Electronic Supplementary Material (ESI) for CrystEngComm.
This journal is © The Royal Society of Chemistry 2017

Supporting Information

Table – SI-1. Summary of the chemical potentials of the various components and the consecutive reactions

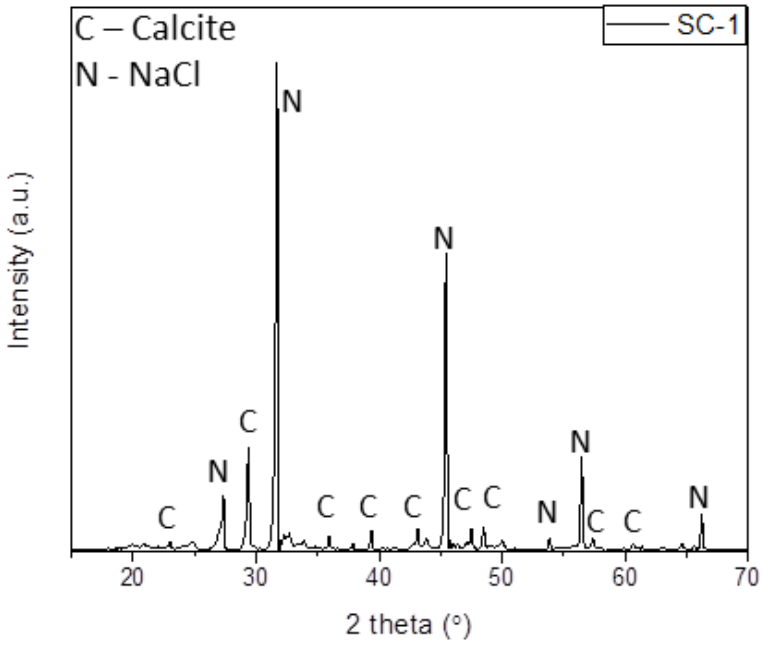
	Component	Na_2CO_3 (s)	$(NH_4)_2CO_3$	$CaCl_2$ (s)	NH_3 (g)	NH_3 (w)	NH_4^+ (w)	CO_2 (g)	CO_2 (w)	CO_3^{2-} (w)	HCO_3^- (w)	H_2O (g)	H_2O (l)	OH^- (w)	NH_4Cl (s)	NaCl (s)	$CaCO_3$ (s)	
	μ (kJ/mol)	-1047.67	-927.12	-748.1	-16.48	-26.6	-79.37	-393.51	-423.8	-527.4	-586.85	-228.6	-237.2	-157.28	-202.97	-384.05	-1128	**$\Delta G = \Sigma\mu_p - \Sigma\mu_r$ (kJ/mol)**
SC	Na_2CO_3 (s) + $CaCl_2$ (s) ----> 2NaCl (s) + $CaCO_3$ (s)	-1047.67	-	-748.1	-	-	-	-	-	-	-	-	-	-	-	-768.1	-1128	**-100.33**
AC	$(NH_4)_2CO_3$ (s) + $CaCl_2$ (s) ----> 2NH_4Cl (s) + $CaCO_3$ (s)		-927.12	-748.1											-405.94		-1128	**141.28**
CR 1	$(NH_4)_2CO_3$ (s) ----> NH_3 (g) + CO_2 (w) + H_2O (g)		-927.12	-	-16.48	-	-	-	-423.8	-	-	-228.6	-	-	-		-	**258.24**
CR 2	NH_3 (w) + H_2O (l) ----> NH_4^+ (w) + OH^- (w)		-	-	-	-26.6	-79.37	-	-	-	-	-	-237.2	-157.28	-		-	**27.15**
CR 3	CO_2 (g) + OH^- (w) ----> HCO_3^- (w)		-	-	-	-	-	-393.51	-	-	-586.85	-	-	-157.28	-		-	**-36.06**
CR 4	HCO_3^- (w) + OH^- (w) ----> CO_3^{2-} (w) + H_2O (l)		-	-	-	-	-	-	-	-527.4	-586.85	-	-237.2	-157.28	-		-	**-20.47**
CR 5	CO_3^{2-} (w) + 2NH_4^+ (w) + $CaCl_2$ (s) ----> $CaCO_3$ (s) + 2NH_4Cl(s)		-	-748.1	-	-	-158.74	-	-	-527.4	-	-	-	-	-405.94		-1128	**-99.7**

* Reactant

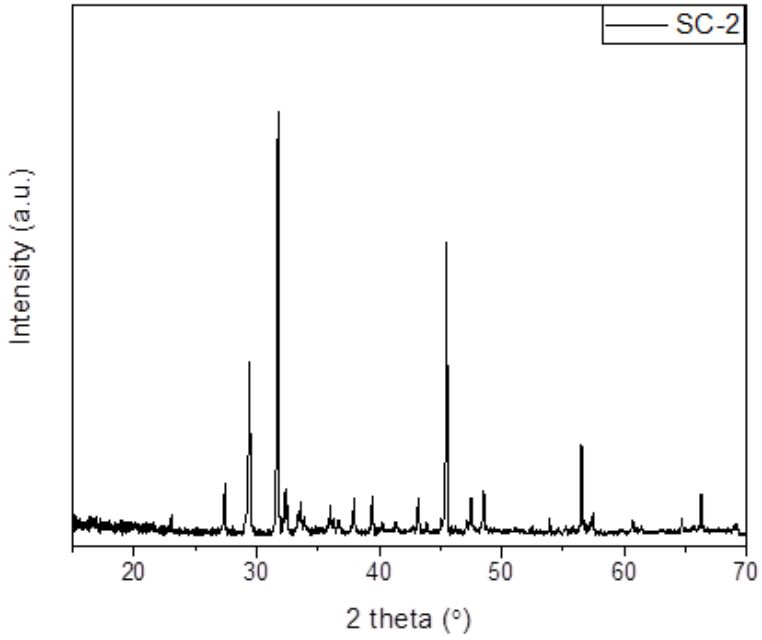
* Product

Figure SI-1: X-ray diffraction patterns of various SSR samples

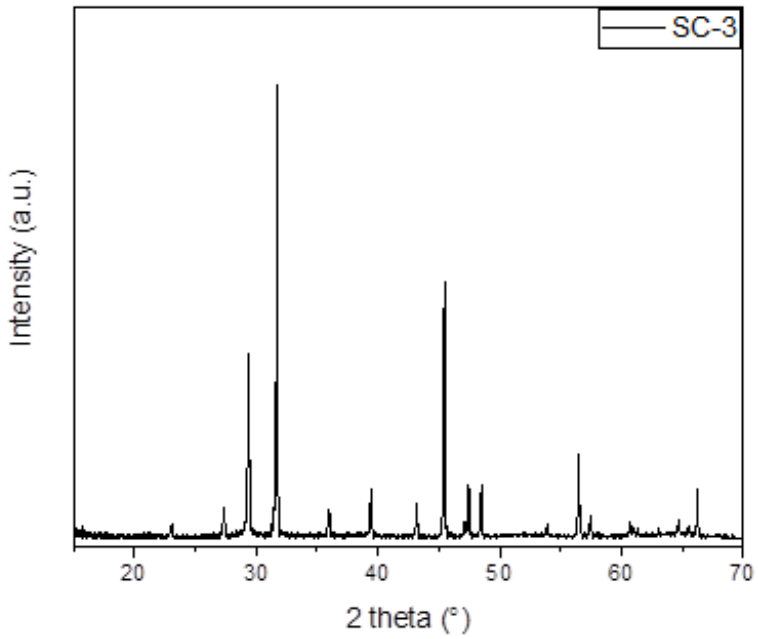
XRD - SC-1: Mortar and pestle at ambient conditions



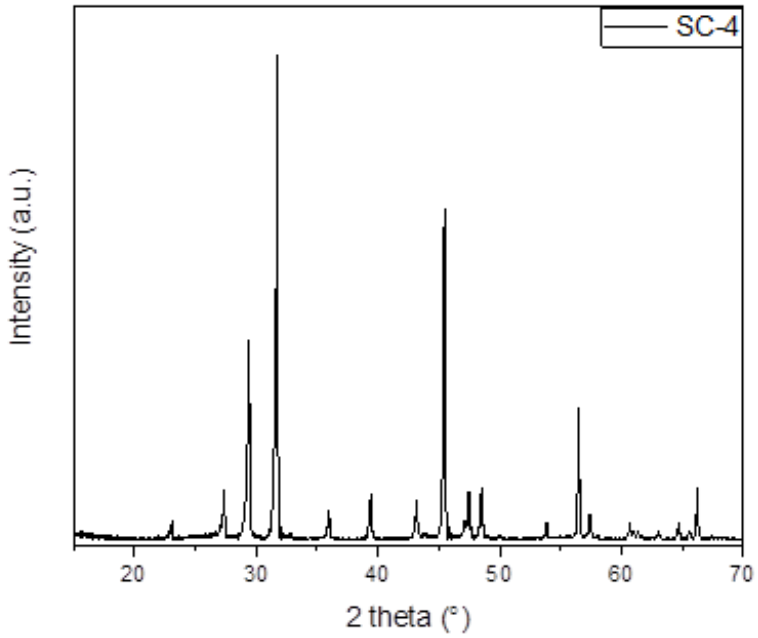
XRD - SC-2: 80°C and under vacuum (1.5 mbar)



