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C. Paillard, M. Aparicio Cordoba, N. Sanson, J.-B. d'Espinose de Lacaillerie, G. Ducouret, et al.. The role of solvent quality and of competitive adsorption on the efficiency of superplasticizers in alkali-activated slag pastes. *Cement and Concrete Research*, 2023, 163, pp.107020. 10.1016/j.cemconres.2022.107020 . hal-03951158

HAL Id: hal-03951158

<https://hal.science/hal-03951158>

Submitted on 28 Sep 2023

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Supplementary Materials

THE ROLE OF SOLVENT QUALITY AND OF COMPETITIVE ADSORPTION ON THE EFFICIENCY OF SUPERPLASTICIZERS IN ALKALI-ACTIVATED SLAG PASTES

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1. Cloud point measurements by UV-visible spectroscopy

The solubility of the polymers in the activating solutions was assessed by cloud point measurements. They were first determined by measuring the light absorbance of the polymer solution with increasing activator molalities, as shown for example in Figure S1 for PCP45 in Na_2CO_3 . A first order transition from a transparent to a turbid solution was observed. Consequently, all other cloud point concentrations could be determined by simple visual inspection.

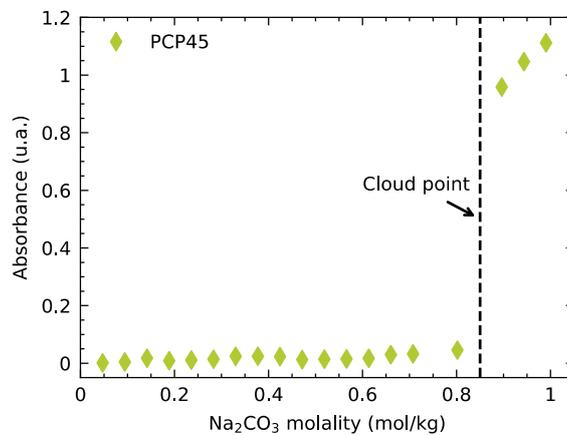


Figure S1: Example of the evolution of the light absorbance at 600 nm of a superplasticizer (PCE45) solution, at 1 g/L of polymer, depending on activator molality (here Na_2CO_3).

2. XRD and ^{29}Si and ^{27}Al NMR analyses of the activated cement pastes at earlier age

The NaOH - and Na_2CO_3 -activated slag pastes were analysed by XRD and NMR at different ages (Figure S2). The NMR experiments were obtained on a Bruker 500WB Avance II spectrometer (11,74 T) equipped with a magic angle spinning probe (MAS-NMR). For the ^{29}Si spectra, the samples were placed in a 7 mm zirconia rotor, at a rotation speed of 6 kHz and a Larmor frequency of 99.3 MHz, following a one pulse excitation with a recycle delay of 20 s and 2000-12000 scans. The pulse length was 3 μs , corresponding to a $\frac{3\pi}{8}$ angle. The ^{27}Al spectra were taken in 2.5 mm rotors, at a rotation speed of 26.5 to 29.5 kHz and a Larmor frequency of

130.06 MHz, following a one pulse excitation with a recycle delay of 2 s and 8000 scans. The pulse length was 0.5 μ s, corresponding to a $\frac{\pi}{10}$ angle. The chemical shift was calibrated with a TMS solution for the ^{29}Si spectra and a 0.1 M $\text{Al}(\text{NO}_3)_3$ solution for the ^{27}Al spectra.

