Pore structure modification of the mixed metal oxides derived from Co-Al layered double hydroxides and catalytic performance enhancement for aerobic oxidation of benzyl alcohol

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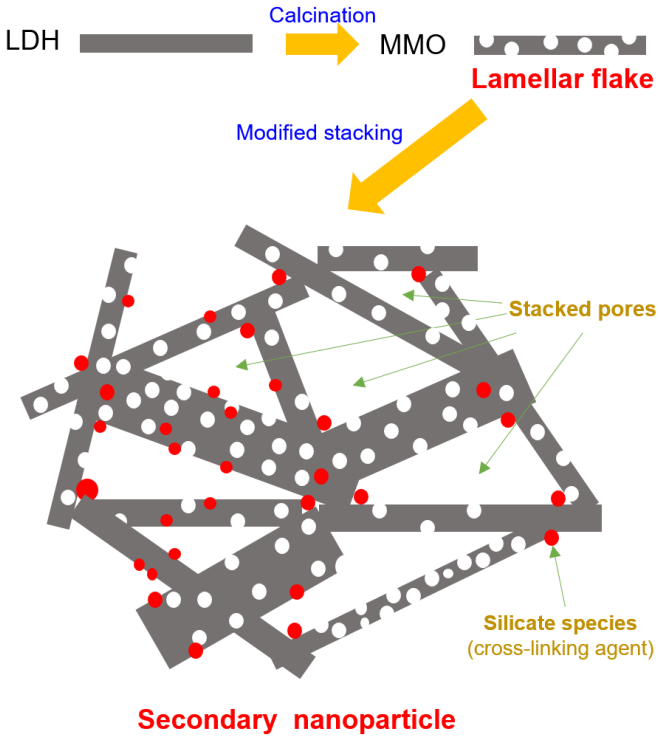


Figure S1. Schematic illustration of the proposed hierarchical structure of Co–Al MMO.

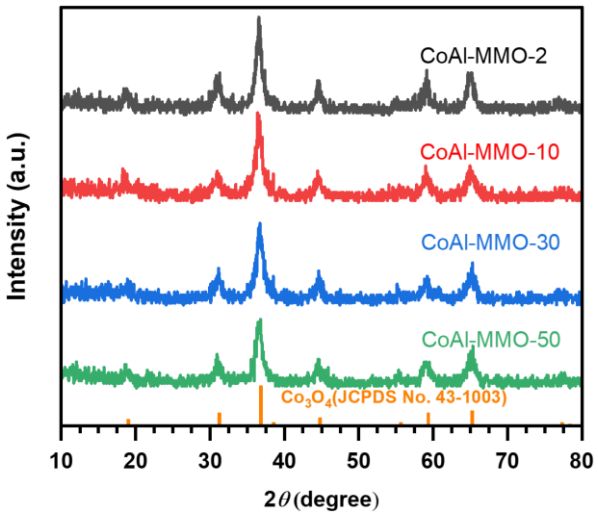


Figure S2. The XRD patterns of the Co–Al MMO samples.

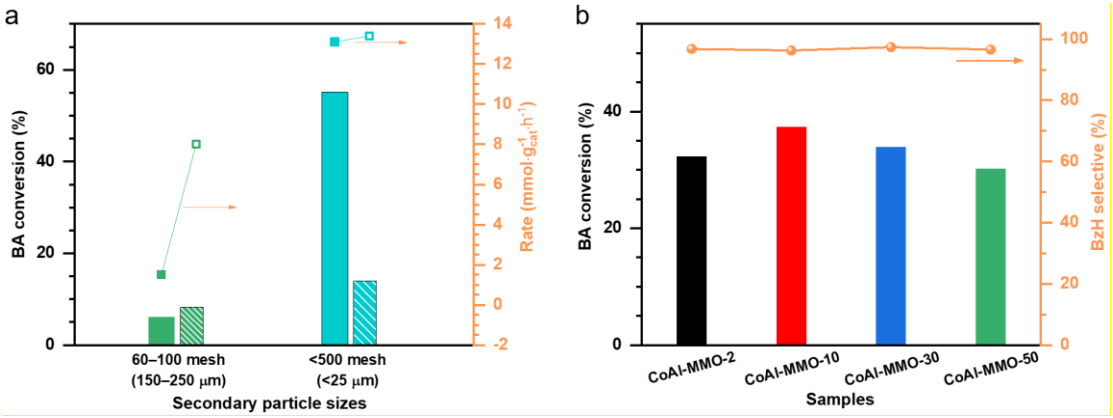


Figure S3. The catalytic reaction results for aerobic BA oxidation under different reaction conditions. (a) the conversions and reaction rates for aerobic BA oxidation in low (left column and left dot of different sizes) and high (right column and right dot of different sizes) BA concentration, catalytic reaction conditions for low concentration: 20 mL DMF, 1.00 mL BA, 100 mg of the CoAl-MMO-50 sample, 1.0 MPa O_2 pressure, 120 °C, 4 h; all conditions for high concentration is identical to that of low concentration except increasing BA dosage to 4.00 mL; (b) catalytic reactions at low O_2 pressure : 20 mL DMF, 0.50 mL BA, 100 mg catalyst, 0.2 MPa O_2 pressure,130 °C, 12 h.

