PERFORMANCE OF SODIUM CARBONATE/ SILICATE ACTIVATED SLAG MATERIALS

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Alkali-activated slag (AAS) materials are acknowledged as environmentally friendly due to the reduced embodied energy associated with their production. However, the use of highly alkaline solutions such as sodium silicate to promote the chemical reactions that lead to their hardening, poses potential human and environmental hazards that might constrain their utilization beyond specialized applications.

It is possible to use less alkaline solution based on near-neutral salts as activators, such as sodium carbonate, to produce alkali-activated slag binders with desirable properties. However, to achieve this, the 'right match' between slag chemistry and activation conditions is required. The use of sodium carbonate presents several advantages compared with using sodium silicate when producing AAS, including reducing alkalinity to values comparable to that of Portland cement, and extending the setting time and improving workability, which facilitates the casting of these materials. Sodium carbonate-activated slag binders do not always meet the setting time and strength requirements for on-site concreting, which has limited the application of these materials. A recent study in pastes demonstrated that the addition of sodium silicate in these binders significantly improves the compressive strength development, while effectively controlling the kinetics of reaction, which makes AAS binders produced with a blend of activators an attractive candidate for producing concretes.

In this study we report compressive strength, water absorption and durability properties of AAS concretes produced with a blended sodium carbonate/silicate activator. Shrinkage microcracking of these materials was also studied, by drying the specimens for 8 weeks at 65% relative humidity (RH) and 23ºC. The results obtained are compared with concretes produced solely using sodium silicate as alkali activator.