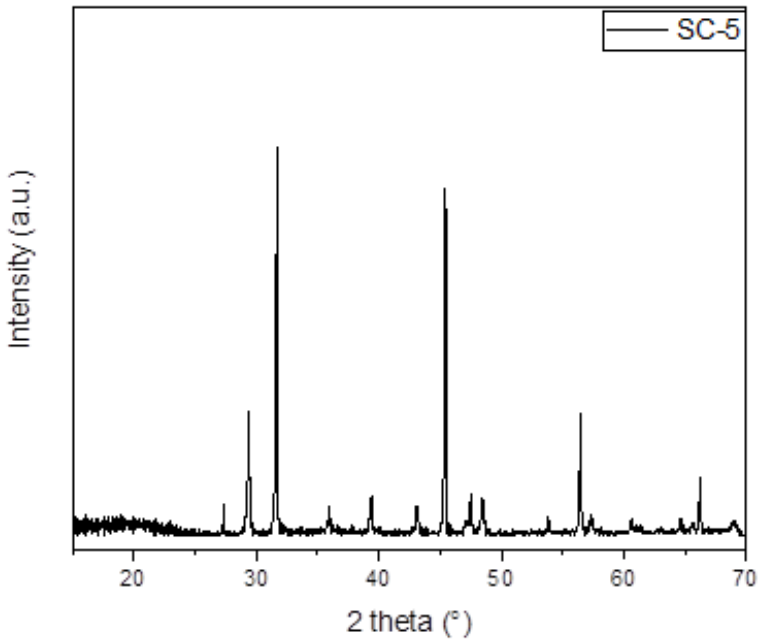
XRD - SC-3: Under 10 ton load/pressure



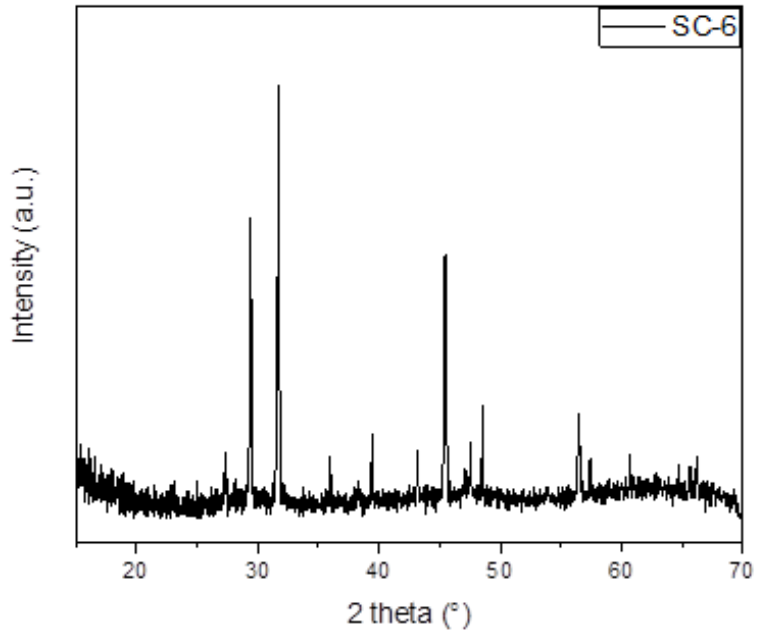
XRD - SC-4: Peristaltic pump



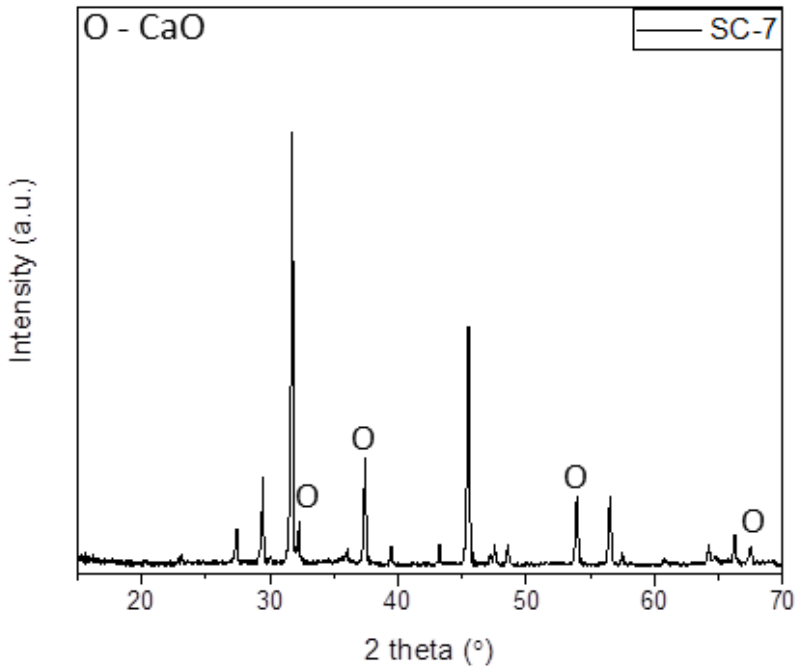
XRD - SC-5: Weighing glass with magnetic stirring at 80 °C



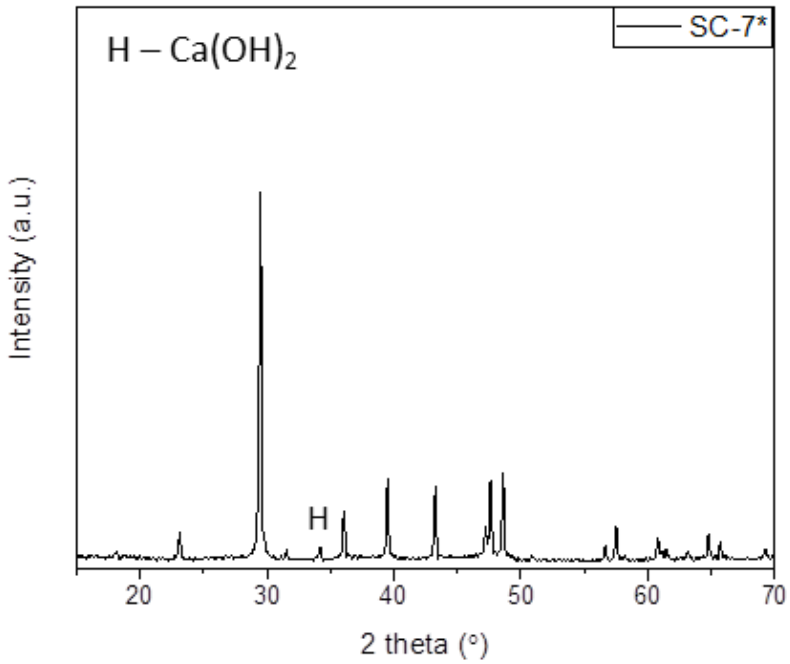
XRD - SC-6: DSC reaction at 600°C



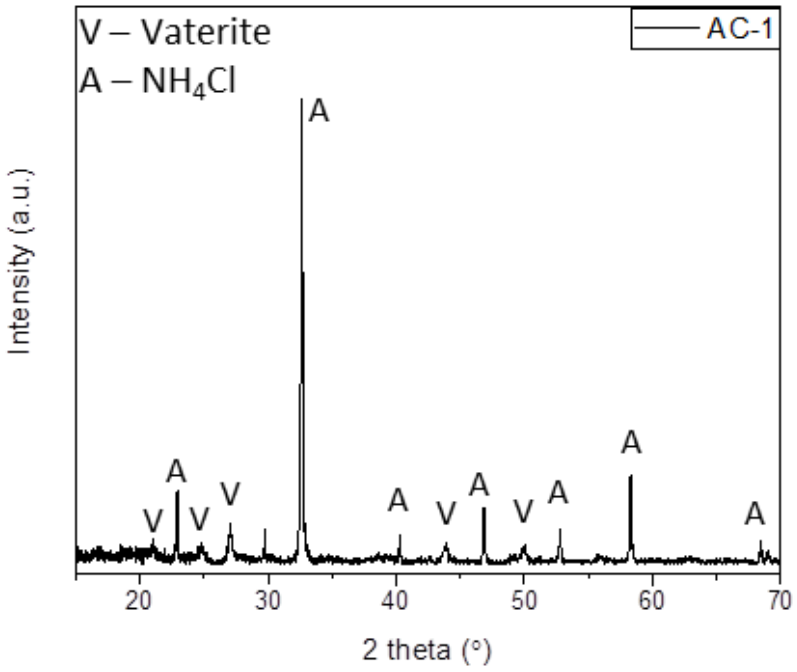
XRD - SC-7: Maintained in furnace at 600°C under N_2 atmosphere



