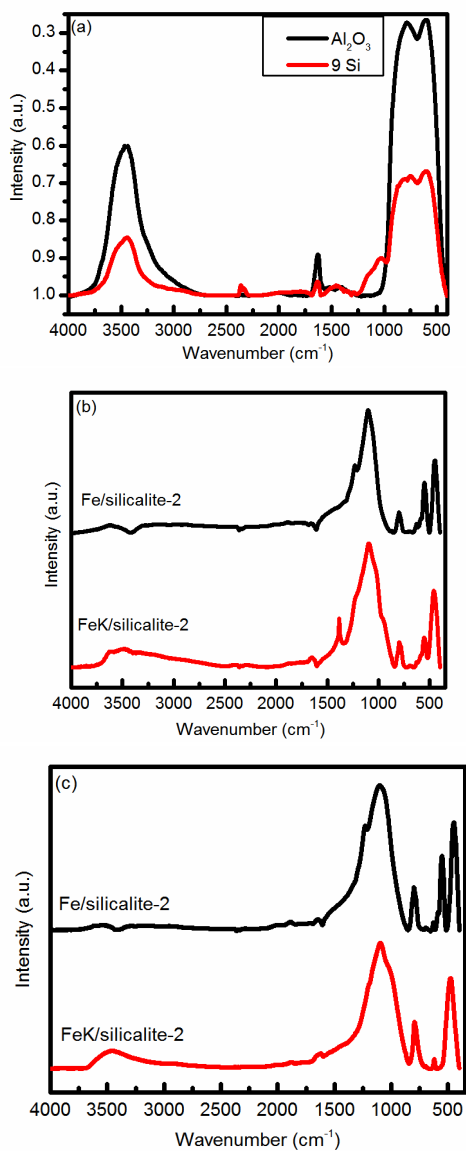


Fig. S2. The FT-IR spectra of the samples.

(a) Alumina and TEOS modification of the alumina. (b) Fe(K)/silicalite-2 catalysts as prepared. (c) Fe(K)/silicalite-2 after reaction.

Table S1 Catalyst activity of the 9Si catalyst in 75 h.^a

Time (h)	CO ₂ conversion (%)	Product Selectivity (%)				
		CO	CH ₄	C ₂ ~C ₄ ⁼	C ₂ ~C ₄ ^o	C ₂ +
1	79.7	6.0	36.6	7.8	16.2	59.2
2	72.0	8.4	34.0	6.5	8.6	57.6
3	73.4	7.6	27.5	22.8	16.0	64.9
4	70.8	7.7	25.8	25.4	15.5	66.5
5	72.0	7.7	24.3	26.8	15.7	68.0
23	70.7	7.5	20.1	31.1	14.5	72.3
24	71.6	9.0	14.9	21.0	10.9	76.1
25	71.0	9.7	14.8	20.9	10.8	75.5
26	70.6	9.7	15.0	21.4	10.8	75.3
28	68.8	10.7	16.1	21.9	11.1	73.2
46	68.6	11.7	16.1	19.3	10.7	72.2
47	68.5	12.5	15.9	19.5	10.8	71.9
48	68.3	12.4	15.5	19.9	11.1	72.2
49	66.8	12.4	15.6	19.8	11.0	72.0
50	67.8	12.6	16.0	19.7	11.0	71.4
71	69.0	12.0	15.6	18.6	10.7	72.4
72	68.6	12.8	16.1	19.2	11.1	71.0
74	64.9	14.8	16.0	17.6	10.4	69.2
75	64.8	16.0	15.5	16.9	10.1	68.4

