

The hydration of ternary blended cements with iron-rich non-ferrous metallurgy slag and limestone: Supplementary Materials

S1 Table of the pore solution concentrations of neat PC and blended cements with 50 wt% replacement of PC by NFM slag with and without limestone.

PC (wt%)	LS/Slag (wt ratio)	Time (days)	Na	K	Ca	Al (mmol/l)	Si	S	Fe	OH ⁻ ^a	pH (-)	C.B.E. ^b (%)
0	-	2	141 ^c	305 ^c	3.7	0.08	0.22	6.8	n.d.	471	13.6	-7
		8	206	389	4.2	0.09	0.26	11	n.d.	468	13.6	19
		28	233	424	1.9	0.13	0.34	11	n.d.	n.d. ^d	n.d. ^d	n.d.
		91	243 ^c	403 ^c	3.1	0.16	0.21	26 ^c	0.007	n.d. ^d	n.d. ^d	n.d.
50	0	2	98 ^c	161 ^c	6.5	0.06	0.18	0.94	n.d.	217	13.3	19
		8	156	176	5.0	0.09	0.12	1.0	n.d.	322	13.5	5
		28	232	182	2.5	0.24	0.17	1.9	n.d.	308	13.4	23
		91	268 ^c	151 ^c	2.0	0.44 ^c	0.25	6.3	0.010	330	13.4	15
50	1/3	2	88	147	6.6	0.04	0.08	0.6	n.d.	235	13.3	5
		8	141	170	5.0	0.05	0.08	1.1	n.d.	298	13.4	6
		28	199	168	3.1	0.1	0.15	2.4	n.d.	263	13.4	28
		91	205	114	2.1	0.15	0.17	8.4	0.008	306	13.5	0.5
			D.L. ^e	1e ⁻²	1e ⁻²	6e ⁻³	4e ⁻⁵	4e ⁻⁴	1e ⁻³	4e ⁻⁵		

^a Calculated from the pH measurements using ionic strengths from GEMS [1,2] and the Helgeson form of the Debye-Hückel equation [3,4] to calculate the activity coefficient.

^b Charge balance error, calculated as the ratio of the difference in total charge due to cations ($\text{Na}^+ + \text{K}^+ + 2\cdot\text{Ca}^{2+}$) versus anions ($\text{OH}^- + 2\cdot\text{S}^{2-}$) to the total charge caused by the cations.

^c Measured concentration > highest standard measured due to a dilution error where a lack of material prevented repeated measurement of the samples.

Based on the measurements without this dilution error, the expected maximum error is < 7% for Na and K.

^d Not enough pore solution could be obtained to measure pH and calculate OH⁻ concentrations but no significant changes are expected at later ages [5].

^e detection limits for 2-28 days, at 91 days the detection limits are 10 times lower as there was less dilution.

S2 Effective saturation indices for neat PC and blended cements with 50 wt% replacement of PC by NFM slag with and without and limestone.

Ett. = Ettringite, Str. = Strätlingite, CH = Ca(OH)_2 , Hdg = Siliceous hydrogarnet, Fh = Ferrihydrite, Al-Hc = Hemicarboaluminate, Al-Mc = Monocarboaluminate, Fe-Hc = Hemicarboferrite, Fe-Mc = Monocarboferrite.

PC (wt%)	LS/Slag (wt ratio)	Time (days)	Ett.	Gypsum	Str.	C-S-H	CH	Hdg	Fh	Al-Hc	Al-Mc	Fe-Hc	Fe-Mc
0	-	2	0.28	-1.04	-0.74	0.47	0.25	-	-	0.002	0.20	-	-
		8	0.34	-0.92	-0.71	0.51	0.26	-	-	0.02	0.22	-	-
		28	0.22	-1.10	-0.71	0.40	0.14	-	-	-0.05	0.15	-	-
		91	0.39	-0.81	-0.66	0.42	0.21	0.58	-1.07	0.03	0.23	0.07	0.25
50	0	2	0.24	-1.14	-0.69	0.42	0.19	-	-	-0.009	0.19	-	-
		8	0.21	-1.27	-0.71	0.38	0.22	-	-	0.02	0.22	-	-
		28	0.19	-1.28	-0.61	0.31	0.11	-	-	-0.004	0.21	-	-
		91	0.28	-1.10	-0.53	0.33	0.08	0.57	-0.90	0.01	0.23	0.01	0.20
50	1/3	2	0.18	-1.26	-0.81	0.32	0.21	-	-	-0.03	0.17	-	-
		8	0.18	-1.24	-0.82	0.31	0.21	-	-	-0.03	0.17	-	-
		28	0.21	-1.14	-0.71	0.32	0.12	-	-	-0.05	0.16	-	-
		91	0.25	-1.01	-0.69	0.29	0.08	0.54	-0.93	-0.07	0.15	-0.003	0.19

References

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