XRD - SC-7*: Maintained in furnace at 600°C under N_2 atmosphere and washed with water



XRD - AC-1: Ammonium carbonate and calcium chloride with mortar and pestle (10 day sample)



XRD - AC-1: Ammonium carbonate and calcium chloride with mortar and pestle (1 year sample)

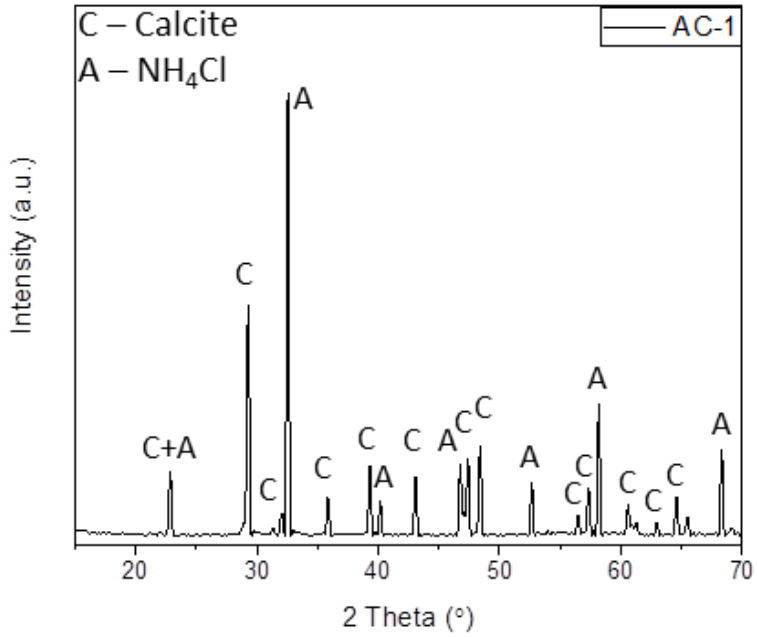
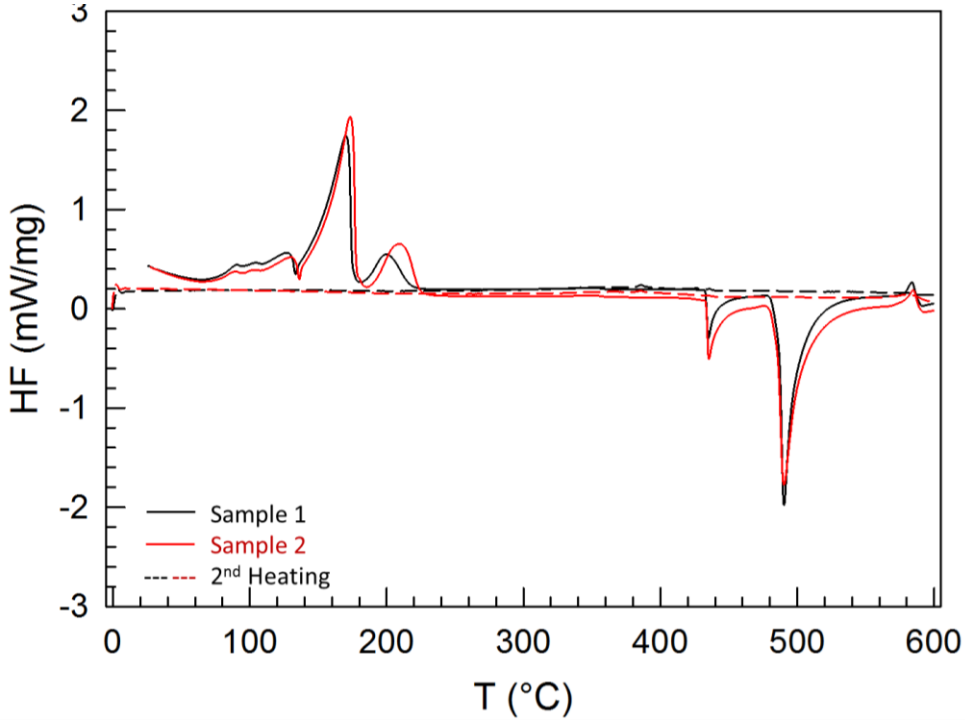


Figure SI-2: DSC heat flow curves of SC-6



Heating/cooling rates were kept at 10 K/min. The thermal cycle for the DSC measurements involved the following steps: 1) cooling from room temperature to 0 °C, 2) heating from 0 to 600 °C, 3) cooling from 600 to 0 °C, 4) heating from 0 to 600 °C and 5) cooling back to room temperature. At each target temperature there was a resting time of 5 min.

Table SI-2: Alien peaks assignment for SC reactions (Fig. 8 in main text)

Alien peaks (**AP**)	**SC-1**	**SC-2**	**SC-6**	**SC-7**	**SC-7***
AP 2θ	53.85°	32.36°	24.93°	32.28°	34.17°
Assignment	Na_2CO_3 (53.58°)	Na_2CO_3 (32.30°)	Unassigned	CaO (32.20°)	$Ca(OH)_2$ (34.11°)
AP 2θ	-	33.60°	28.18°	37.43°	-
Assignment		Na_2CO_3 (33.58°)	Unassigned	CaO (37.35°)	
AP 2θ	-	37.96°	33.70°	53.96°	-
Assignment		Na_2CO_3 (38.0°)	Na_2CO_3 (33.58°)	CaO (53.85°)	
AP 2θ	-	-	38.35°	67.49°	-
Assignment			Na_2CO_3 (38.62°)	CaO (67.37°)	

Table SI-3: Water uptake of various components in a water-saturated atmosphere

Sample	r_{wup} (g/h)	S_w (g/L)	C_{ww} $(g_w/g_s)_w$*	C_{wd} $(g_w/g_s)_d$**
Blank	4.64×10^{-4}	-	0.3034	~ 0.01
Na_2CO_3	4.59×10^{-3}	217	5.043	1.192
$CaCl_2$	9.28×10^{-2}	740	6.781	0.725
NaCl	5.34×10^{-3}	358	8.381	0.222
SC-1	6.13×10^{-3}	-	4.559	0.074
SC-7	5.46×10^{-3}	-	4.573	0.094
AC-1	7.89×10^{-3}	-	2.910	- 0.209 ***
Calcium carbonate	5.54×10^{-4}	1.4×10^{-3}	0.2550	0.018

