Supporting Information

An aluminum hydroxide-mediated synthesis of mesoporous metal oxides by mechanochemical nanocasting strategy

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Characterization of the Catalyst: X-ray diffraction (XRD) pattern were recorded with a PANalytical Empyrean diffractometer in the 2θ interval of 10−80° using Cu Kα radiation (45 kV, 40 mA). N_2 adsorption-desorption isotherms were collected at −196 °C under a Gemini VII surface area analyzer. Scanning electron microscope (SEM) images of the series samples were conducted on Quanta 200F (FEI company) apparatus operated at 5.0 kV. High resolution transmission electron microscopy (HRTEM), high-angle annular dark-field scanning transmission electron microscopy (HAADF-STEM), and energy dispersive spectroscopy (EDS) mapping were performed on an aberration-corrected FEI Titan S 80-300 TEM/STEM operated at 300 kV. Temperature programmed reduction with H_2 (H_2-TPR) experiments were performed on the Quantachrome Instruments of Autosorb-1Q. 100 mg sample was pretreated under Ar by calcination at 500 °C for 1 h and subsequently cooled to 60 °C. Afterwards, 10% H_2/Ar flow (60 mL/min) was passed over the catalyst bed while the temperature was ramped from 60 to 1000 °C at a heating rate of 10 °C/min.

Catalytic CO Oxidation: Catalytic CO oxidation was conducted in a fixed-bed reactor at atmospheric pressure. For the measurement of CO light-off curves showing CO conversion as a function of reaction temperature, 20 mg of catalyst was placed in the reactor. The feed gas of 1 % CO balanced with dry air passed though the catalyst bed at a flow rate of 10 $mL \cdot min^{-1}$ corresponding to gas hourly space velocity of 30,000 mL $(h \cdot g_{cat})^{-1}$. The concentrations of CO and CO_2 in the reactor effluent were analyzed by a Buck Scientific 910 gas chromatograph equipped with a dual molecular sieve/porous polymer column and a thermal conductivity detector.

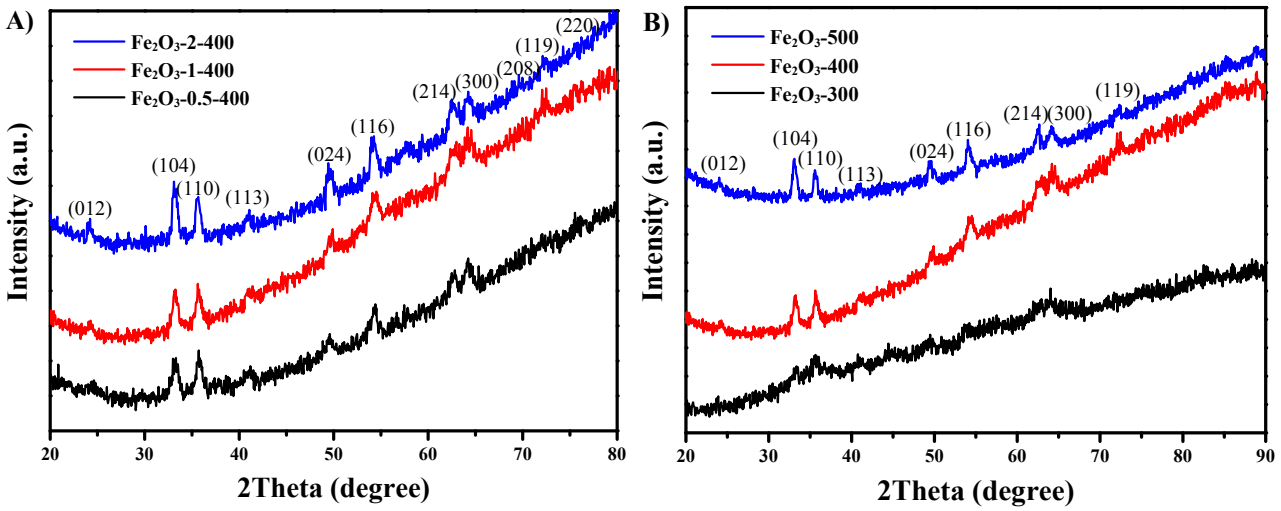

Figure S1. XRD patterns (A) Fe_2O_3-Y-400, and (B) Fe_2O_3-Z.

