

## RHEOLOGICAL BEHAVIOUR OF FRESH INORGANIC POLYMER PASTE: POLYMER BRIDGING EFFECT OF THE ALKALI SILICATE SOLUTION

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Inorganic polymers (IP), produced by alkali activation of a glassy precursor, have been mainly investigated on their microstructure and mechanical strength properties. However, it is important to understand how the IP flow behaves under shear conditions, in particular when pumping is required. The activating solution is one of the main parameters influencing rheology. Therefore, the physical effect of the silicate structure on the rheology was investigated by varying the  $\text{SiO}_2/\text{Na}_2\text{O}$  molar ratio from 1.4 to 2.0 in the activator. The elastic and rheological properties of the IP were measured with a rheometer. In order to investigate the activator silicate structure and IP polymerisation development, Fourier Transform Infrared Spectroscopy (FTIR) and Nuclear Magnetic Resonance Spectroscopy (NMR) were performed. A decrease in elasticity was monitored for IP with a low  $\text{SiO}_2/\text{Na}_2\text{O}$  ratio as a result of the dissolved species, which can be correlated to NMR. The FTIR spectra implied that an activating solution with a higher  $\text{SiO}_2/\text{Na}_2\text{O}$  ratio resulted in the formation of a 3D silicate network with  $Q_3$  and  $Q_4$  crosslinks. The presence of a network modifier in the activating solution, such as Na, resulted in more  $Q_1$  and  $Q_2$  crosslinks. A higher stress, at a shear rate of  $0.1 \text{ s}^{-1}$ ; was observed in IP which consisted of a 3D silicate network as a result of the polymer bridging effect between the particles. A stronger shear thinning was observed in an IP with a higher  $\text{SiO}_2/\text{Na}_2\text{O}$  ratio, due to the steric hindrance from the entangled silicates. The rheological data of the IP can be fitted with the Herschel-Bulkley model.