

Tables deposited

Table 1S. EDS data and phase analysis of different morphology particles

Sample	Morphology	T/°C	EDS data					Phase analysis		
			Chemical formula	K:Al:Si	Ca:Si	Ca:Al	Ca:Al+Si		Al:Si	
OK	original K-feldspar	~	$K_{0.92}Al_{1.04}Si_{3.10}O_{8.00}$	1:1.13:3.3 7	~	~	~	1:2.98	Potassium feldspar	
NK	average	190	$K_{0.83}Al_{1.01}Si_{2.86}O_{8.00}$	1:1.22:3.4 5	~	~	~	1:2.83	Potassium feldspar	
KK	average	190	$K_{0.96}Al_{0.99}Si_{2.93}O_{8.00}$	1:1.03:3.0 5	~	~	~	1:2.96	Potassium feldspar	
CK-1	a, fibroid	160	$Ca_{0.88}K_{2.45}Al_{2.61}Si_{8.85}O_{18.00}$	1:1.06:3.6 1	1:10.07	1:2.97	1:13.04	1:3.40	Transitional compound of $KAlSi_3O_8$ with a few Ca inserted.	
	b, spheroidal		$Ca_{2.31}K_{0.43}Al_{2.00}Si_{3.34}O_{18.00}$	1:4.69:7.8 1	1:1.44	1:16:1	1:2.30	1:1.66		Hydrogarnet
	c, polyhedron		$Ca_{3.07}K_{0.32}Al_{0.96}Si_{3.03}O_{18.00}$	1:2.94:9.2 2	1.01: 1	3.18:1	1:1.30	1:3.14		UCSH
CK-2	a, fibroid	190	$Ca_{2.97}K_{2.11}Al_{2.09}Si_{8.42}O_{18.00}$	1.01:1:4.0 2	1:2.83	1.41:1	1:3.54	1:4.02	Transitional compound of $KAlSi_3O_8$ with substantial Ca inserted.	
	b, block		$Ca_{5.64}Si_{3.50}O_{18.00}$	~	1.61:1	~	~	~		UCSH
CK-3	a, fibroid	220	$Ca_{5.58}K_{0.14}Al_{0.69}Si_{3.75}O_{18.00}$	1:5.28:28. 96	1.49:1	8.13:1	1.26:1	1:5.46	Tobermorite	
	b, octahedron		$Ca_{3.91}Al_{2.60}Si_{2.32}O_{18.00}$	~	1.68:1	1.50:1	1:1.26	1:12:1	Hydrogarnet.	
	c, bar		$Ca_{5.41}Al_{0.77}Si_{4.65}O_{18.00}$	~	1.16:1	7:1	1:1	1:6.01	Tobermorite	

CK-3P	a, bar	220	$\text{Ca}_{2.17}\text{K}_{0.10}\text{Al}_{0.68}\text{Si}_{2.96}\text{O}_{18.00}$	1:6.98:30.20	1:1.37	3.20:1	1:1.68	1:4.37	Tobermorite.
	b, spheroidal		$\text{Ca}_{4.91}\text{Al}_{0.28}\text{Si}_{1.81}\text{O}_{18.00}$	~	2.71:1	17.54:1	2.35:1	1:6.46	UCSH
	c, needle		$\text{Ca}_{2.50}\text{K}_{0.13}\text{Al}_{0.76}\text{Si}_{3.13}\text{O}_{18.00}$	1:6.06:25.06	1:1.25	3.31:1	1:1.55	1:4.14	Tobermorite.
Reference phase	Tobermorite	~	$\text{Ca}_{5-x}\text{Si}_{6-y}\text{Al}_y\text{O}_{17-2x}(\text{OH})_{2x}\cdot 5\text{H}_2\text{O}$	~	1:1.2-1:1.5	1:0-4.17:1	1:1.2-1:1.5	0:1-1:4	~
	Hydrogarnet	~	$\text{Ca}_3\text{Al}_2(\text{SiO}_4)_{3-x}(\text{OH})_{4x}$	~	1:0-1:1	1.5:1	1.5:1-1:1.67	1:0-1:1.5	~

Note: 1. Few square microns area was scanning to measure compositions of OK, NK and KK. Three or more points were chosen to measure an average composition of different shaped particles.

2. H atom was not provided by EDS because of the limited resolution. Therefore, the authors concluded that calcium silicate compound was hydrate, which was based on a general rule of the hydrothermal reaction. The term “unconfirmed calcium silicate hydrate (UCSH)” refers to the phases unconfirmed in this study.

Table 2S. Quantitative phase analysis by the Rietveld method and R factors

	R_{wp}	R_p	χ^2	K-feldspar KAlSi_3O_8	Portlandite $\text{Ca}(\text{OH})_2$	Calcite CaCO_3	Hydrogarnet $\text{Ca}_3\text{Al}_2(\text{SiO}_4)_{1.53}(\text{OH})_{5.88}$	Dicalcium silicate hydrate $\text{Ca}_2(\text{SiO}_3\text{OH})(\text{OH})$	Tobermorite $\text{Ca}_5\text{Si}_6\text{H}_2\text{O}_{18}\cdot 4\text{H}_2\text{O}$	Potassium carbonate K_2CO_3	Butschliite K_2CaCO_3
PCK-1	14.8	11.3	1.80	45.19	25.35	10.50	13.88	/	/	5.09	/
PCK-2	15.7	12.3	1.97	22.72		23.08	25.51	14.42	1.57	/	12.69
PCK-3	16.8	13.0	2.28	11.41		4.62	30.59	/	43.05	/	10.33