RETARDATION IN ALKALI-ACTIVATED MATERIALS VIA ZINC OXIDE: MECHANISM AND IMPLICATIONS

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For ordinary Portland cement (OPC), chemical admixtures and additives that manipulate its hydration and setting are widely available. However, for alkali-activated materials (AAMs) the number of such admixtures that effectively manipulate short-term properties is severely limited. This scarcity of robust admixtures is attributed to the differences in solution and surface chemistry between OPC and AAMs, where existing admixtures are either unstable in the alkaline solution or show mixed/limited efficacy. Here, we utilize zinc oxide, a known retarder for OPC hydration, and investigate its influence on the alkali-activation reaction. We find that ZnO is a robust retarder for alkali-activation of blast furnace slag but has no effect on metakaolin-based AAMs. Using isothermal calorimetry and in situ X-ray pair distribution function analysis, the mechanism of ZnO retardation in alkali-activated materials is uncovered, revealing that calcium plays a pivotal role. Finally, since there is an ongoing debate on the retardation mechanism of ZnO in Portland cements, the results obtained here are significant for developing a fundamental understanding of retarding admixtures in general.

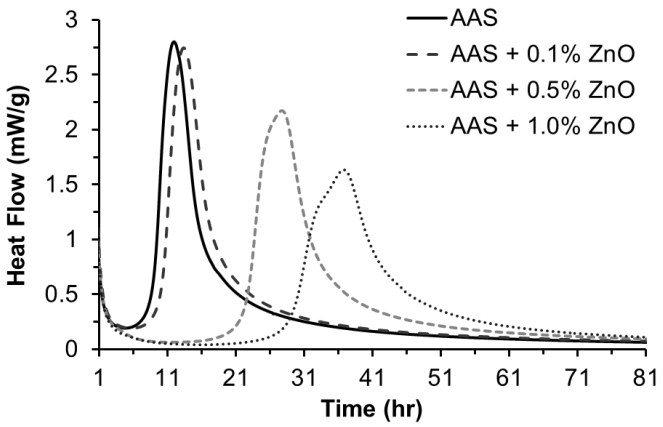

Figure 1 – Isothermal calorimetry data of alkali-activated slag (AAS) pastes with and without various amounts of ZnO.