Supporting information

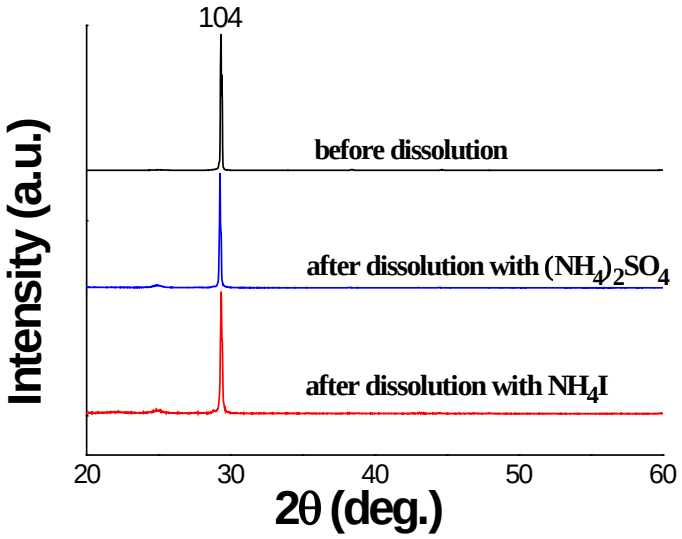

Figure S1. XRD patterns of calcite substrates before (black line) and after dissolution for 15 hours in the presence of 10 mM of NH_4I (red line) and 25 mM of $(NH_4)_2SO_4$ (blue line), respectively.

