

Supporting Information

Heavy Alkyl-benzene Sulfonate controlled Growth of Aragonite-Based Polymorphic CaCO₃ Crystals in Emulsion

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Table S1. Fraction of vaterite, aragonite and calcite in kerosene emulsions with various concentrations of HABS.

Sample	[CaCl ₂] (mol/L)	[Na ₂ CO ₃] (mol/L)	HABS (mol/L)	Temp. (°C)	Time (min)	Content of Vaterite	Content of Aragonite	Content of Calcite
1a	0.01	0.01	200	45	60	39.54%	29.38%	31.08%
1b	0.01	0.01	400	45	60	43.96%	11.22%	44.82%
1c	0.01	0.01	600	45	60	52.46%	12.42%	35.12%
1d	0.01	0.01	800	45	60	48.63%	0	51.37%
1e	0.01	0.01	1000	45	60	68.38%	0	31.62%

Table S2. Fraction of vaterite, aragonite and calcite in kerosene emulsions with various reaction times.

Sample	[CaCl ₂] (mol/L)	[Na ₂ CO ₃] (mol/L)	HABS (mg/L)	Temp (°C)	Time (min)	Content of Vaterite	Content of Aragonite	Content of Calcite
2a	0.01	0.01	600	45	5	86.11%	0	13.89%
2b	0.01	0.01	600	45	10	88.54%	0	11.46%
2c	0.01	0.01	600	45	20	93.01%	0	6.99%
2d	0.01	0.01	600	45	30	82.96%	4.55%	12.49%
2e	0.01	0.01	600	45	60	53.72%	12.27%	34.01%

Table S3. Fraction of vaterite, aragonite and calcite in kerosene emulsions with various reaction temperatures.

Sample	[CaCl ₂] (mol/L)	[Na ₂ CO ₃] (mol/L)	HABS (mg/L)	Temp (°C)	Time (min)	Content of Vaterite	Content of Aragonite	Content of Calcite
3a	0.01	0.01	600	35	60	88.97%	0	11.03%
3b	0.01	0.01	600	45	60	43.57%	5.55%	50.88%
3c	0.01	0.01	600	55	60	41.48%	19.19%	39.33%
3d	0.01	0.01	600	65	60	43.17%	47.38%	9.45%
3e	0.01	0.01	600	75	60	18.03%	65.06%	16.91%
3f	0.01	0.01	600	85	60	16.10%	66.74%	17.16%

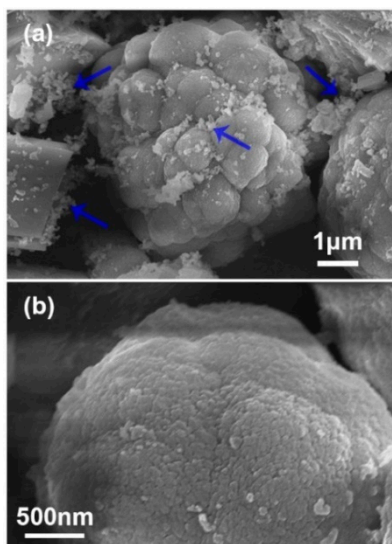


Figure S1. SEM images of vaterites particles and the corresponding enlarged view.

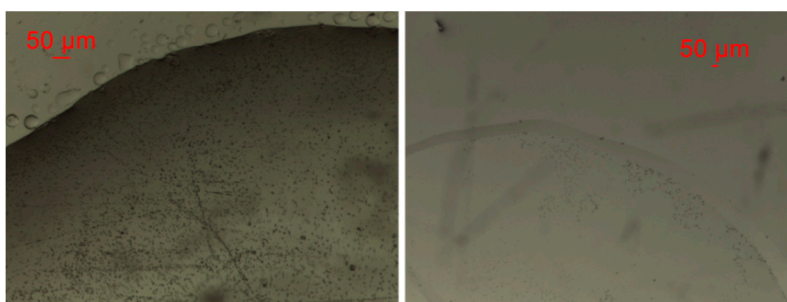


Figure S2. Images of ACC migration. Left: water, Right: HABS/kerosene /water.

