Support Information

Controllable Synthesis of Two CaO Crystals: Precursors’ Template-Free Synthesis and Formation Mechanism

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Fig. S1 TGA and DSC plots of dumbbell-like, wheat spike-like and microsphere-like CaCO\textsubscript{3} samples.
Fig. S2 FTIR spectra and XRD patterns of CaCO$_3$ precursors obtained at different reaction temperature with saturated Ca(OH)$_2$ solution for 1 h: $A_{T1}$ 80 °C, $A_{T2}$ 120 °C and $A_{T3}$ 150 °C with 1.5 g/L CO$_2$SM concentration; $B_{T1}$ 80 °C, $B_{T2}$ 120 °C and $B_{T3}$ 150 °C with 3.0 g/L CO$_2$SM concentration; $C_{T1}$ 80 °C, $C_{T2}$ 120 °C and $C_{T3}$ 150 °C with 20.0 g/L CO$_2$SM concentration. In the second picture, “C” and “V” stand for calcite and vaterite respectively.

Fig. S3 FTIR spectra (I) and XRD patterns (II) of CaCO$_3$ precursors obtained in different reaction time at 100 °C with saturated Ca(OH)$_2$ solution: $A_{t1}$ 0.5 h, $A_{t2}$ 2.0 h and $A_{t3}$ 4.0 h with 1.5 g/L CO$_2$SM concentration; $B_{t1}$ 0.5 h, $B_{t2}$ 2.0 h and $B_{t3}$ 4.0 h with 3.0 g/L CO$_2$SM concentration; $C_{t1}$ 0.5 h, $C_{t2}$ 2.0 h and $C_{t3}$ 4.0 h with 20.0 g/L CO$_2$SM concentration. In Figure II, “C” and “V” stand for calcite and vaterite respectively.
Fig. S4 FTIR spectra (I) and XRD patterns (II) of CaCO₃ precursors obtained in different Ca(OH)₂ concentrations at 100 °C for 1 h: A_N1 1.44 g/L, A_N2 1.28 g/L and A_N3 1.12 g/L with 1.5 g/L CO₂SM; B_N1 1.44 g/L, B_N2 1.28 g/L and B_N3 1.12 g/L with 3.0 g/L CO₂SM; C_N1 1.44 g/L, C_N2 1.28 g/L and C_N3 1.12 g/L with 3.0 g/L CO₂SM. In Figure II, “C” and “V” stand for calcite and vaterite respectively.

Fig. S5 The adsorption-desorption isotherms and the corresponding pore diameter distribution curves of CaO by calcinating A dumbbell-like, B wheat spike-like and C microsphere-like CaCO₃ precursors, respectively. Typical BET isotherms and pore diameter distribution curves for various samples were plotted.
Fig. S6 The N$_2$ adsorption-desorption isotherms of A dumbbell-like, B wheat spike-like and C microsphere-like CaCO$_3$ precursors. The values of specific surface area could be obtained were 4.7, 4.9 and 16.4 m$^2$/g respectively for dumbbell-like, wheat spike-like and microsphere-like CaCO$_3$ precursors respectively.

Fig. S7 Breakthrough curves of CaO crystals: by calcinating A dumbbell-like, B wheat spike-like and C microsphere-like CaCO$_3$ precursors respectively with 8 % CO$_2$ under the atmospheric pressure and the gas velocity was 30 mL/min. In addition, the local enlargement of the breakthrough curve is placed in the diagram.