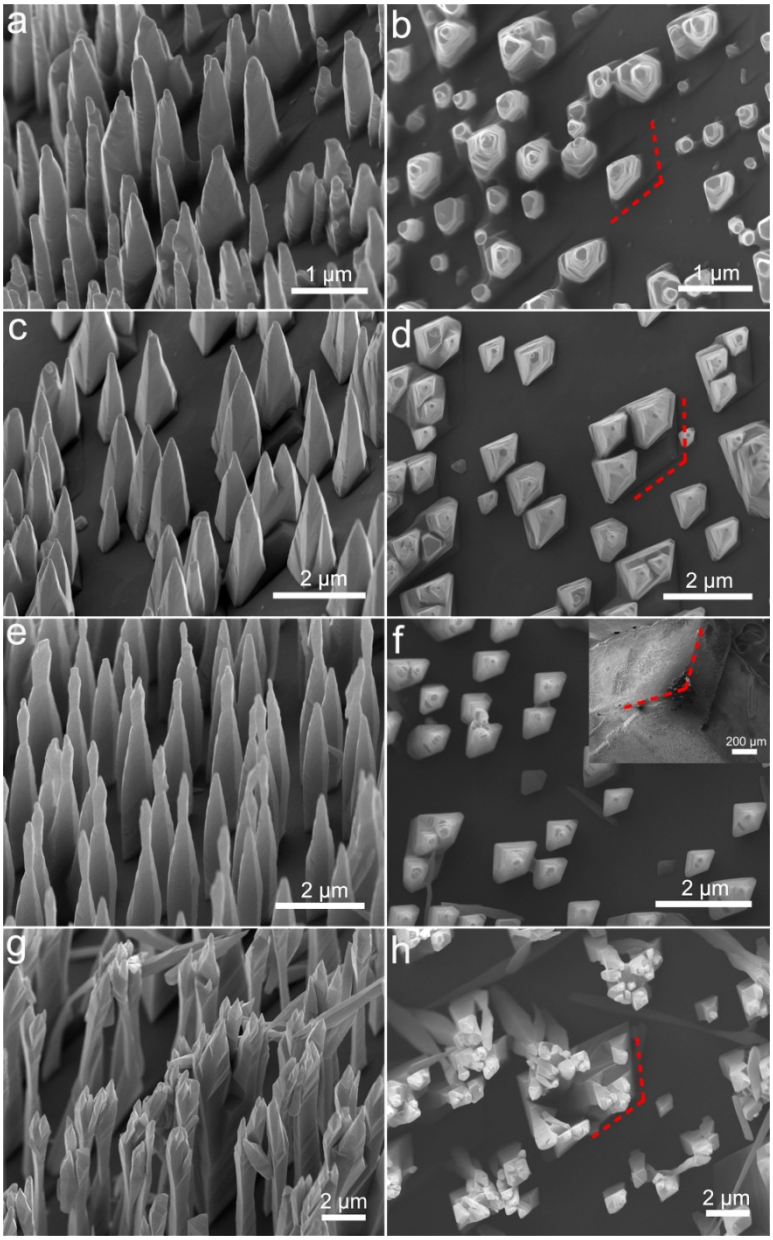

Figure S2. Side view (a, c, e, g) and top view (b, d, f, h) SEM images of calcite micropyramids obtained in the presence of NH_4I solutions with different concentrations; (a, b) 2 mM, (c, d) 5 mM, (e, f) 50 mM, (g, h) 100 mM. (b, d, f, h) top view images were taken with electron beam along calcite [001] direction, (a, c, e, g) side view images were taken with electron beam 24 ° away from [001]. The red lines represent $[\bar{4}41]$ and $[48\bar{1}]$ directions of calcite.

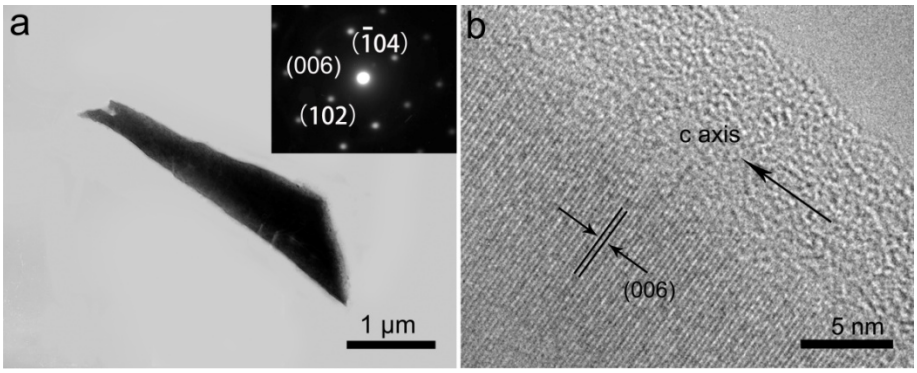

Figure S3. TEM and HRTEM images of calcite micropyramids obtained in aqueous solution with the presence of 25 mM of $(NH_4)_2SO_4$.

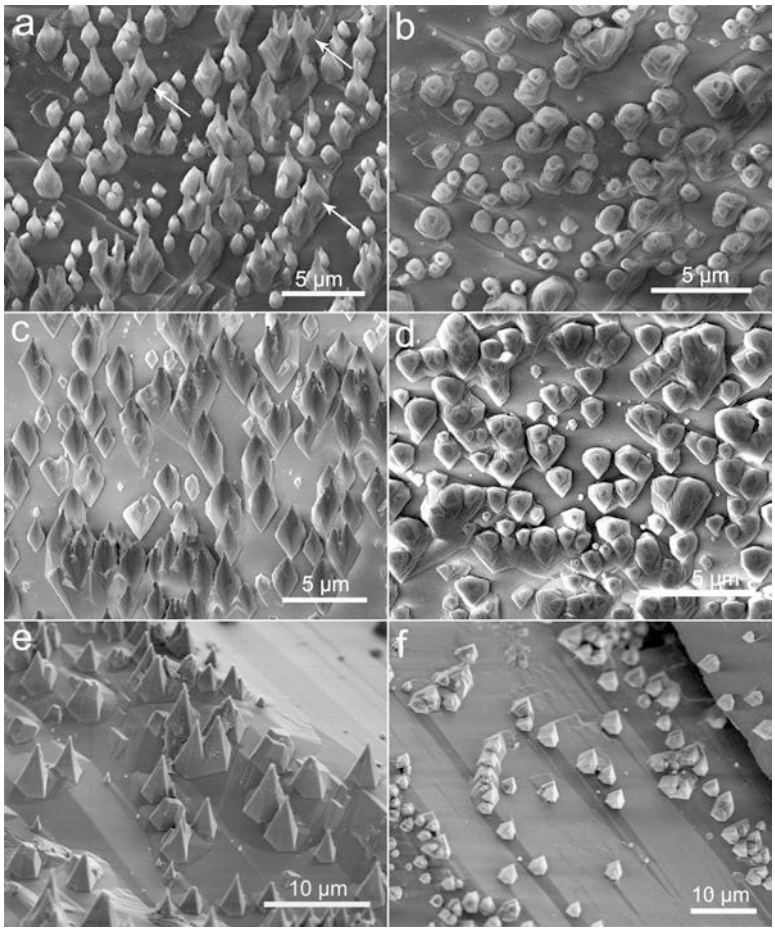

Figure S4. Side view (a, c, e) and top view (b, d, f) SEM images of calcite micropyramids obtained in the presence of $(NH_4)_2SO_4$ solutions with different concentrations; (a, b) 5 mM, (c, d) 10 mM, (e, f) 50 mM. Side view images were taken with electron beamline 20 °, 20 °, and 25 ° away from *c* axis of calcite, respectively.