^a Reaction conditions: 693 K, 3 Mpa, H₂/CO₂=3.0 1800ml g⁻¹ h⁻¹

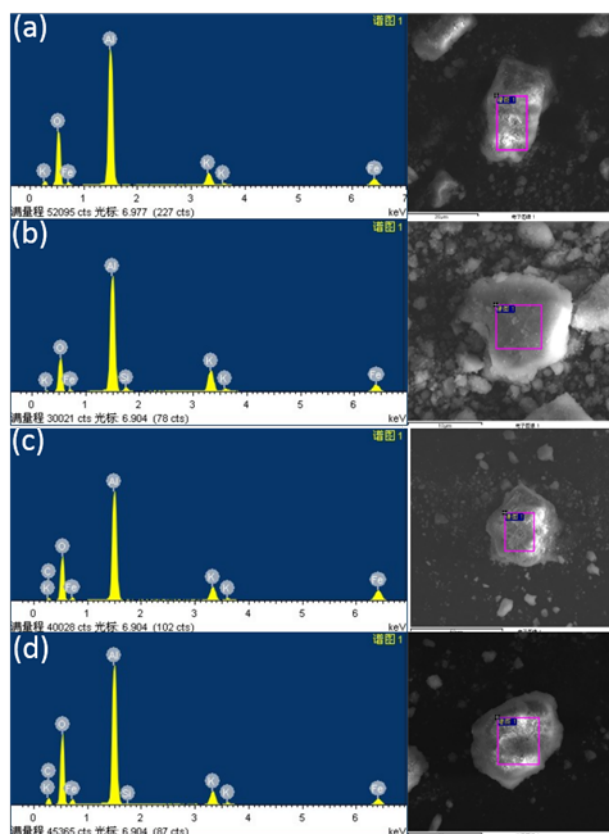


Fig. S3. SEM-EDX images of the catalysts.

(a) 0Si, fresh; (b) 9Si, fresh; (c) 0Si, used; (d) 9Si, used.

Table S2. Weight percentage of the elements by SEM-EDX measurement.

Sample	Weight percentage (%)						Total
	Fe	K	Al	O	Si	C	
0Si fresh	8.7	5.5	37.1	48.7	-	-	100
9Si fresh	9.8	10.3	35.5	42.6	1.8	-	100
0Si used	12.8	5.7	29.6	43.5	-	8.4	100
9Si used	5.6	4.0	25.6	49.7	0.05	15.1	100

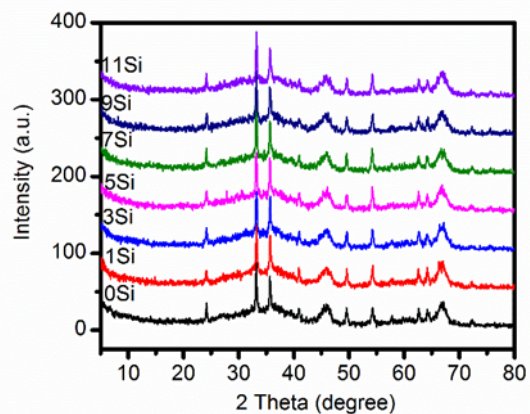


Fig. S4. XRD patterns of the fresh catalysts with 0~11% SiO₂-coating content.

Table S3. Morphological features of SiO₂-coated catalysts.

Sample	I% of the peak		Average crystal size (nm)
	33.152° (104)	35.611° (110)	
0Si	100	56.1	29.2
1Si	100	72.3	27.8
3Si	100	86.0	25.7
5Si	100	85.7	26.3
7Si	100	66.2	36.1
9Si	100	60.0	31.6
11Si	100	56.1	29.2

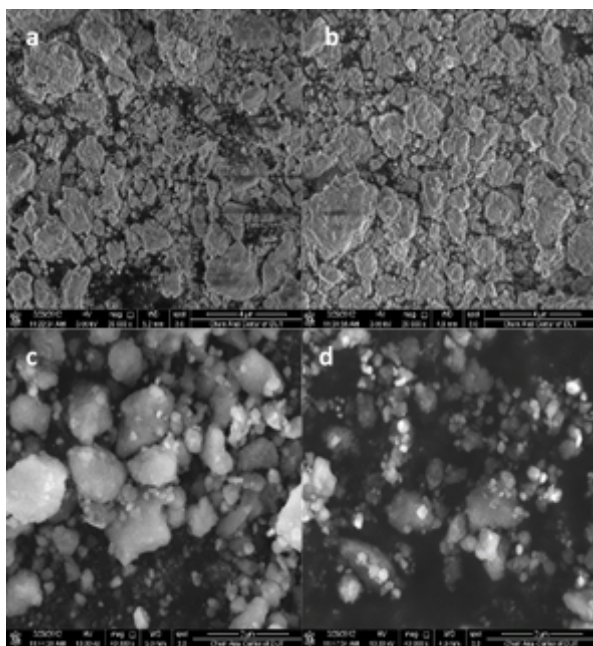


Fig. S5. SEM images of the catalysts.