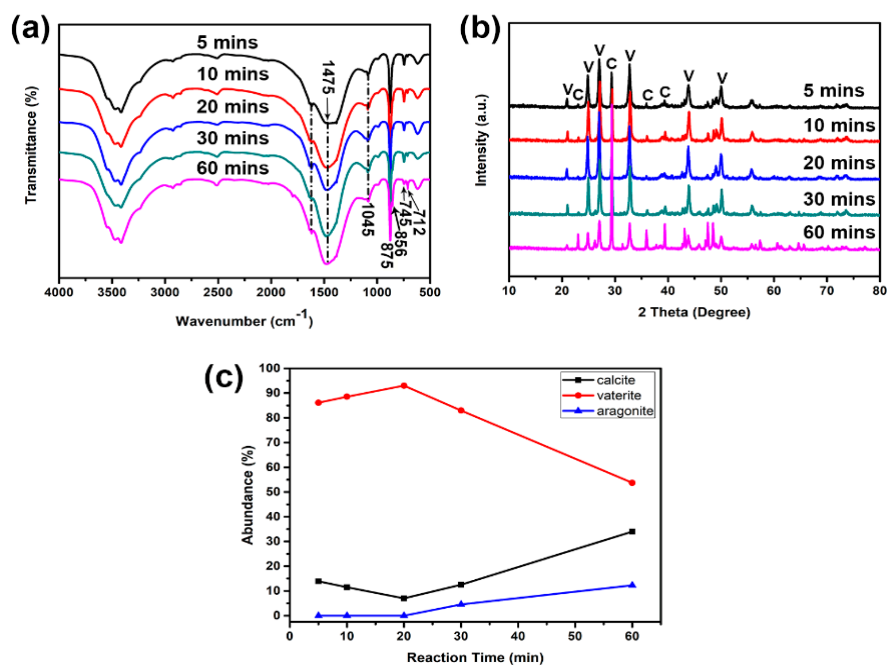


Figure S3. FTIR, XRD and content variation of CaCO₃ at 45 °C under various reaction times (5 mins, 10 mins, 20 mins, 30 mins, and 60 mins).

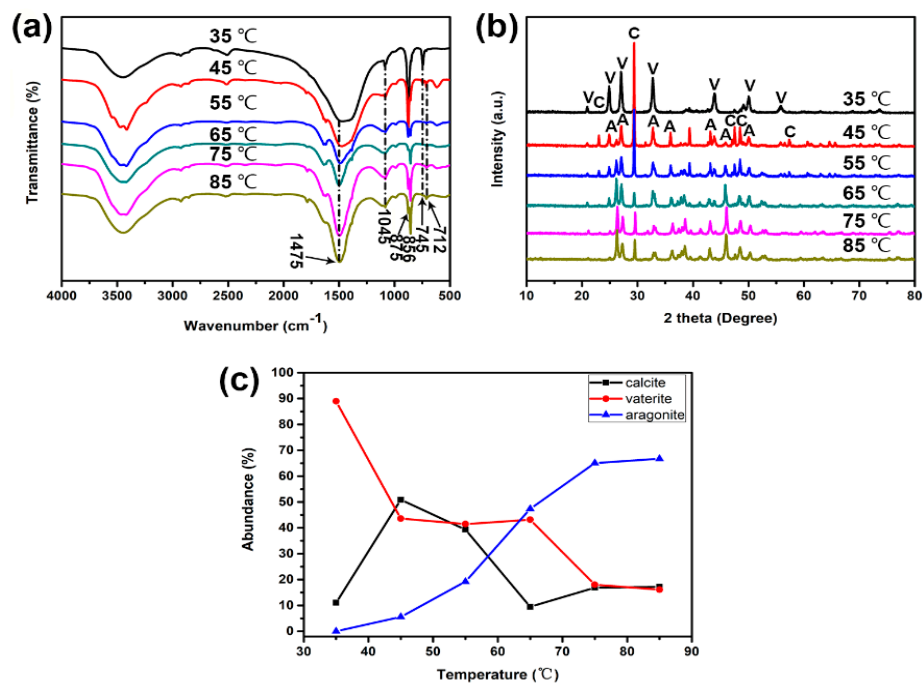


Figure S4. FTIR, XRD and content variation of CaCO₃ under reaction temperature(35 °C, 45 °C, 55 °C, 65 °C, 75 °C, and 85 °C).

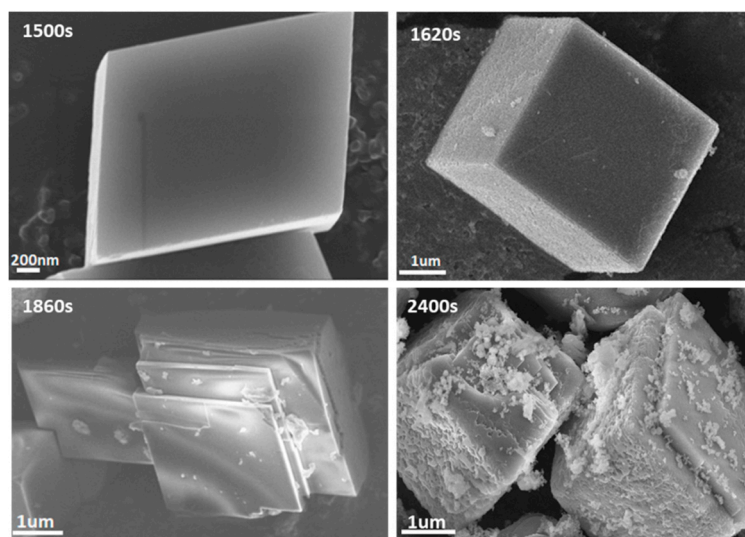


Figure S5. SEM images collected during the calcite dissolution process from 1500s to 2400s.