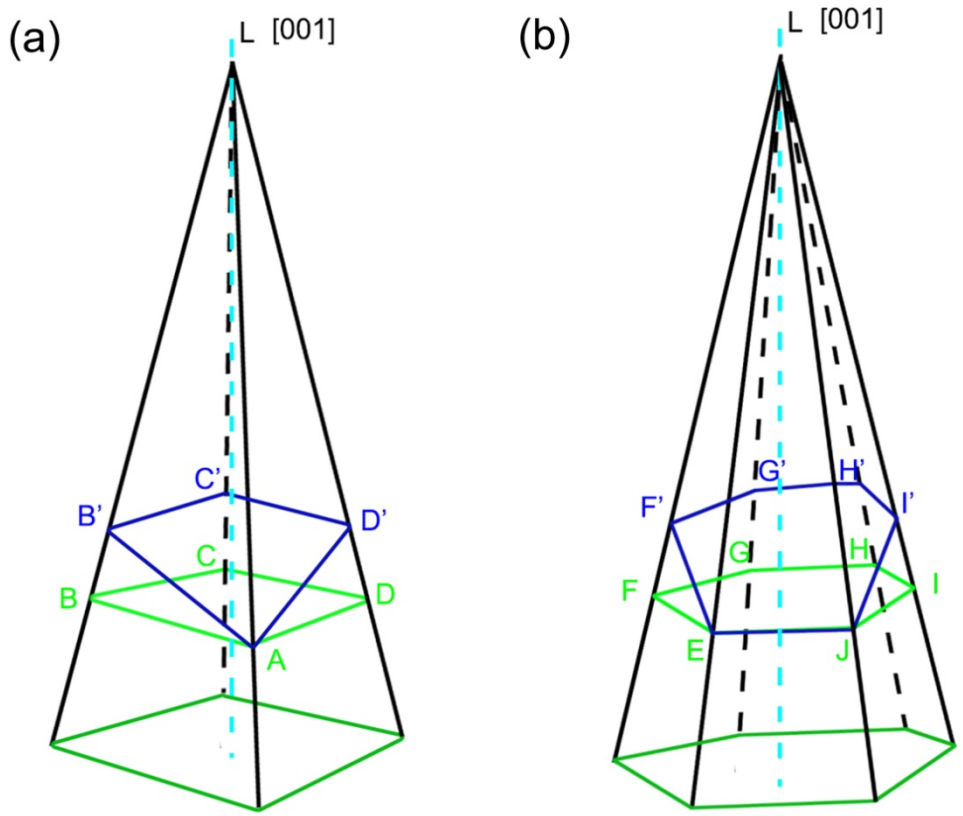

Figure S5. Schematic illustration of the corresponding angles for the neighbor steps of transverse cross sections of calcite micropyramids in (001) and one of the {104} planes. (a) NH_4I, (b) $(NH_4)_2SO_4$. Blue quadrangle and hexagon situate on one of the {104} planes, green quadrangle and hexagon situate on (001) plane, while light blue dashed line shows the *c* axis of calcite and the long axis of the micropyramids.

Table S1. The corresponding angles for the neighbor steps of transverse cross sections of calcite micropyramids in (001) and one of the {104} planes.