* At water-saturated vapor conditions

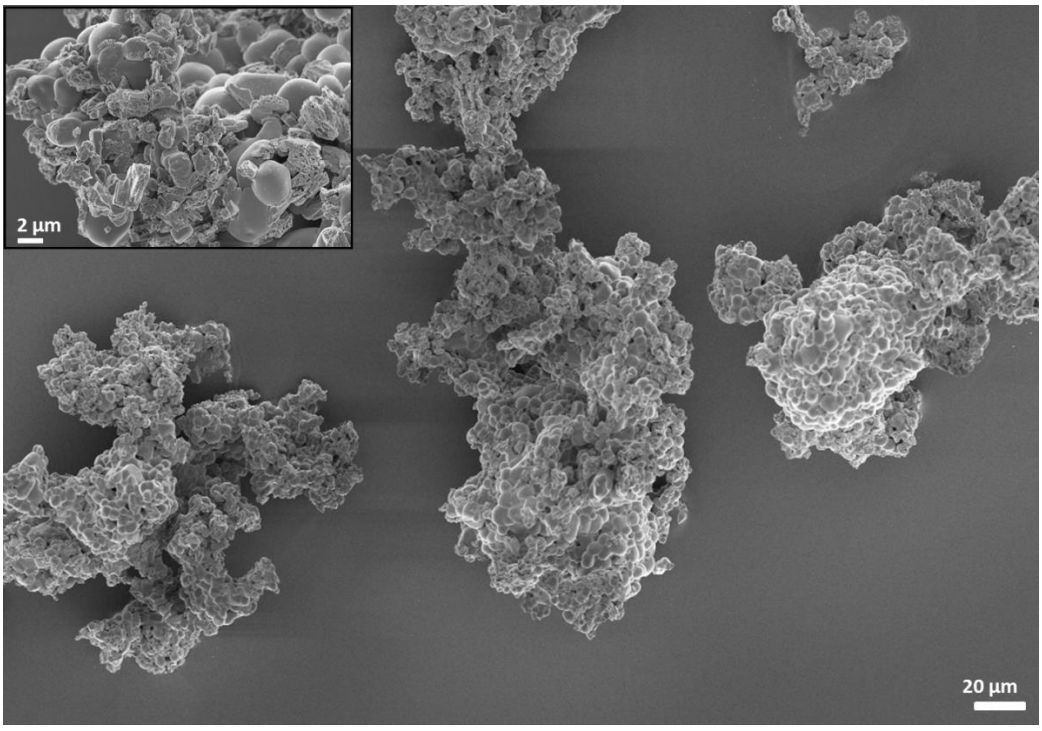
** At ambient humidity

*** Negative value due to $(NH_4)_2CO_3$ decomposition

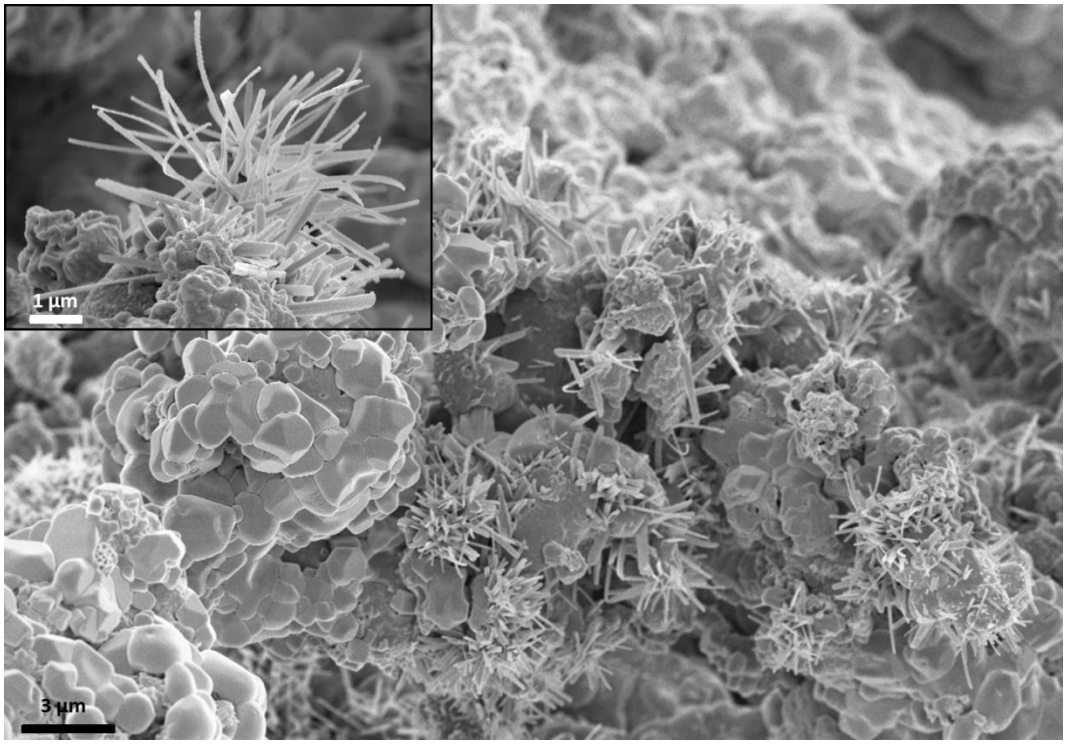
r_{wup} = Rate of water uptake (g/h)
S_w = Solubility in water
C_{ww} = Concentration of water (wet state)
C_{wd} = Concentration of water (dry state)
g_w = Mass of water
g_s = Mass of solid