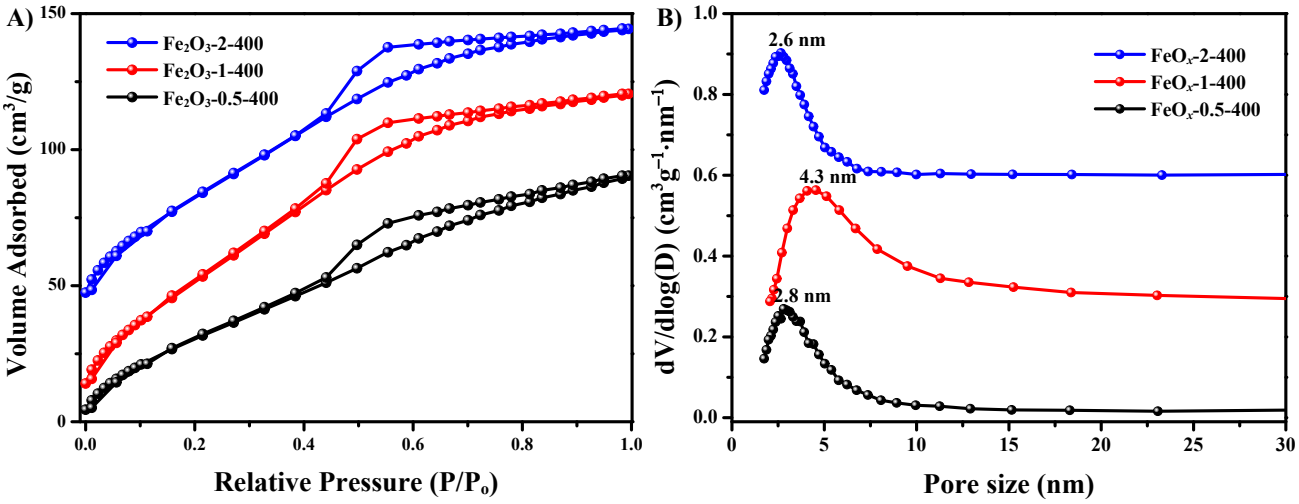

Figure S2. (A) N_2 adsorption-desorption isotherms (−196 °C), and (B) the pore size distributions of Fe_2O_3-Y-400 prepared by mechanochemical nanocasting at 400 °C.