	Angles (°) on (001) plane		Angles (°) on {104} planes	
NH_4I	∠BAD	100.2 ± 2.8	∠B'AD'	80.0 ± 2.4
	∠ABC	62.1 ± 2.2	∠AB'C'	79.0 ± 2.0
	∠BCD	137.1 ± 2.3	∠B'C'D'	122.0 ± 2.6
	∠CDA	60.1 ± 2.0	∠C'D'A	79.0 ± 2.1
$(NH_4)_2SO_4$	∠FEJ	140.0±4.0	∠F'EJ	126.0±4.4
	∠EFG	130.1±5.2	∠EF'G'	136.5±5.4
	∠FGH	119.8±3.1	∠F'G'H'	133.5±3.4
	∠GHI	98.0±2.9	∠G'H'I'	78.0±3.2
	∠HIJ	119.8±3.1	∠H'I'J	133.5±3.5
	∠IJE	129.1±5.1	∠I'JE	136.5±5.2

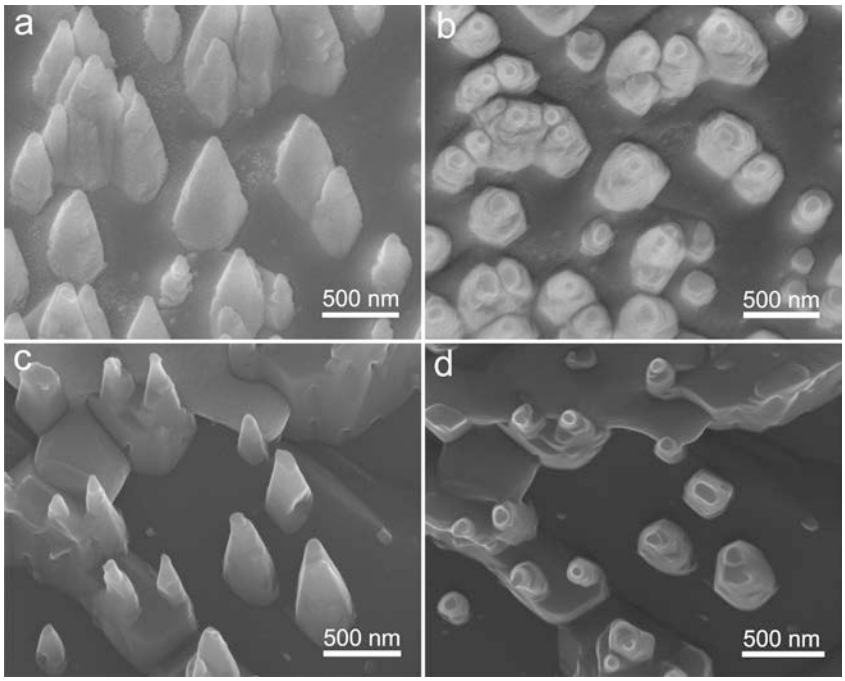

Figure S6. Side view (a, c) and top view (b, d) SEM images of calcite micropyramids obtained in the presence of alkaline metal iodides after 15 hours. (a, b) 10 mM of NaI, (c, d) 10 mM of KI. Side view images were taken with electron beam 24 ° away from [001] direction of calcite.

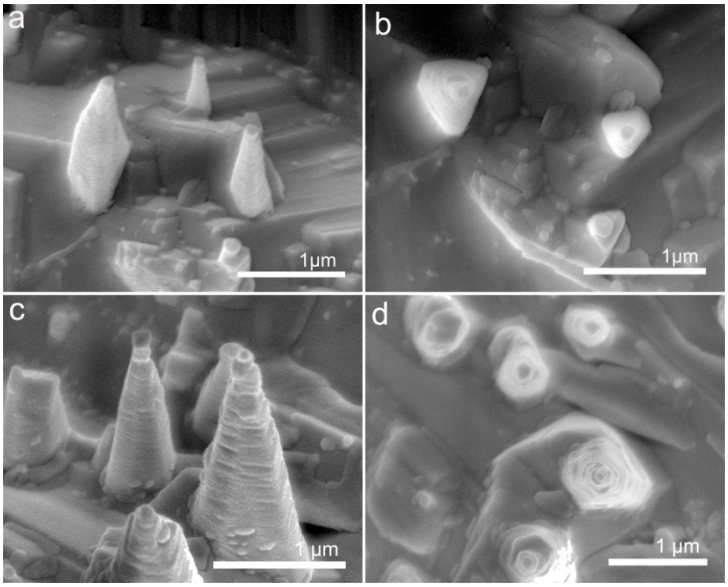

Figure S7. Side view (a, c) and top view (b, d) SEM images of calcite micropyramids obtained in the presence of alkaline metal sulphates after 15 hours. (a, b) 25 mM of Na_2SO_4, (c, d) 25 mM of K_2SO_4. Side view images were taken with electron beam 31 ° away from [001] direction of calcite.