Controlling cohesion through chemistry: a dry-blended alkali-activated slag-based binder

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Abstract

A dry-blended alkali-activated binder has been developed characterized by fast strength development at early curing times and high compressive strength at longer curing times, as shown in Figure 1.

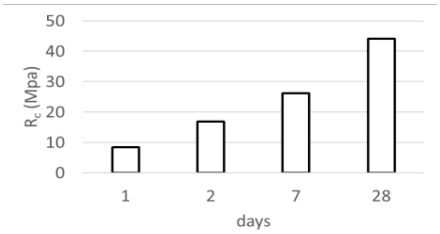

Figure 1. Compressive strength of the paste at w/s 0.3.

The binder is constituted by a blend of blast-furnace slag and a pozzolanic material like e.g. class F fly ash. The activation system is based on a blend of $Ca(OH)_2$ and Na_2CO_3. The hardening kinetics and the long-term strength gain are set by the activating blend, which controls the nucleating phases and the pore solution composition [1-3]. In addition, the nature of the nucleating phases control the rheological properties of the paste, influencing the cohesion of the colloidal particles. The surface potential of the binder particles in the pore solution is slightly negative, around -5mV. Accordingly the most effective dispersant for our system turned out to be a cationic polymer.

Compared to cement, apart from the well-known sustainability considerations, this system shows a much higher flexibility and performance control. The choice of the activating system enables to tailor the properties to the desired application by controlling the colloidal interactions.

[1] Ke *et al.* (2016) *Cem.Concr.Res.* **81**, 24-37. [2] Bernal *et al.* (2015) *Adv.Cem.Res.* **28**, 262-273. [3] Bernal *et al.* (2015) *Materials and Structures* **48**, 517-529.