Figure SI-3: SEM micrograph of various SSR samples

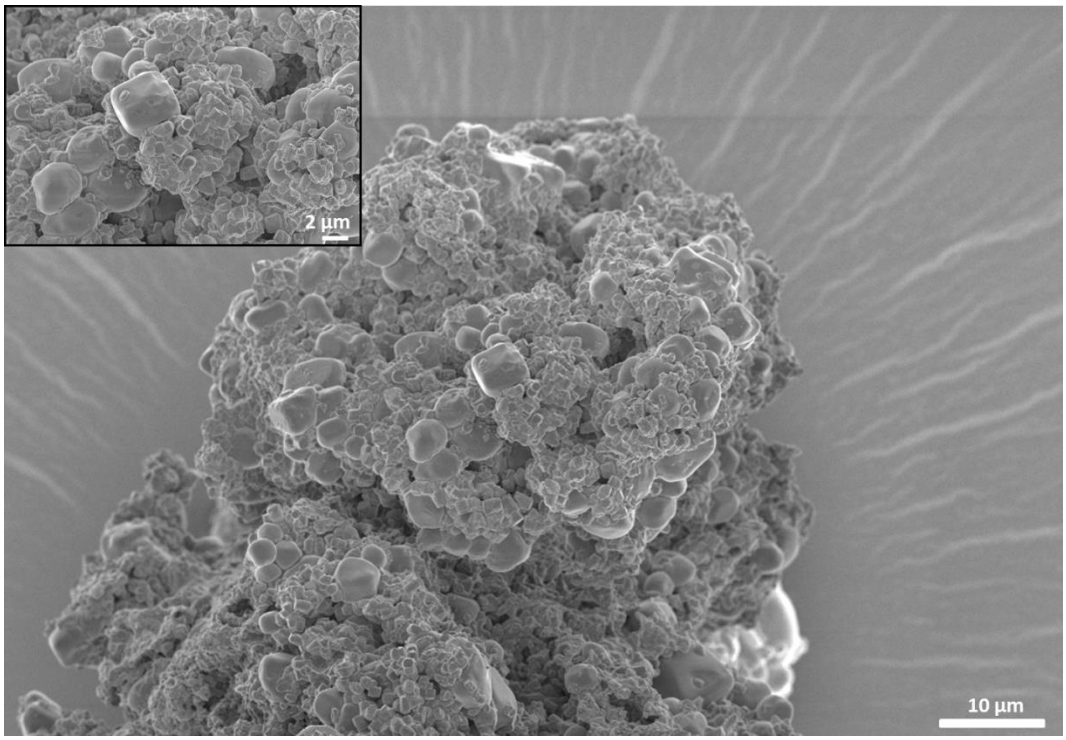
SC-1



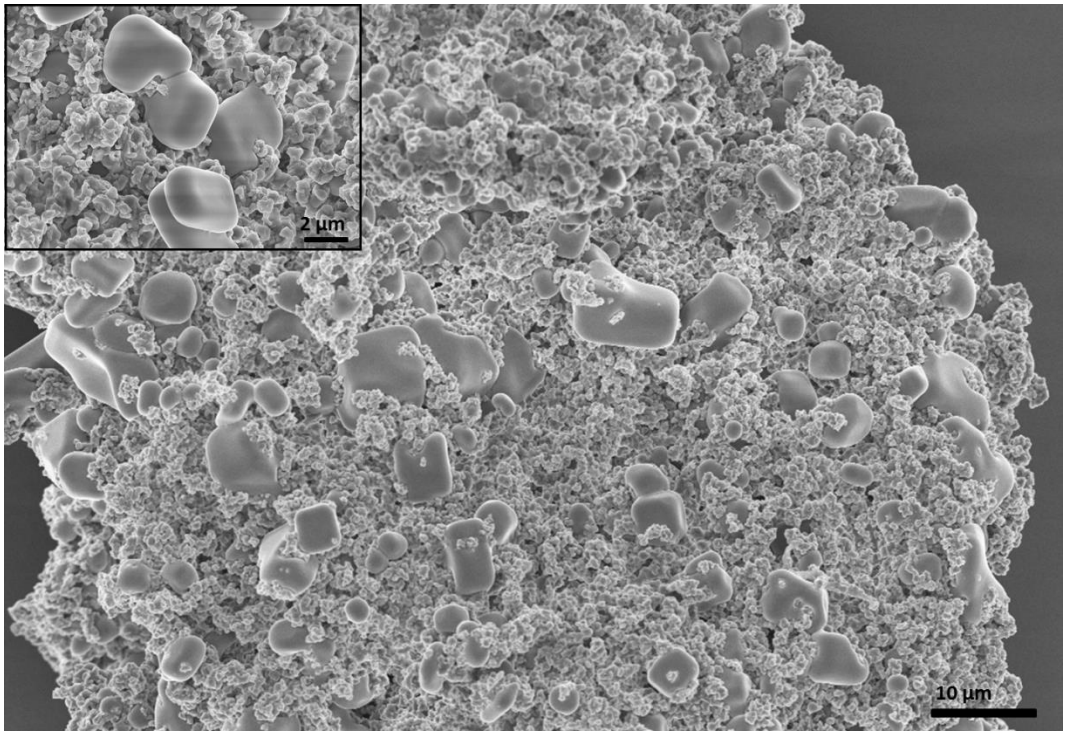
SC-2



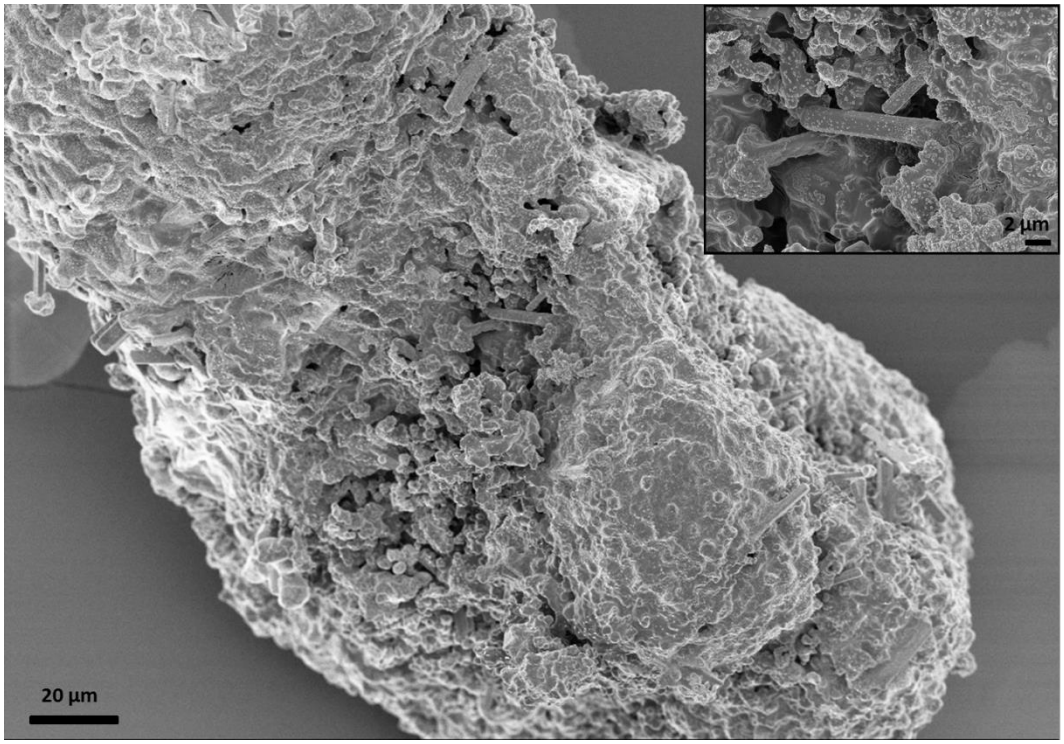
SC-3



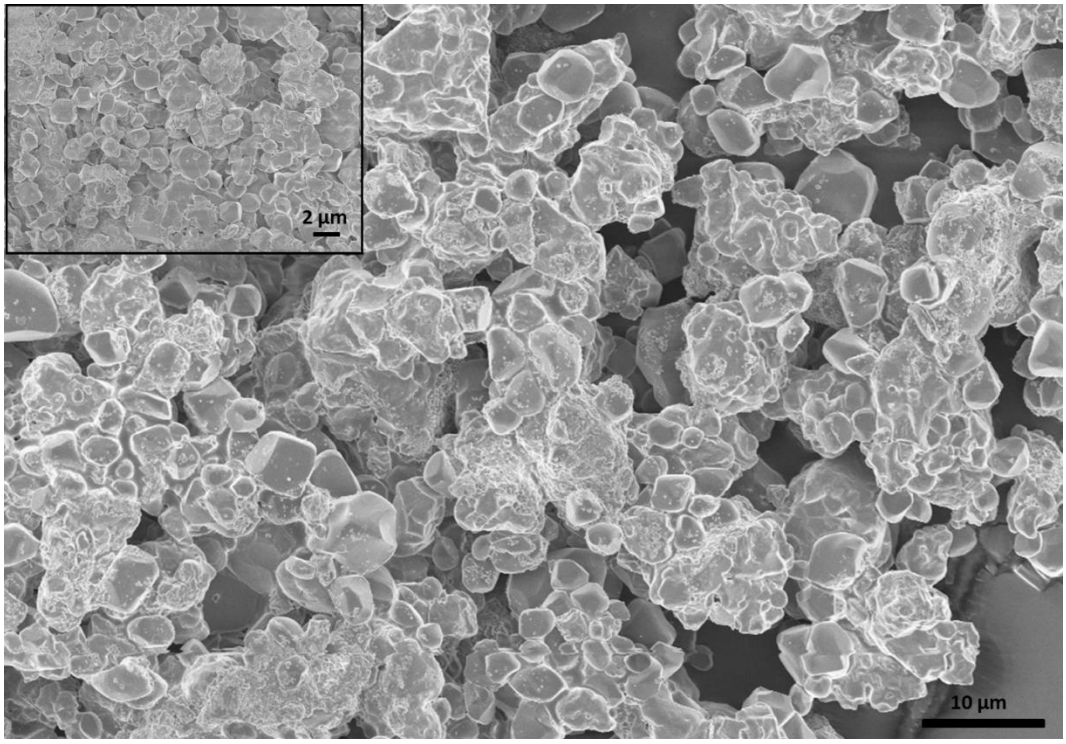
SC-4



