

## UNDERSTANDING THE AUTOGENOUS SHRINKAGE IN ALKALI-ACTIVATED SLAG/FLY-ASH BLENDS

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Alkali-activated materials offer the potential for more durable, sustainable and low-CO<sub>2</sub> construction and building materials with reduced environmental footprints when compared to Portland cement concrete. However, this new concrete technology suffers substantially from early-age autogenous shrinkage and micro cracking. The aim of this work is to illuminate the intrinsic reasons that are responsible for larger autogenous shrinkage in alkali-activated slag/fly-ash (AASF) blends by understanding the essential link between solidification process (reaction mechanism, kinetics, phase formations and binder structures) and early-age autogenous shrinkage deformations.

In this study, six different compositions of AASF are studied by varying the type and the concentration of three different activators: sodium metasilicate, combinations of sodium metasilicate with sodium carbonate and sodium sulfate. The results show that the solidification process strongly depends on both the alkalinity and anion type of the alkaline solution. A higher alkalinity (high amount of Na<sub>2</sub>O) accelerates the reaction process, as the presence of OH<sup>-</sup> ions enhances the dissolution of slag and also increases the solubility of silica and alumina. Therefore, the intense autogenous shrinkage of alkali-activated slag at early-ages can be attributed to the high amount of chemical shrinkage. Autogenous shrinkage of alkali-activated slag is not only caused by well-known self-desiccation process in hardened state, but related to the condensation shrinkage. The larger autogenous shrinkage in AAS may also be attributed to refined pore structure and silica polymerization, which is controlled by the nature of anion presence in the solution.