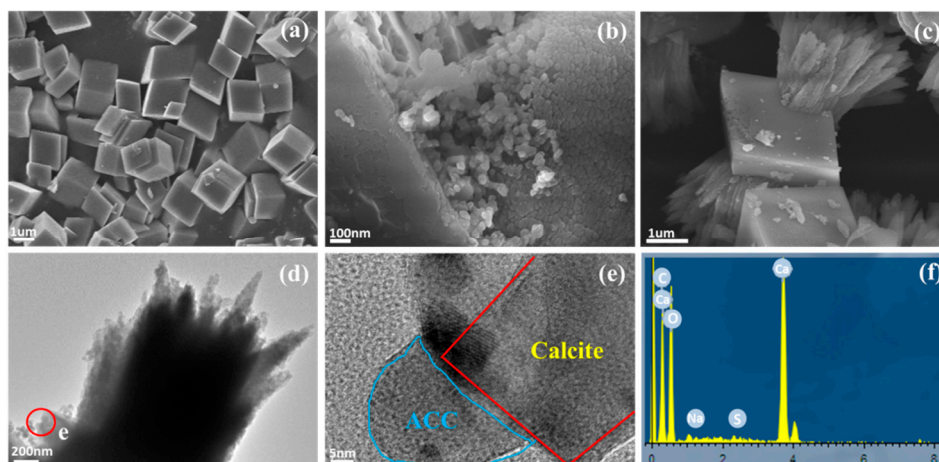


Figure S6. SEM images at reaction time of 1400s (a) and 2820s (b). TEM, HRTEM, and EDS of the typical mixed crystal, respectively(c) - (f).

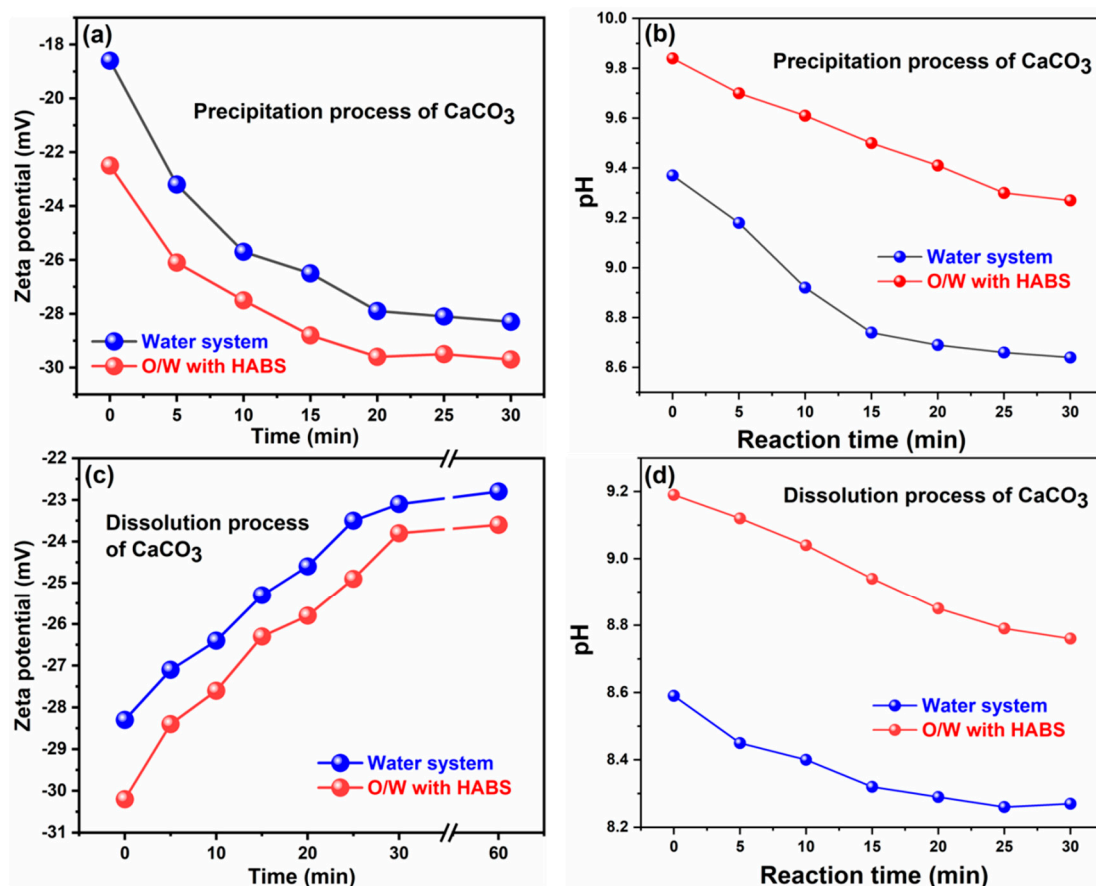


Figure S7. Trends in pH and Zeta potential during calcite precipitation process and calcite dissolution process in different systems.