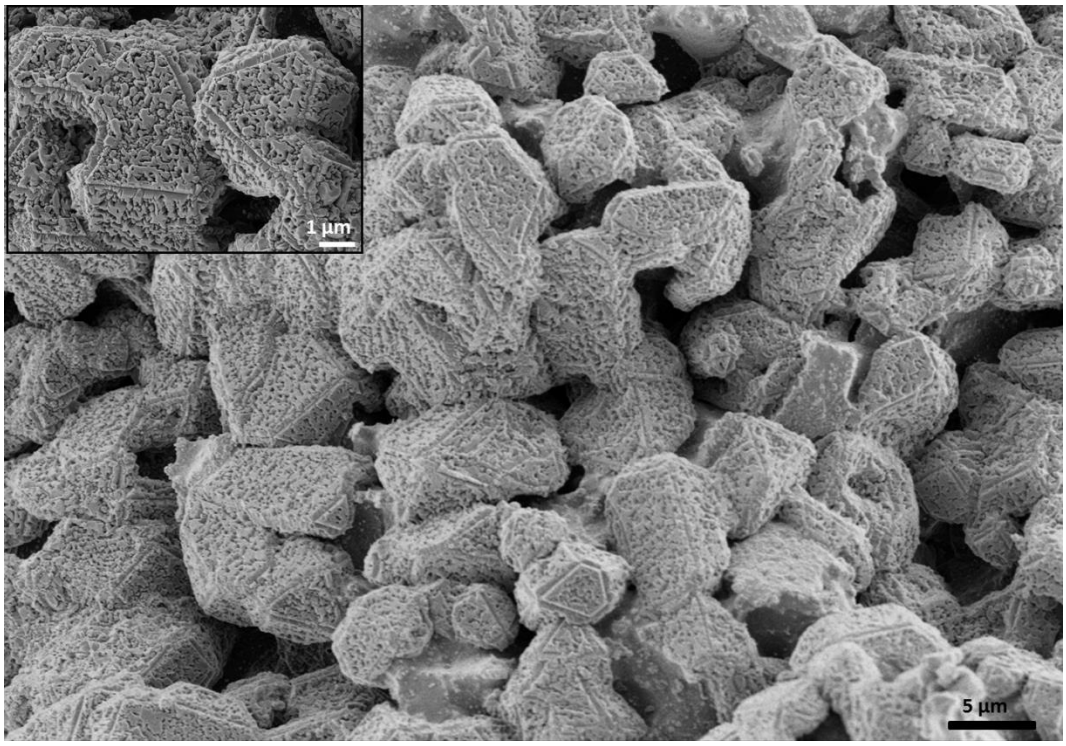
SC-5



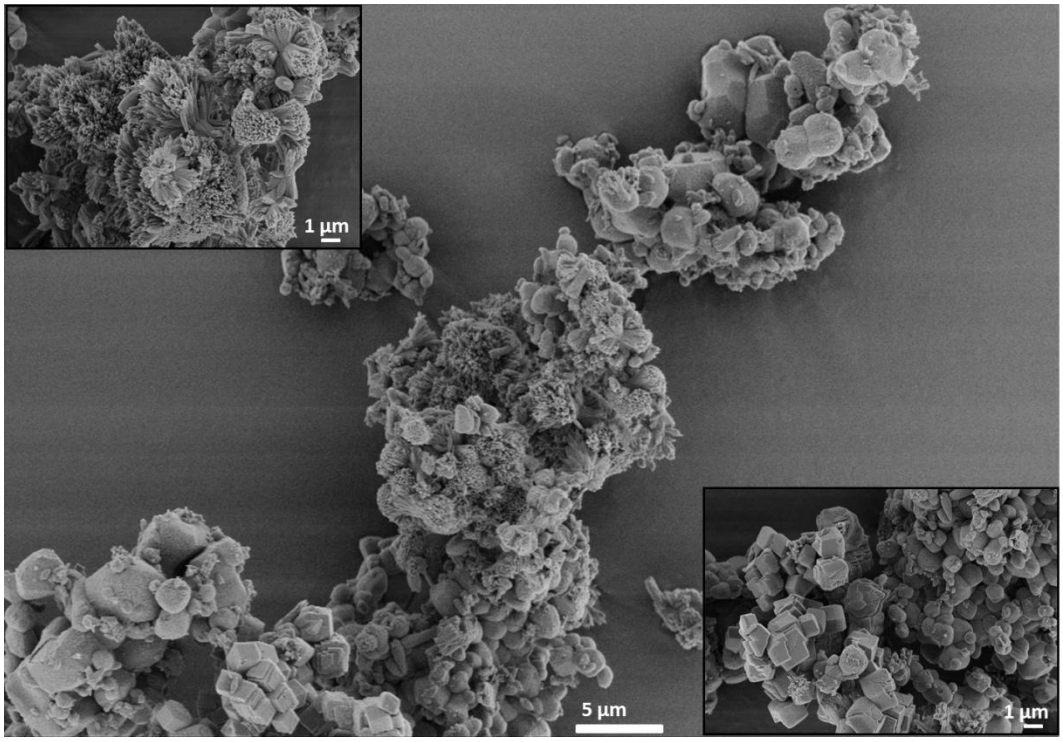
SC-6



SC-7



SC-7*



AC-1

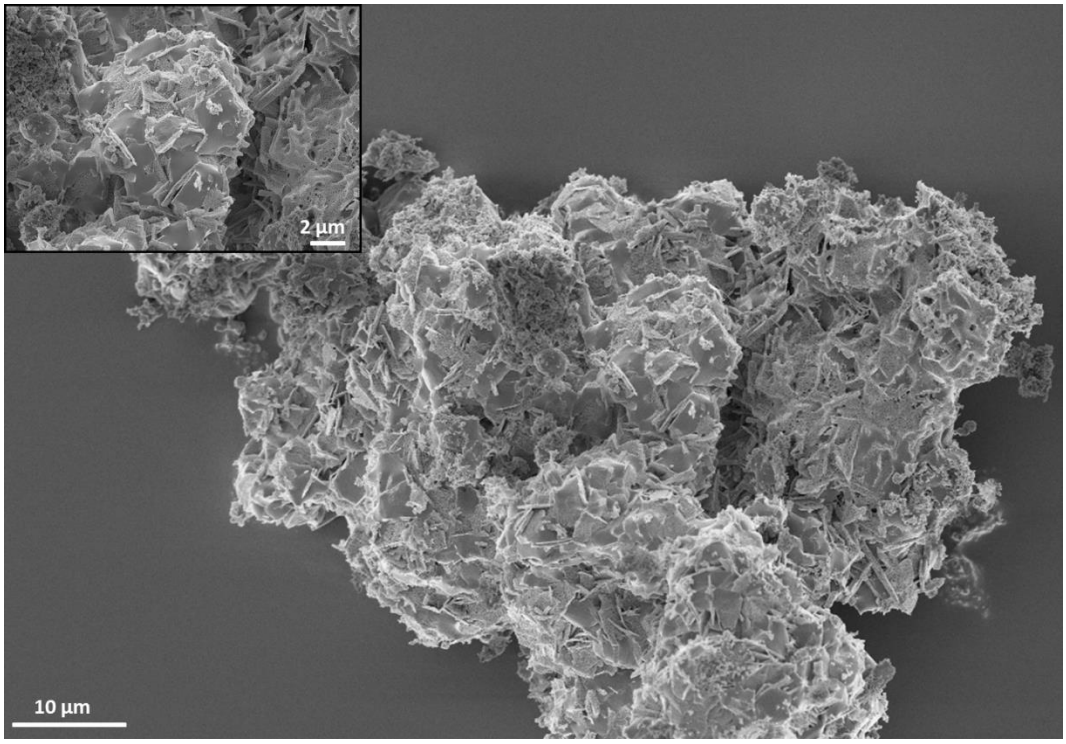
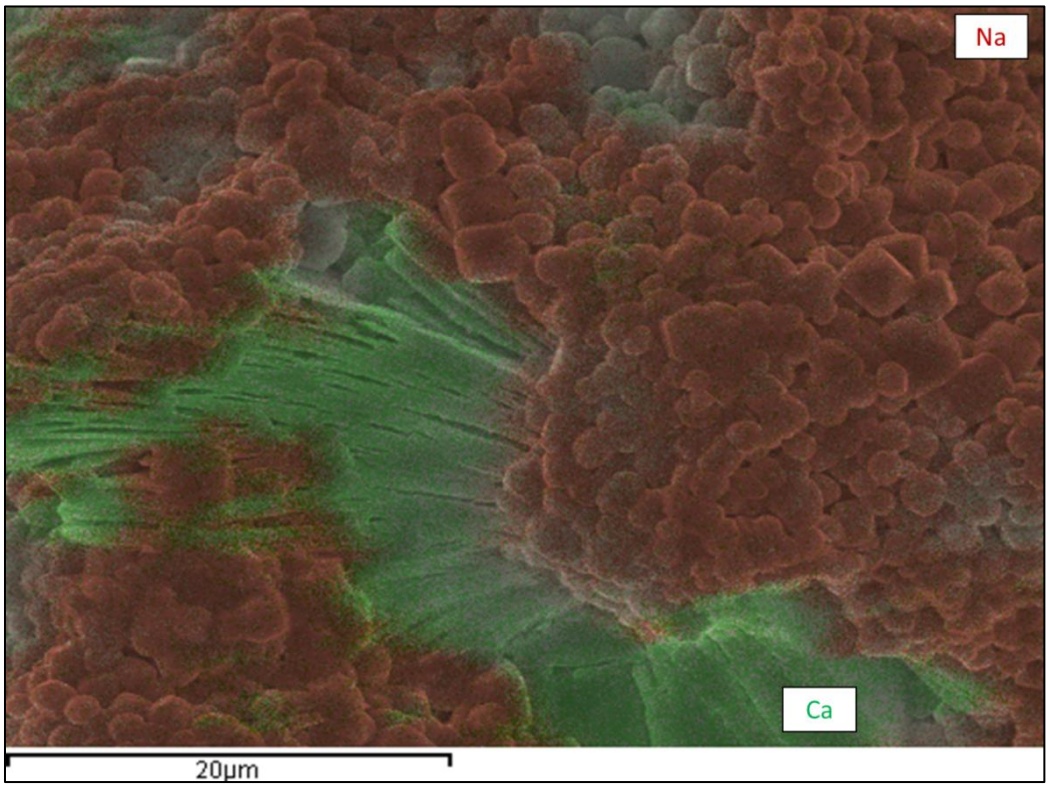
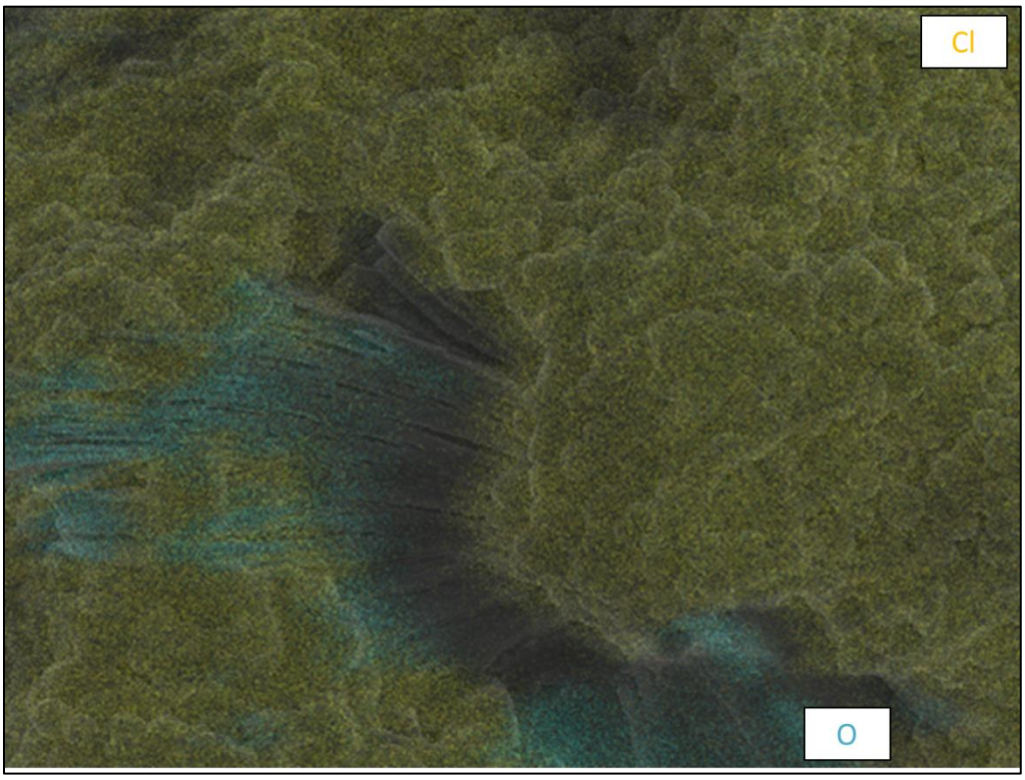


