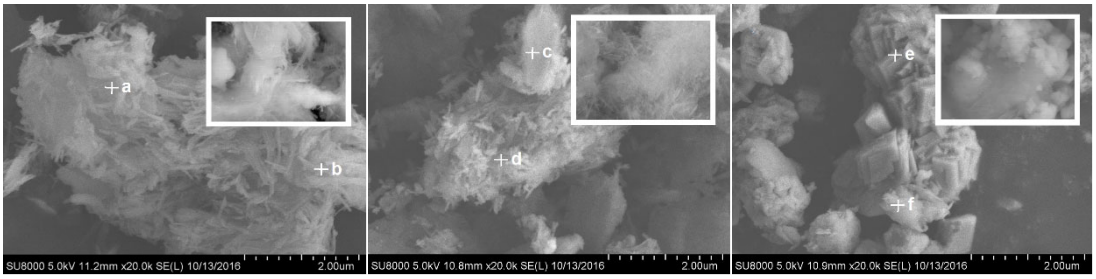
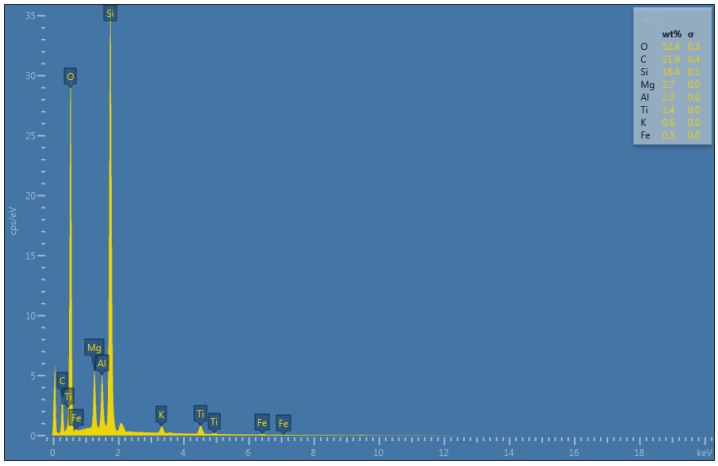
Appendix A: Supplementary data

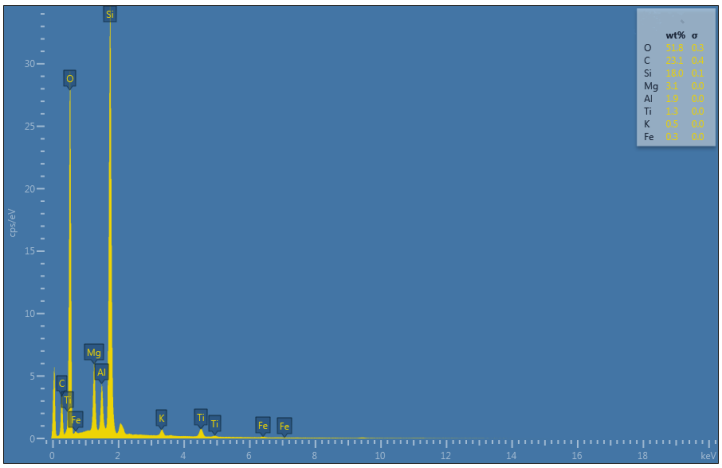


(a) (b) (c)

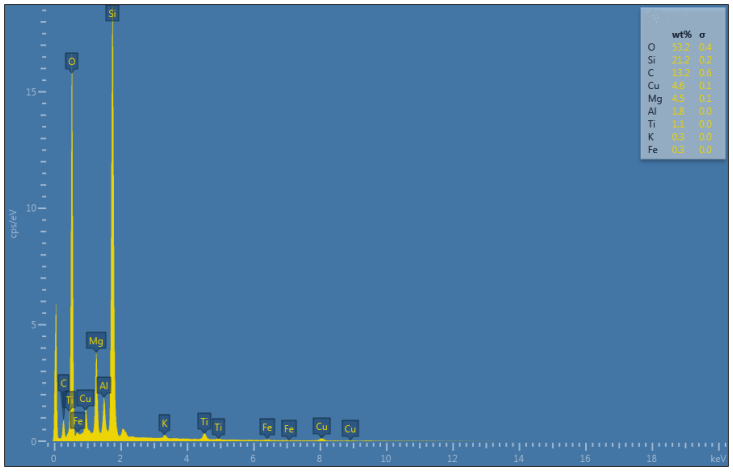
Fig. S1 SEM images of (a) Ti-Sep, (b) 5Cu/Ti-Sep, and (c) 30Mn5Cu/Ti-Sep