(a) 0Si, fresh; (b) 9Si, fresh; (c) 0Si, used; (d) 9Si, used.

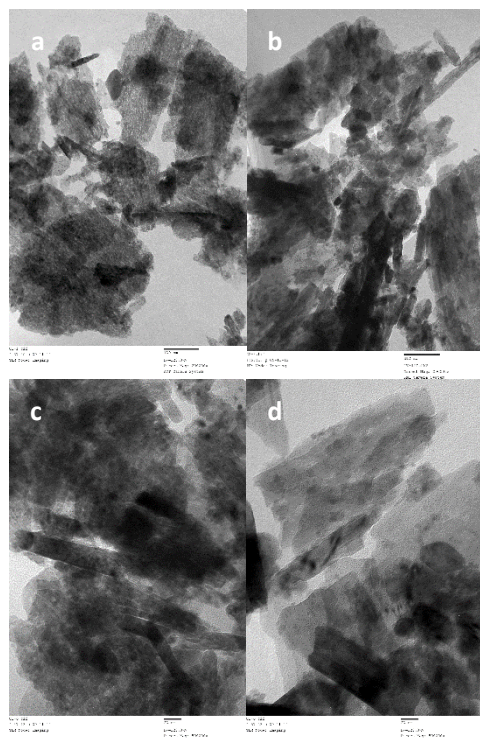


Fig. S6. TEM images of the fresh catalysts.

(a) 0Si, 100nm; (b) 9Si, 100nm;

(c) 0Si, 20nm; (d) 9Si, 20nm.