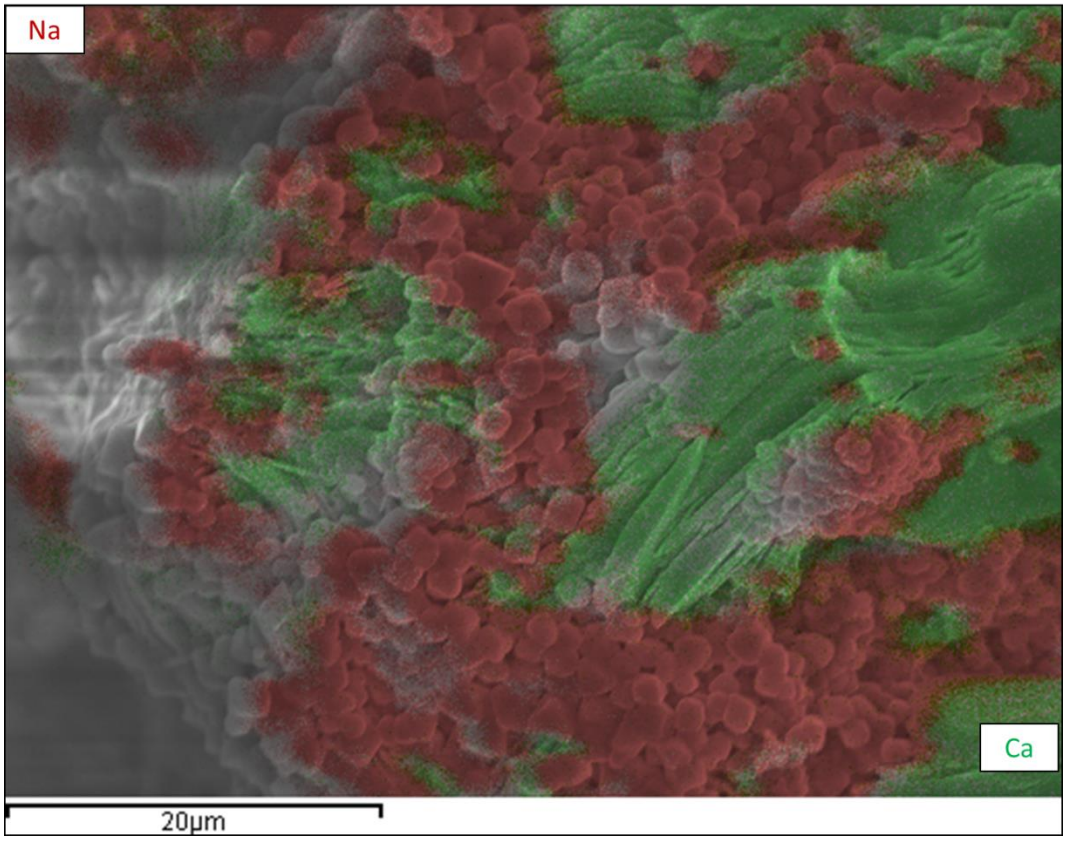
Figure SI-4: EDX mapping of SC-5 samples

