Supplementary Information

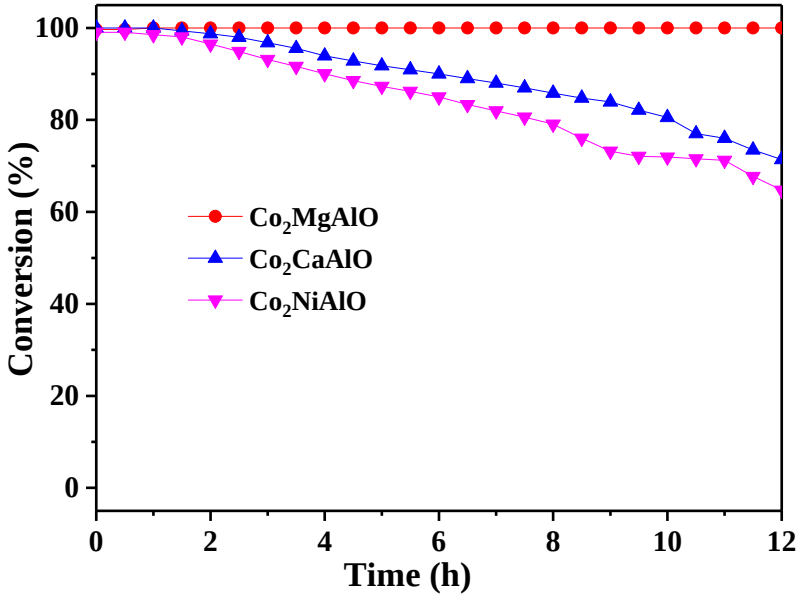

Fig. S1 Reaction tests for *o*-chlorophenol oxidation with time-on-stream over Co_2MgAlO, Co_2CaAlO and Co_2NiAlO catalysts at 400°C.

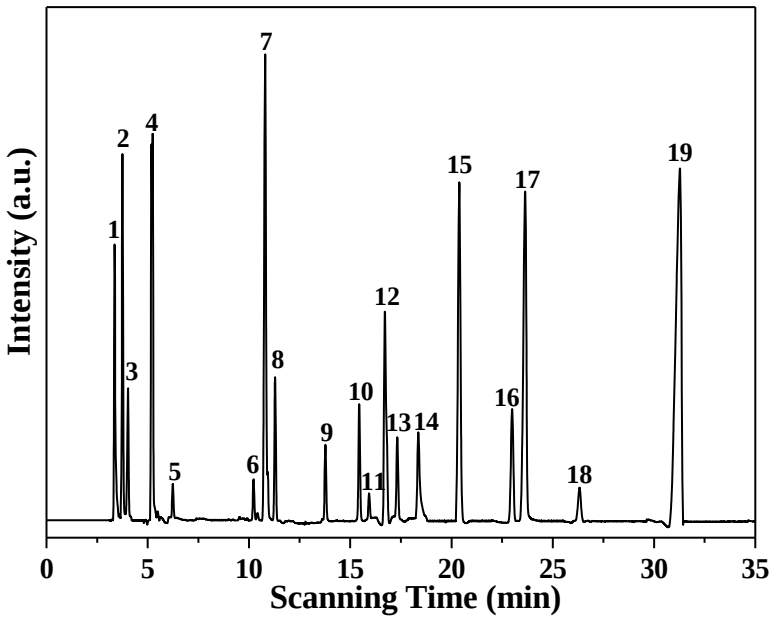

Fig. S2 GC-MS analyses on the intermediate products for Co_2MgAlO catalyst at 400 ºC.

Table S1 Composition of the CoXAlO catalysts

Catalyst	Co[a] (wt.%)	X[a](wt.%)	Al[a](wt.%)	Molar ratio of Co/X	Molar ratio of Co/Al
Co_3AlO	41.5	--	6.5	--	2.93
Co_2MgAlO	29.8	6.5	7.1	1.87	1.92
Co_2CaAlO	37.1	4.7	8.4	5.36	1.73
Co_2NiAlO	34.5	15.9	7.3	2.16	2.16

a Content by ICP, the measurement error is less than 1%.

Table S2 Hydrogen consumption and surface active oxygen of the CoXAlO catalysts

Catalyst	Hydrogen consumption[a]				Surface active oxygen[b] ($mmolO_2/g$)
	Orange area (mmol/g)	Green area (mmol/g)	Yellow area (mmol/g)	Gray area (mmol/g)	
Co_3AlO	0.01	1.07	0.03	1.25	0.04
Co_2MgAlO	0.71	0.77	0.43	0.92	0.28
Co_2CaAlO	0.32	0.61	0.09	2.66	0.12
Co_2NiAlO	0.19	0.81	0.59	0.79	0.11