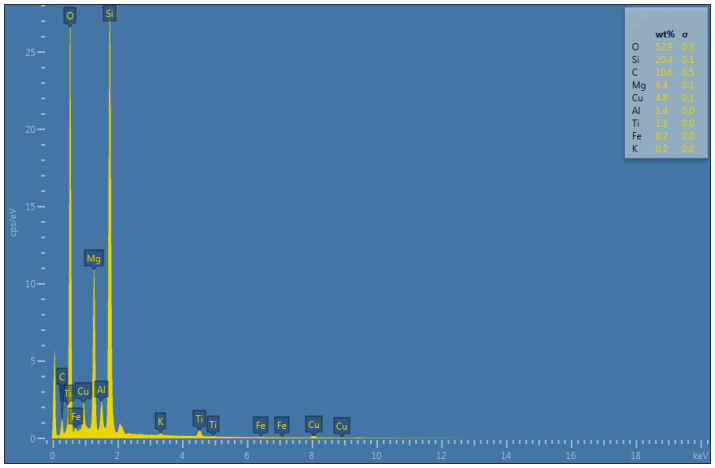
(a)



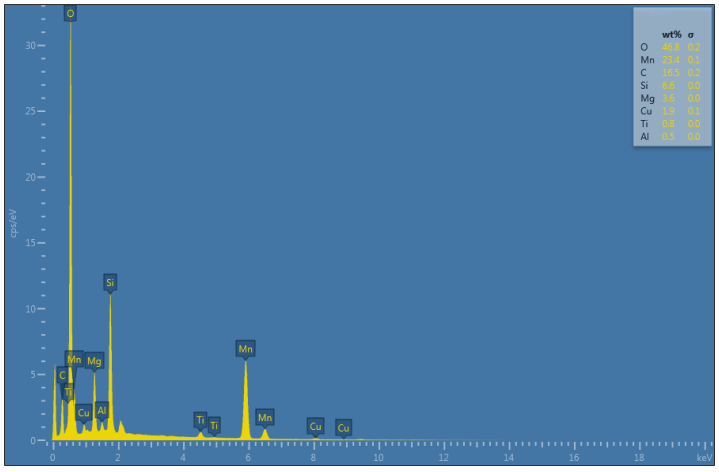
(b)


wt% σ
O
Si
C
Cu
Mg
Al
Ti
K
Fe
cps/eV
keV

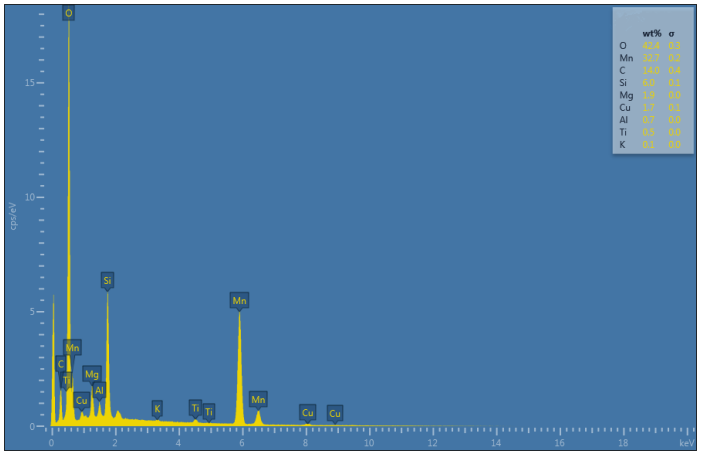
(c)


wt% σ
O
Si
C
Mg
Cu
Al
Ti
Fe
K
cps/eV
keV

(d)


wt% σ
O
Mn
C
Si
Mg
Cu
Ti
Al
cps/eV
keV

(e)



(f)

Fig. S2 EDS patterns and element compositions (insets) of the regions ((a), (b)) in Ti-Sep, ((c), (d)) in 5Cu/Ti-Sep, and ((e), (f)) in 30Mn5Cu/Ti-Sep indicated in Fig. S1