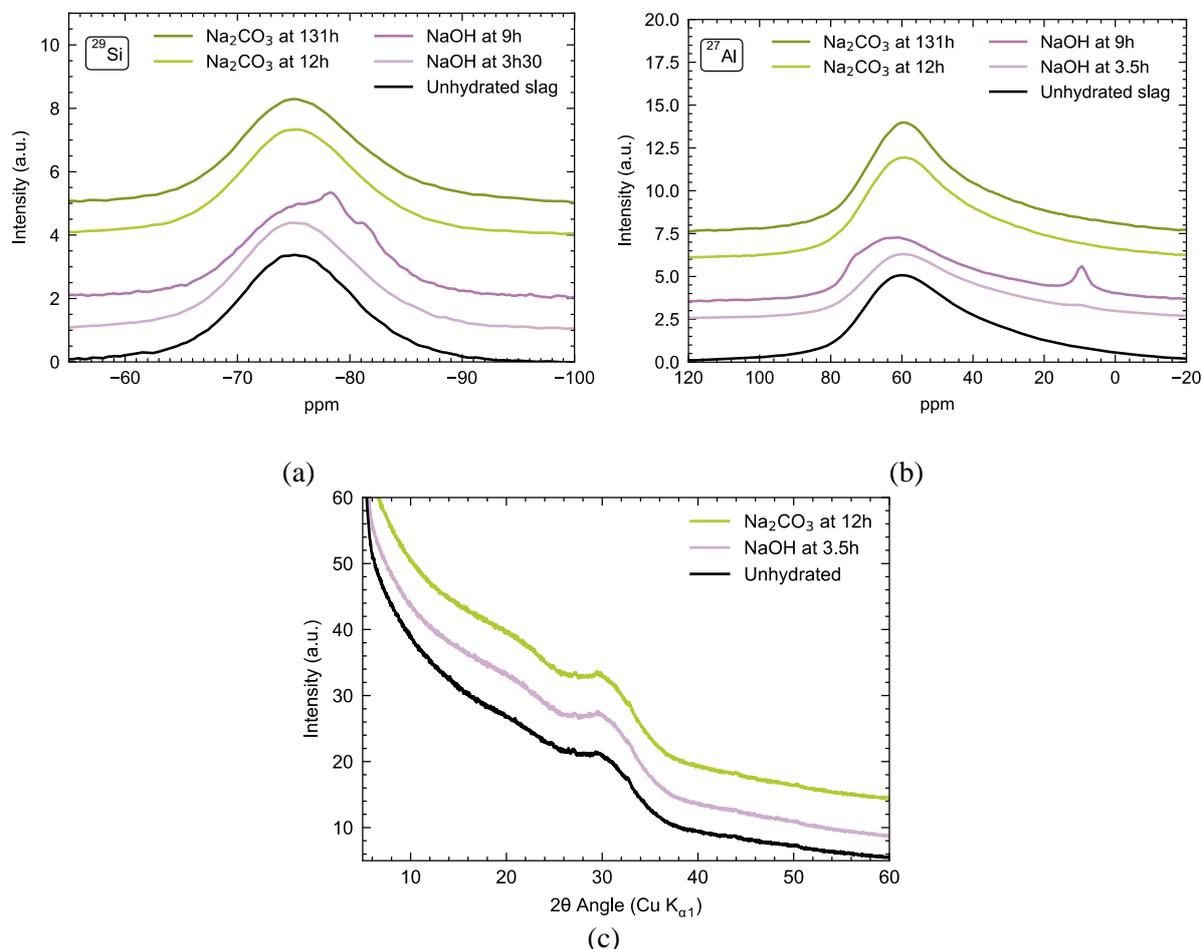


Figure S2: ^{29}Si (a) and ^{27}Al (b) NMR spectra, and X-ray diffractograms (c) of unhydrated slag and of the NaOH- and Na_2CO_3 -activated slag cements, after hydration stops at different ages. Samples were prepared at a w/s ratio of 0.4 and 4.0 wt% of Na_2O .

For Na_2CO_3 -activated pastes, no reaction products could be identified at 12 h, but the formation of calcite and of a very amorphous alumina-silicate gel are visible at 131h. The NaOH activation led to a faster formation of hydration products. At 3.5 h, the NMR spectra and the diffractogram are similar to the ones for the unhydrated slag, but at 9 h, they bring to light the precipitation of a C-A-S-H gel and of aluminate hydrates in the family of the AFm or hydrotalcite phases. The cement pastes were only studied at two different hydration ages: the first one to show that the

precipitation of reaction products is negligible at the 30 minutes-time window that we used for most experiments; the second one to characterize the products formed. However, according to the calorimetric results (Figure 3), significant quantities of reaction products are expected to precipitate between 12h and 131h in the case of Na_2CO_3 , and between 3.5h and 9h for NaOH.

3. Dispersing ability of PCE17

The dispersing ability of PCE17 was assessed by flow measurements in non-activated and NaOH-activated slag pastes. As can be seen in Figure S3, the superplasticizer induces a good flowability of the non-activated paste. However, no dispersing effect is visible in the case of the NaOH activation. This superplasticizer is still not soluble enough in the NaOH solution at 3.2 mol/kg, corresponding to an activation with 4 wt% of Na_2O and a w/s ratio of 0.4.

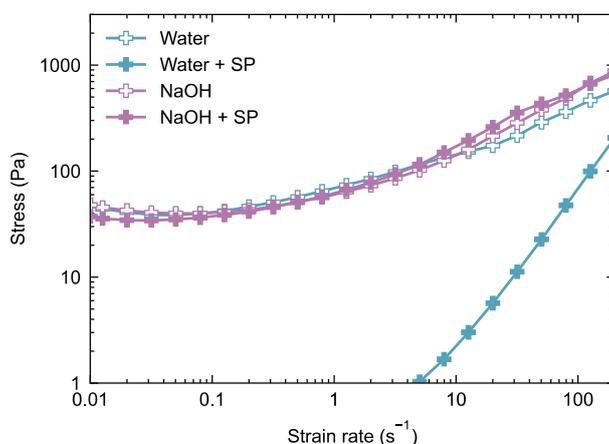


Figure S3: Flow curves obtained in the non- activated and the NaOH-activated systems right after the mixing stage. PCE17 (SP) is used in proportions of 0.5 wt% of slag. The w/s ratio is 0.4 and the NaOH quantity corresponds to 4 wt% of Na_2O .