SC-5 – EDX map 1





SC-5 – EDX map 2



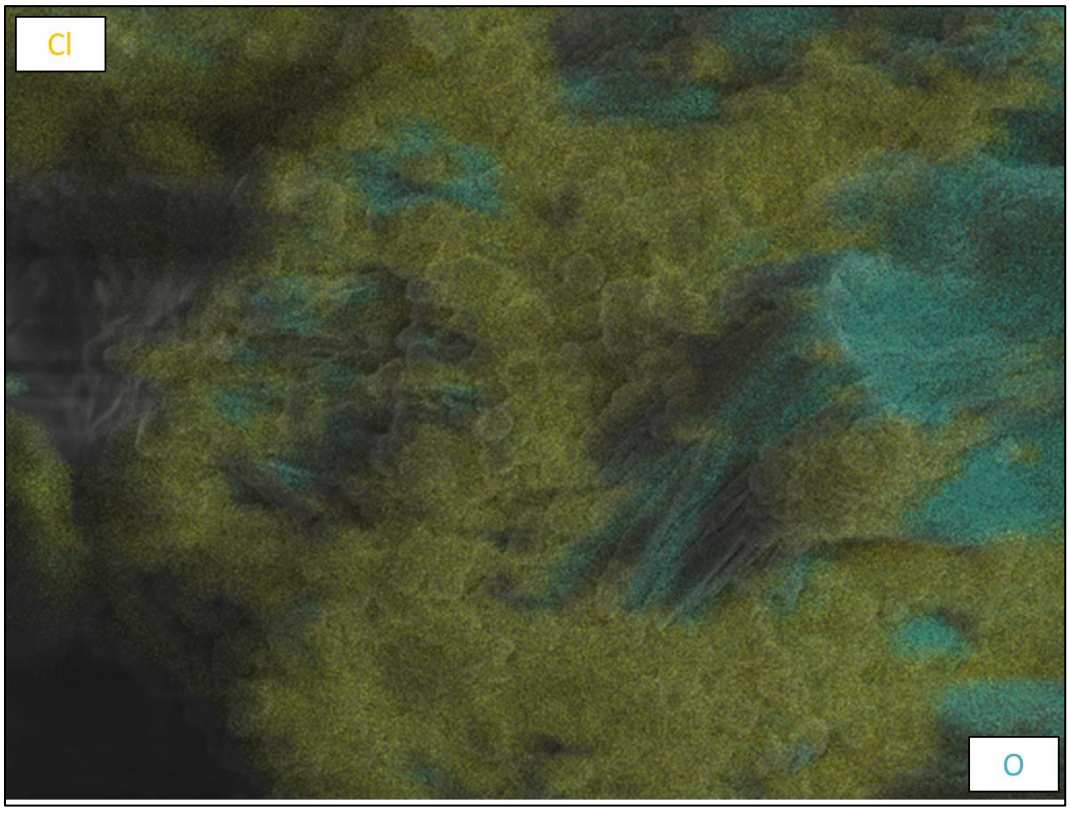
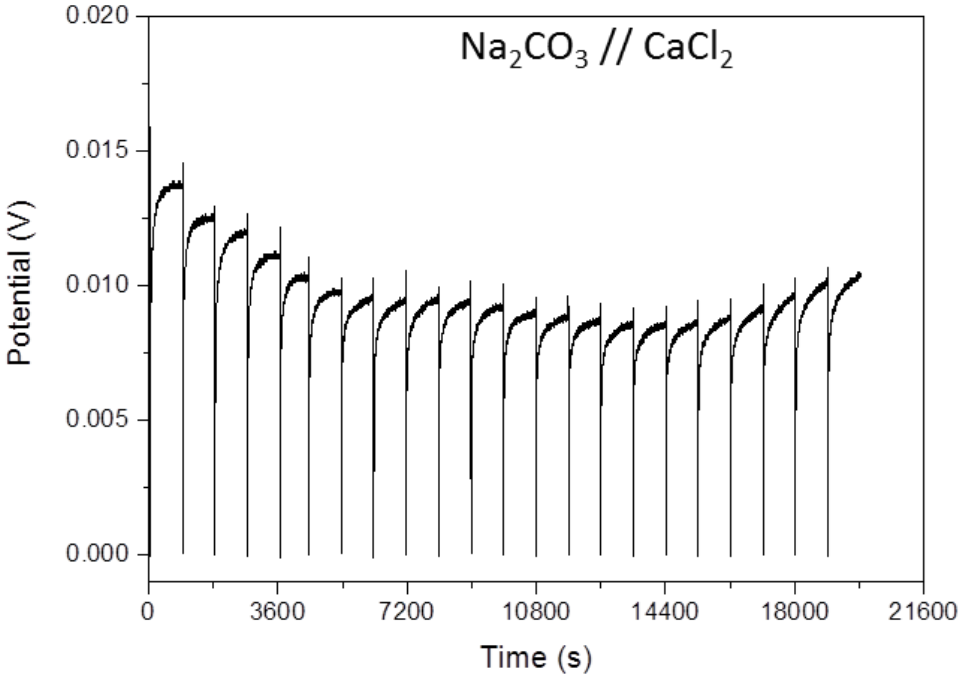
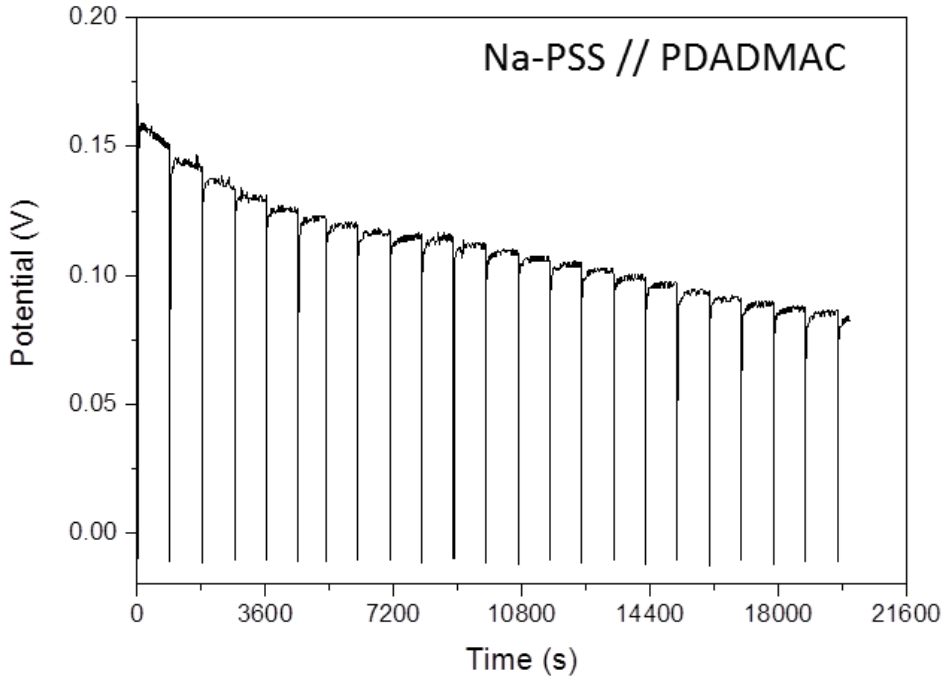
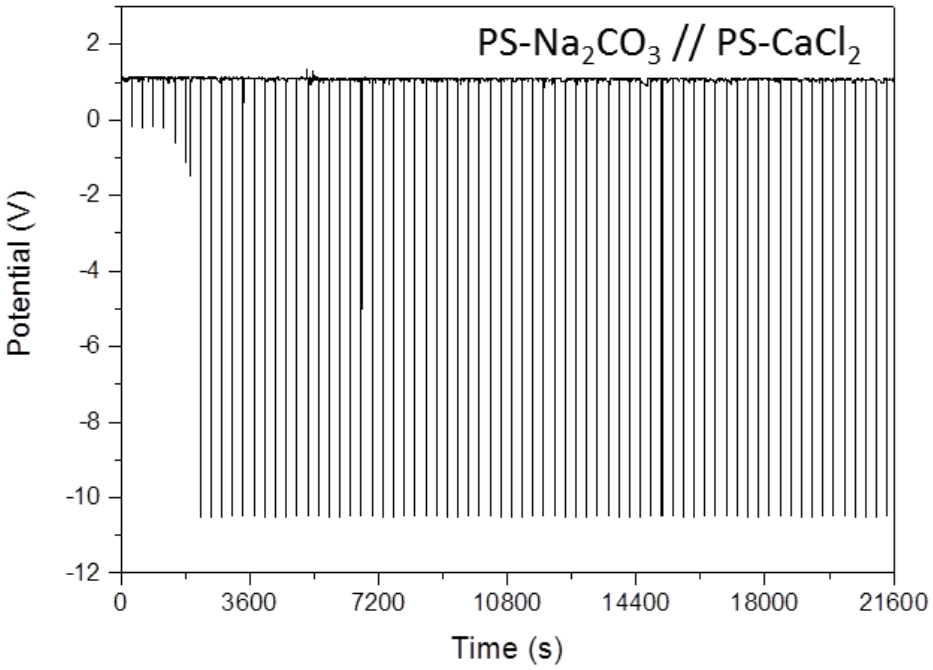
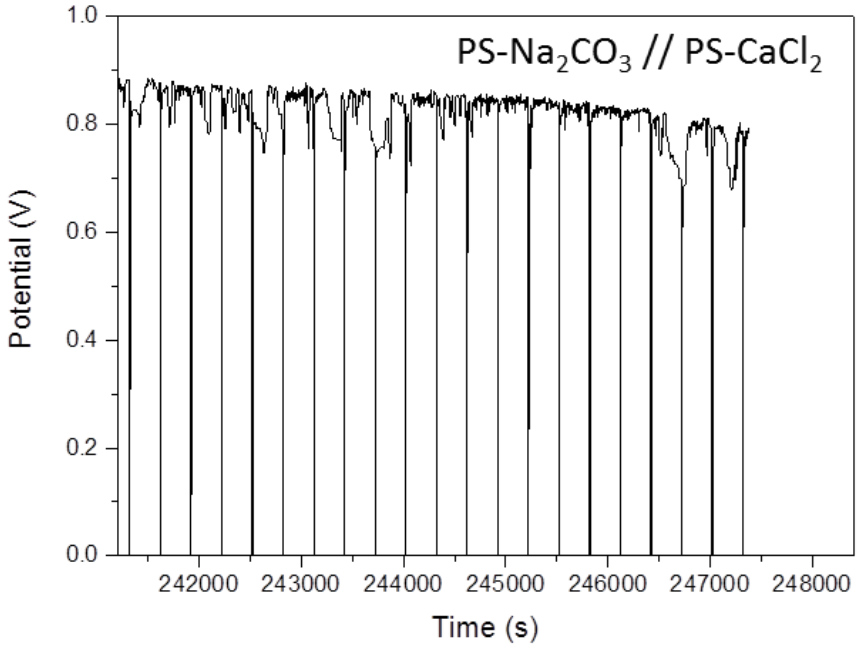


Figure SI-5: Plots of potential against time when contacting 2 different tablets






PS-Na2CO3 // PS-CaCl2
Potential (V)
Time (s)
2
0
-2
-4
-6
-8
-10
-12
0
3600
7200
10800
14400
18000
21600


PS-Na2CO3 // PS-CaCl2
Potential (V)
Time (s)
1.0
0.8
0.6
0.4
0.2
0.0
242000
243000
244000
245000
246000
247000
248000