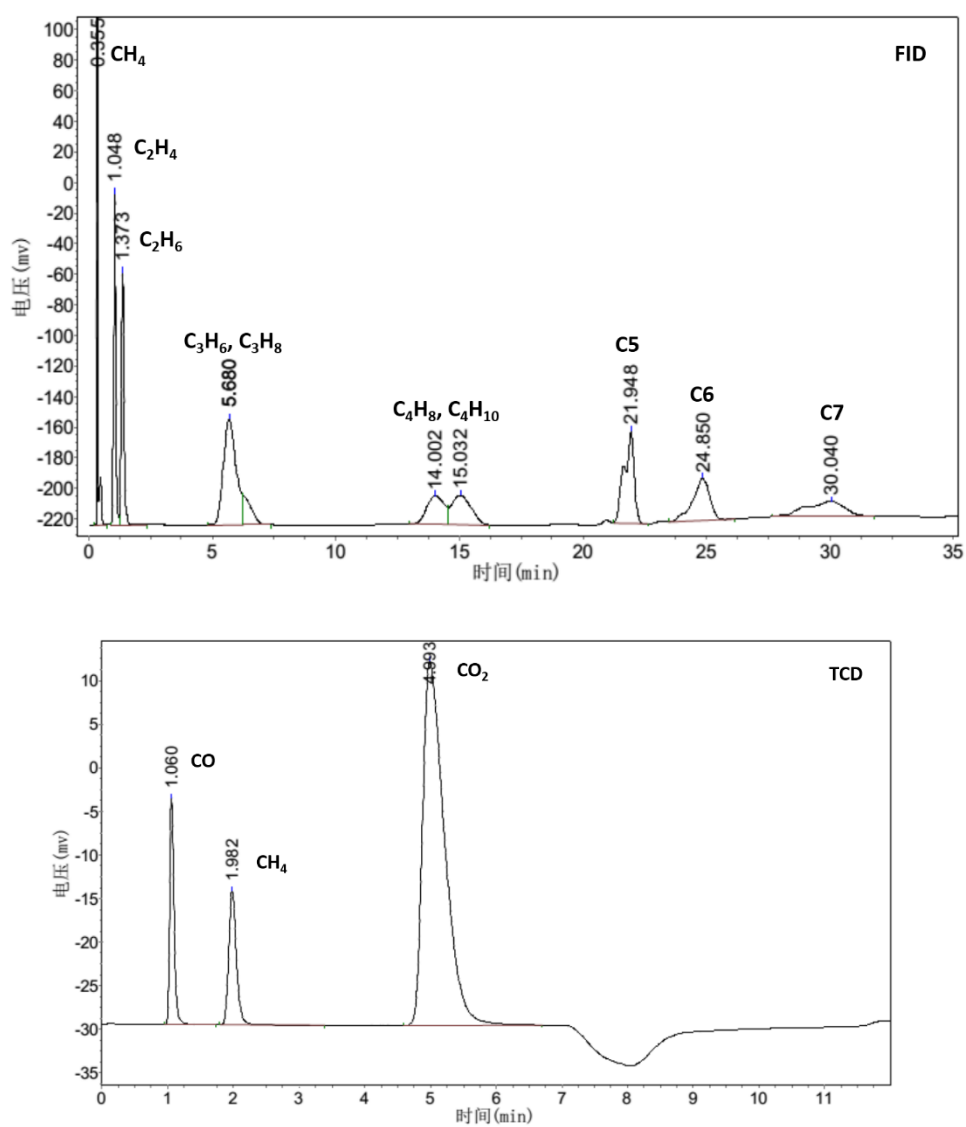


Fig. S7. FID and TCD chromatogram.

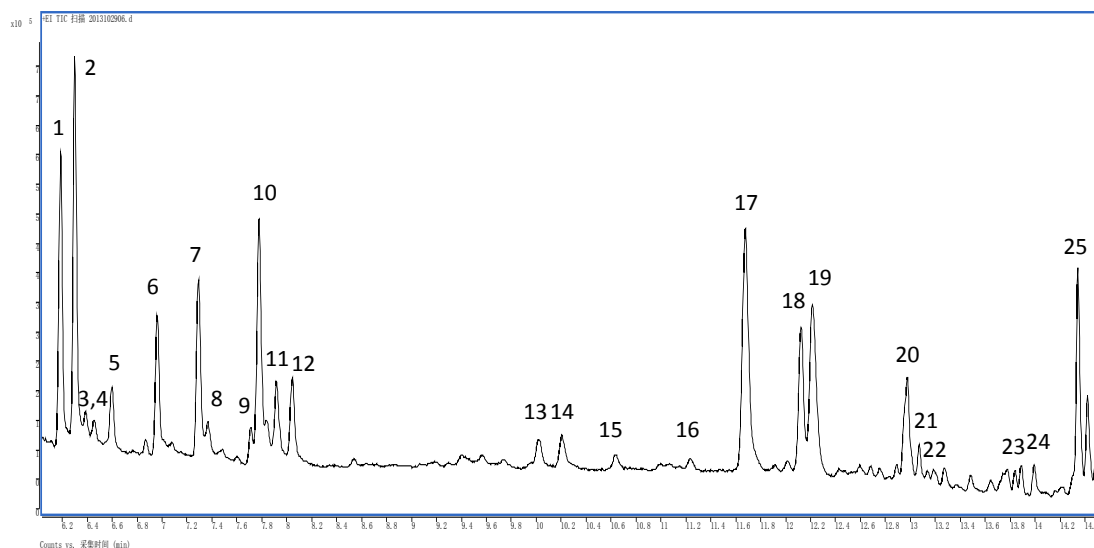


Fig. S7. Total ion chromatogram of the liquid product.

After reaction, the liquid organic product was obtained through extraction with dichloromethane (AR) to remove water. Peaks numbered 5, 7, 10, 17, 19 are organic halide which come from the extraction reagent dichloromethane.

Table S4. Composition of total ion chromatogram.

Peak	Composition
1	1-Butanol
2	2-Pentanone
3	n-Hexane
4	3,6-dimethyl-Octan-2-one
6	2,4-dimethyl-Heptane
8	2-methyl-1-Butanol
9	4-methyl-Octane
11	1-Pentanol
12	2-Hexanone
13	1-Hexanol
14	2-Heptanone
15	Decane
16	4-methyl-Decane
18	2-methyl-Undecane
20	Undecane
21	Dodecane
22	4-methyl-Undecane
23	2-methyl-Undecane
24	2,3-dimethyl-Undecane
25	Tetradecane