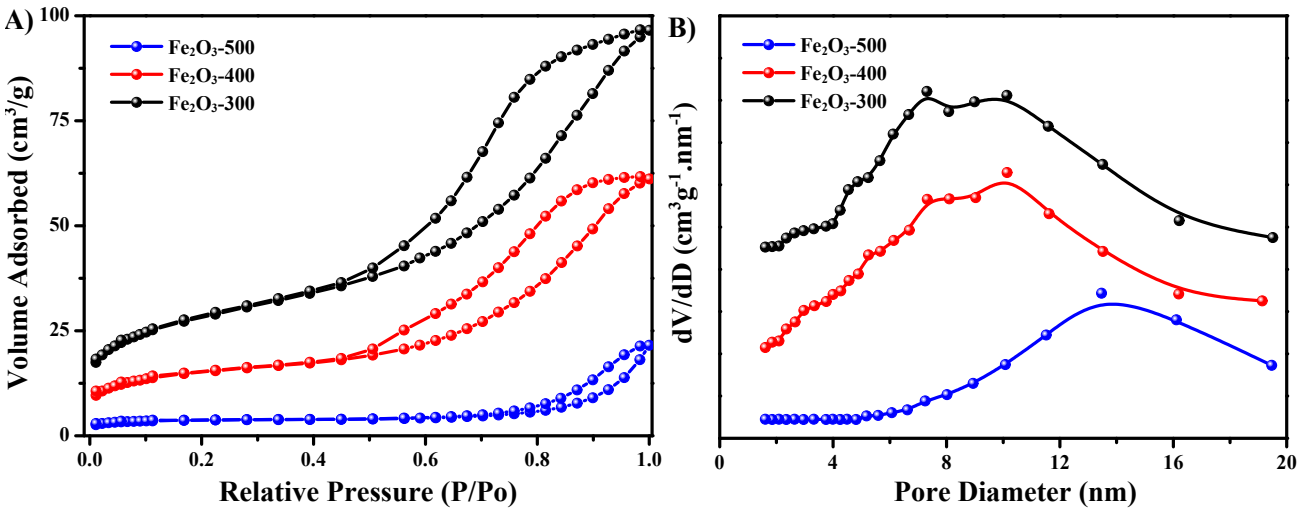

Figure S3. (A) N_2 adsorption-desorption isotherms (−196 °C), and (B) the pore size distributions of Fe_2O_3-Z prepared at different calcination temperatures.

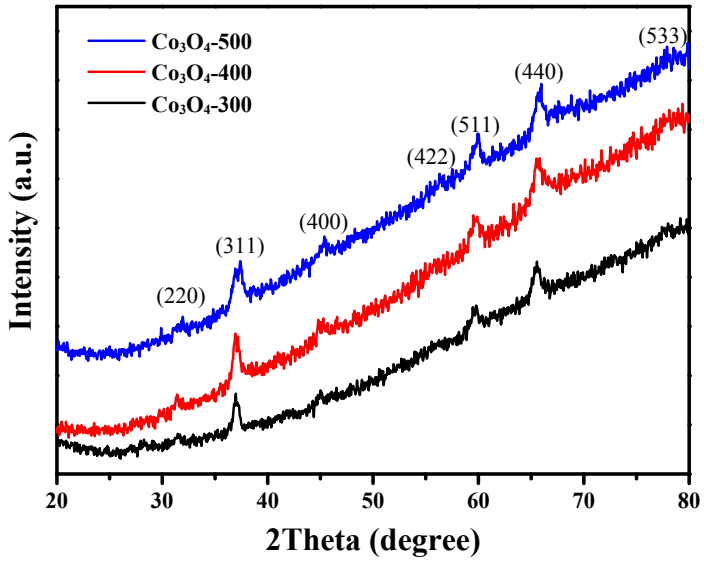

Figure S4. XRD patterns Co_3O_4-Z.