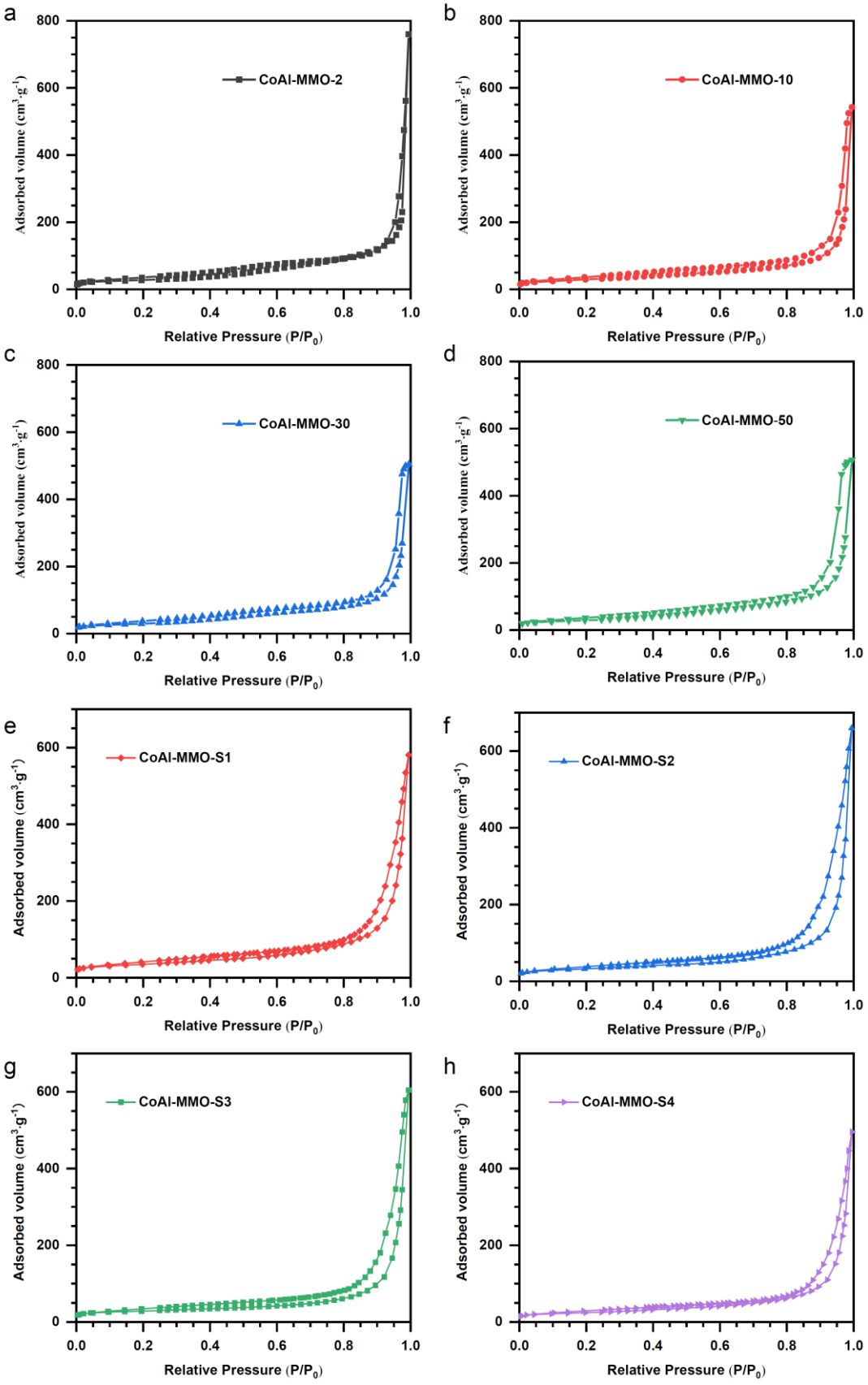


Figure S4. The N_2 adsorption/desorption isotherms data of the unmodified (a) and silicate-modified (b) Co–Al MMO samples.

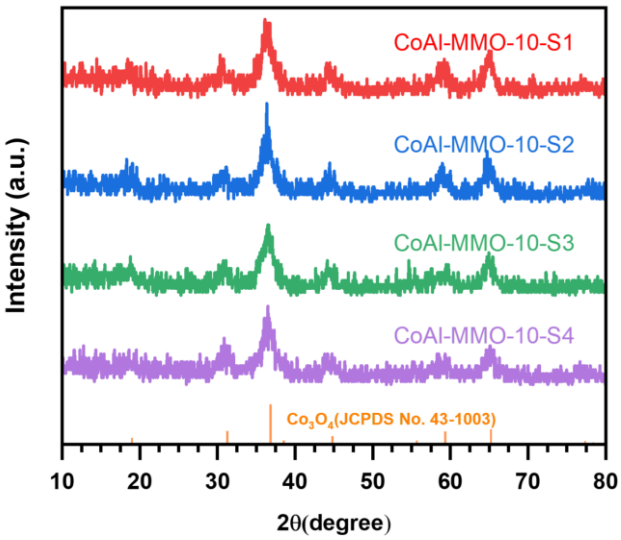


Figure S5. The XRD patterns of the silicate-modified Co–Al MMO samples.