Table S1 Element concentrations of the Ti-Sep, 5Cu/Ti-Sep, and 30Mn5Cu/Ti-Sep samples

sample	element composition /(wt.%)									
	region	O	C	Si	Al	Mg	K	Fe	Ti	Cu	Mn
Ti-Sep	a	52.4	21.9	18.4	2.3	2.7	0.6	0.3	1.4	0.0	0.0
	b	51.8	23.1	18	1.9	3.1	0.5	0.3	1.3	0.0	0.0
5Cu/Ti-Sep	c	53.2	13.2	21.2	1.8	4.5	0.3	0.3	1.1	4.6	0.0
	d	52.9	10.6	20.4	1.4	8.4	0.2	0.2	1.1	4.8	0.0
30Mn5Cu/Ti-Sep	e	46.8	16.5	6.6	0.5	3.6	0.0	0.0	0.8	1.9	23.4
	f	42.4	14.0	6.0	0.7	1.9	0.1	0.0	0.5	1.7	32.7

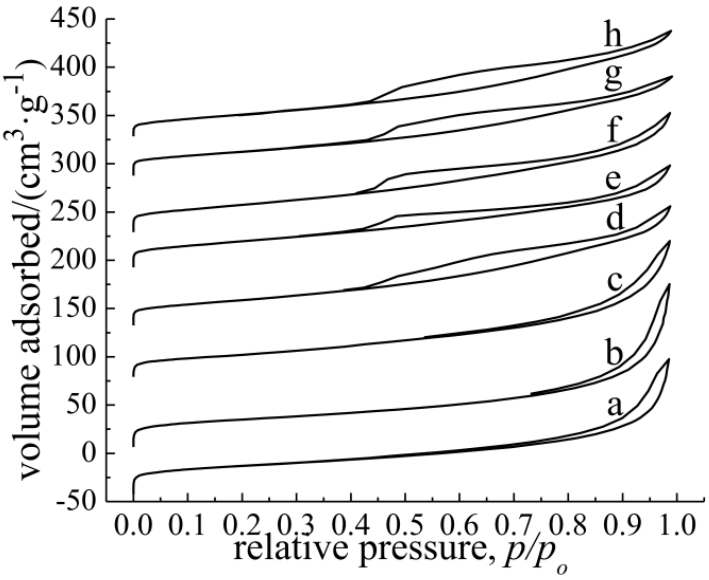


Fig. S3 N_2 adsorption–desorption isotherms of: a, Sep; b, Ti-Sep; c, 5Cu/Ti-Sep; d, 30Mn/Ti-Sep; e, 20Mn5Cu/Ti-Sep; f, 30Mn5Cu/Ti-Sep; g, 40Mn5Cu/Ti-Sep; and h, 30Mn5Cu/Sep

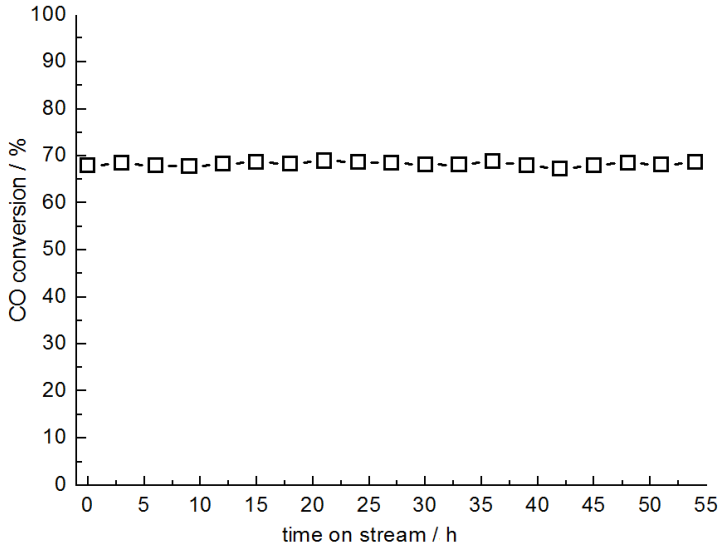


Fig. S4 CO conversion as a function of on-stream reaction time over the 30Mn5Cu/Ti-Sep catalyst under the reaction conditions of 1.01 vol% CO + air and reaction temperature of 70℃