Rheological Behaviour of Alkali-Activated Slag Pastes and Mortars. Effect of Admixtures

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The main objective of the present work was to study the rheological behaviour of alkali-activated slag (AAS) pastes and mortars, which was unknown so far, and determine the influence of superplasticizers and shrinkage-reducing admixtures on the rheological properties.

Two different alkaline solutions were used, NaOH and waterglass ($Na_2O{\cdot}nSiO_2{\cdot}mH_2O$) solution with 4% of Na_2O by mass of slag. AAS pastes were prepared with a liquid/solid (l/s) ratio of 0.5 and a dosage of admixture in the range of 0-2.0%. AAS mortars with a sand:slag ratio of 2:1 were also prepared with the l/s determined by slump test and the dosage of admixture was kept constant in 1%.

A CSL^2 500 Carri-Med TA INSTRUMENTS and a Schleibinger Geräte VISKOMAT NT rotational viscometers were used to study the rheology of AAS pastes and mortars, respectively.

The rheological behaviour of AAS pastes and mortars depends on the nature of the alkaline activator employed. When waterglass solution is used, the rheological behaviour of pastes and mortars is fitted to Herschel-Bulkley model and these systems show a complex shear-dependent rheology and a significant delay of the setting time was observed with the increase of the shear time. However, NaOH-AAS pastes and mortars are Bingham fluids, as Portland cement systems.

Yield stress and viscosity of waterglass-AAS pastes and mortars no modifies in presence of admixtures, due to the most of them are no stable in high alkaline solution; however, naphthalene derivated admixture reduces by up 80% the yield stress in NaOH-AAS pastes.