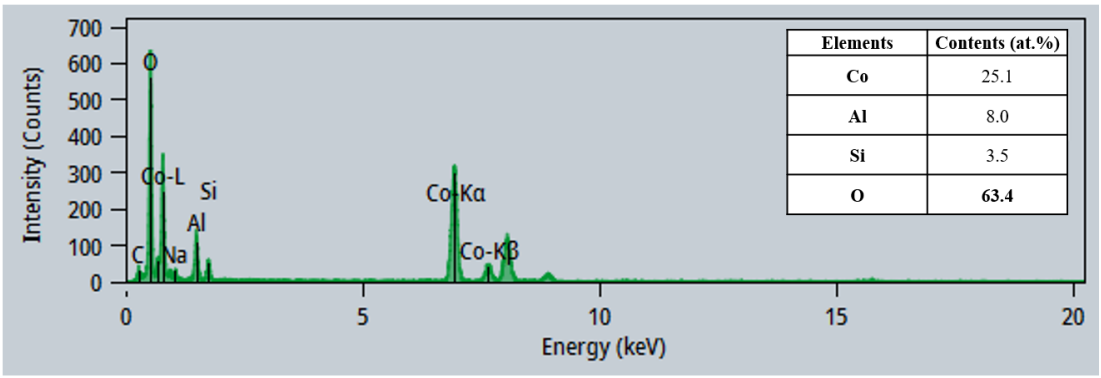


Figure S6. The EDX mapping results of the CoAl-MMO-S2 sample.

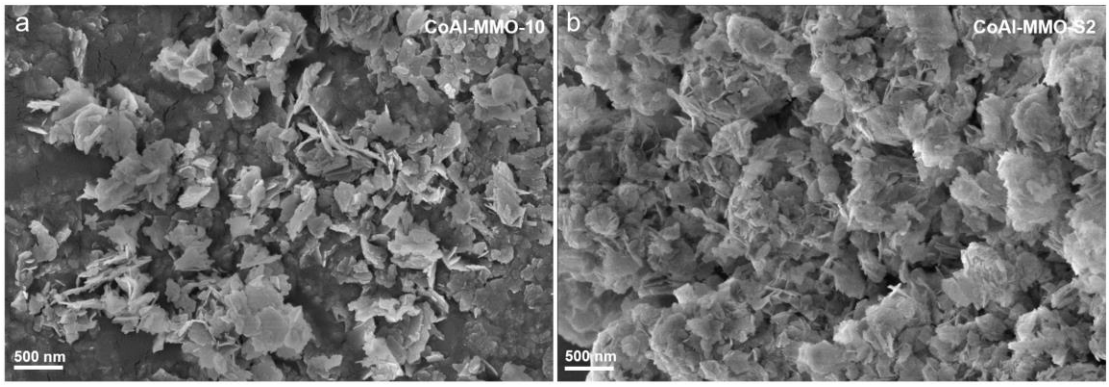
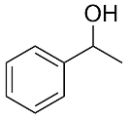
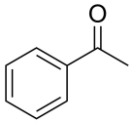
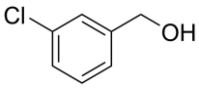
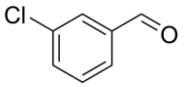
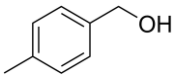
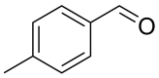


Figure S7. SEM images of the CoAl-MMO-10 (a) and CoAl-MMO-S2 (b) samples after a single use.

Table S1. Aerobic oxidation of various substrates using the CoAl-MMO-S2 sample*

Entry	Substrates	Main products	Conversion (%)	Selectivity (%)
1			28.0	85.2
2			47.8	82.8
3			70.2	72.0

*Catalytic reaction conditions: 1 mmol Substrate, 10 mL DMF, 50 mg of the CoAl-MMO-S2 sample, 1.0 MPa O_2 pressure, 120 °C, 4 h.

Table S2 Three repeat experiment results of aerobic oxidation of BA*

No.	BA conversion (%)	Selectivity (%)			
		BzH	Benzoic acid	Toluene	Benzyl benzoate
1	37.4	96.3	1.4	2.3	-
2	36.4	95.3	0.7	4.0	-
3	36.5	95.8	1.9	2.3	-

*Catalytic reaction conditions: 20 mL DMF, 0.50 mL BA, 100 mg of CoAl-MMO-10, 0.2 MPa O_2 pressure, 130 °C, 12 h.