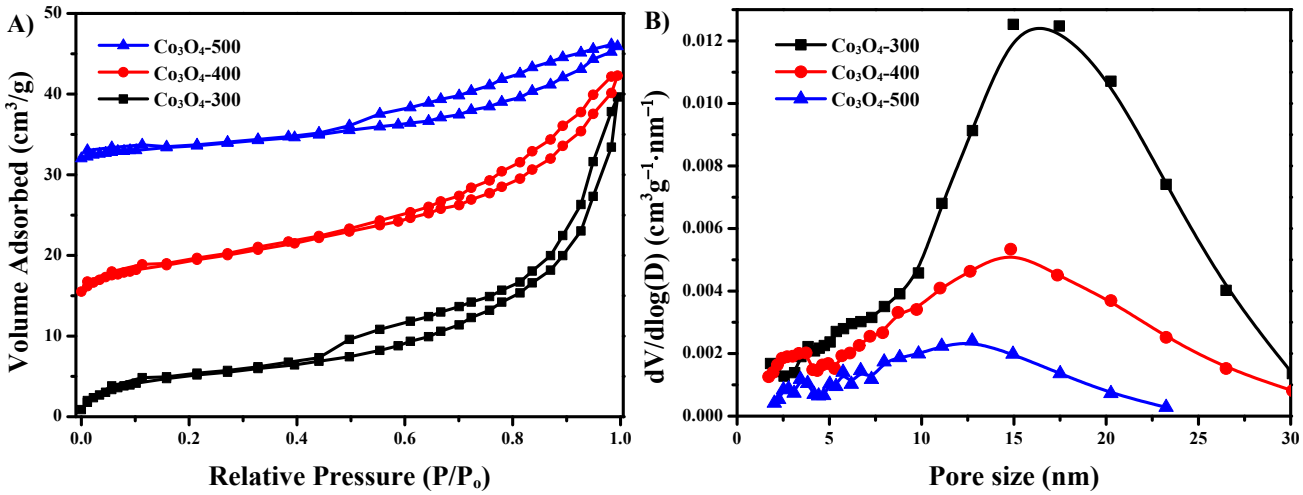

Figure S5. (A) N_2 adsorption-desorption isotherms (−196 °C), and (B) the pore size distributions of Co_3O_4-Z prepared at different calcination temperatures.

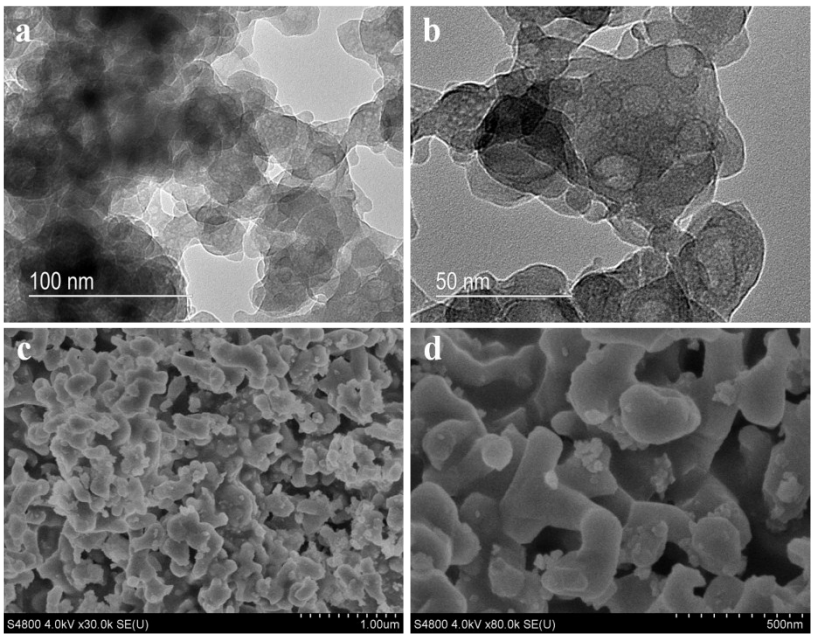

Figure S6. SEM images of $Al(OH)_3$ (a,b) and Al_2O_3 (c,d) formed by ball milled for 1 h followed by being calcinated at 400 °C in air for 3 h.