[a] the measurement error is less than 5%

[b] Content by O_2-TPD, the measurement error is less than 10%

Table S3 Acidity and basicity of the CoXAlO catalysts

Catalyst	Weak acidity[a] (mmol NH_3/g)	Strong acidity[a] (mmol NH_3/g)	Weak basicity[b] (mmol CO_2/g)	Strong basicity[b] (mmol CO_2/g)
Co_3AlO	0.41	0.21	0.17	0.16
Co_2MgAlO	0.13	0.14	0.74	1.44
Co_2CaAlO	0.24	0.18	0.52	1.41
Co_2NiAlO	0.57	0.27	0.49	0.15

[a and b] Acidity and basicity calculated from the NH_3 and CO_2-TPD-MS curve, the measurement error is less than 5%

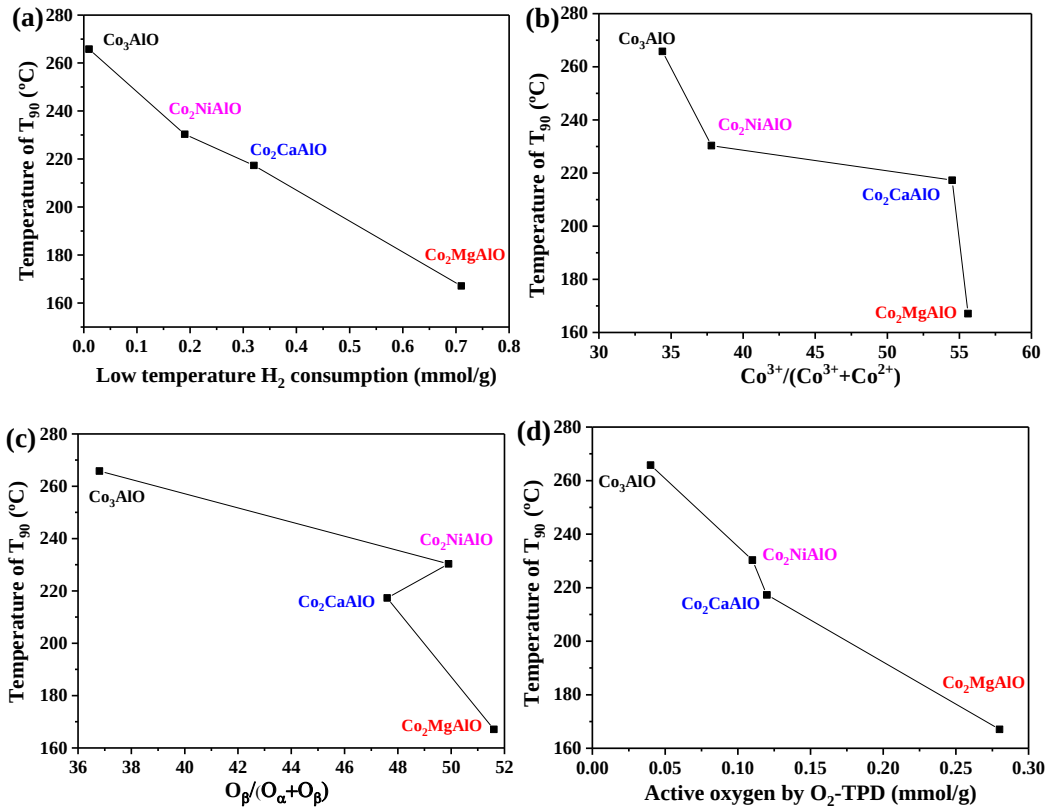

Fig. S3 Influences of the surface active oxygen and low temperature reducibility on the activity of the catalysts.

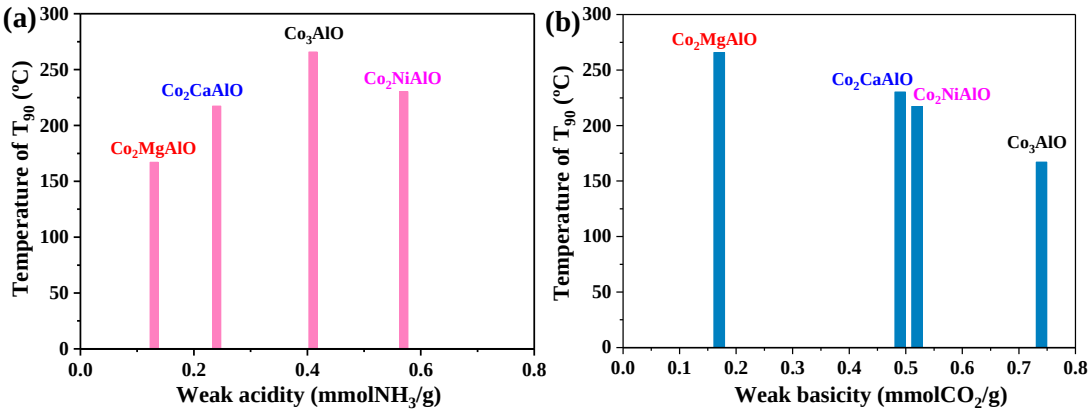

Fig. S4 Influences of the surface weak activity and weak basicity on the activity of the catalysts.