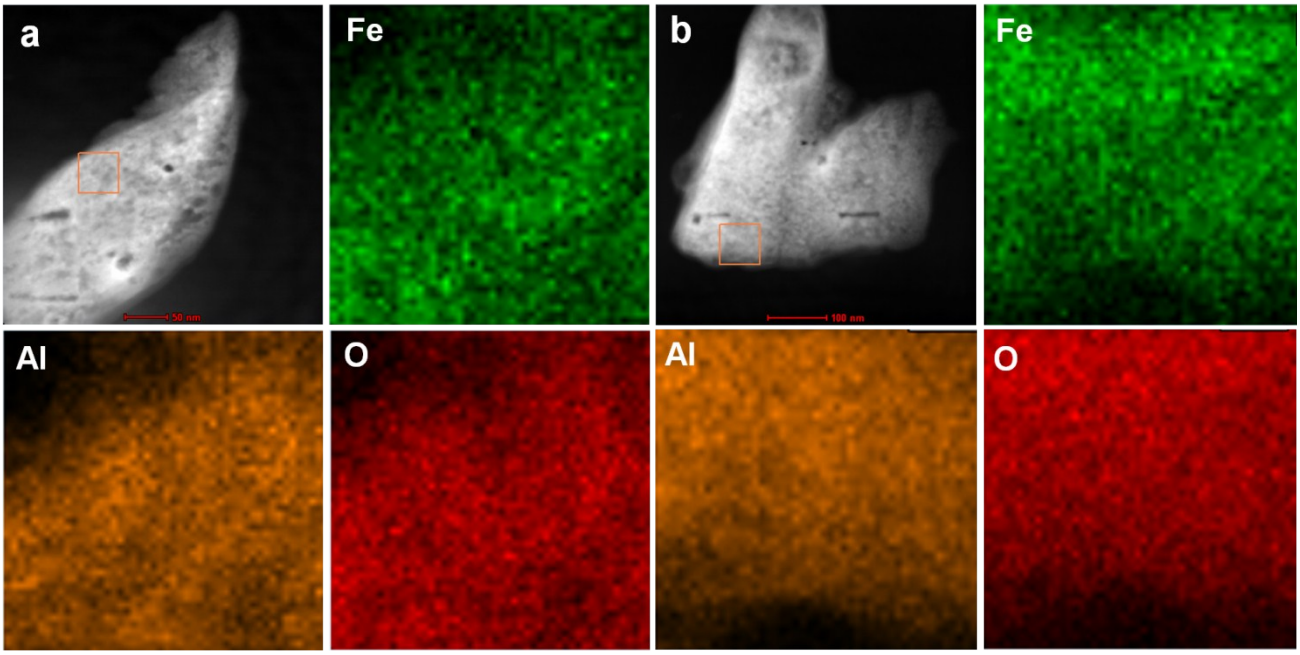

Figure S7. EDS mapping images of elemental Fe and O for the precursors of Fe_2O_3-1-400: (a) the complex of equal mass of $Al(OH)_3$ and Al_2O_3 after being ball milled for 1 h; (a) the complex of equal mass of $Al(OH)_3$ and Al_2O_3 after being ball milled and calcinated at 400 °C.

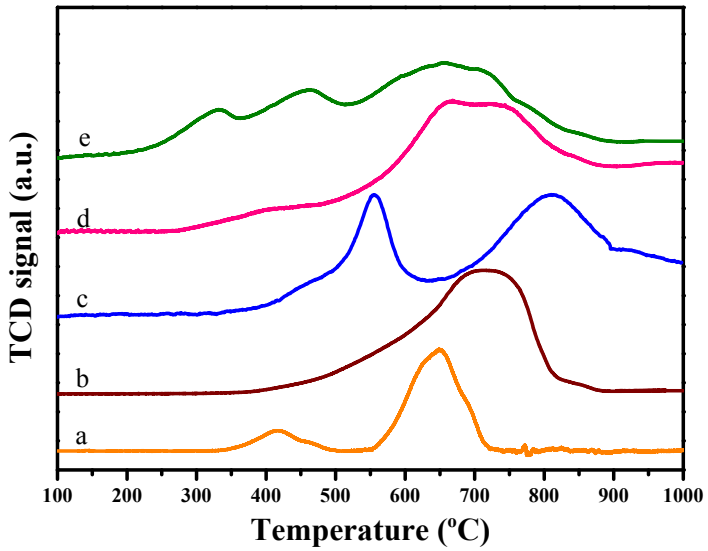

Figure S8. H_2-TPR profiles of (a) Co_3O_4-1-400, (b) Fe_2O_3-1-400, (c) CeO_2-1-400, (d) FeO_x-CeO_y-400, and (e) CoO_x-FeO_y-CeO_z-1-400 catalysts.