Fresh, Hardened, And Microstructural Properties Of Self-compacting Alkali-activated Concrete Cured At Ambient Temperatures

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The fast-paced construction industries around the globe have increasingly been looking for environmentally friendly and sustainable concrete to reduce the carbon footprint caused by conventional Portland cement concrete (PCC). This study examines the fresh, hardened, and microstructural properties of self-compacting alkali-activated concrete (AAC), a low-carbon concrete. A blend of granulated glass furnace slag (GGBFS) and fly ash (FA) was used to produce the AAC cylinder samples. Aluminosilicates of GGBFS and FA blend were activated using a low molar (2M) NaOH solution and sodium silicate solution with SiO_2/Na_2O. Locally available crushed stones and sand were used as coarse and fine aggregates, respectively. A nano-silica-based superplasticizer was also added at the end of the mixing. No compaction method was applied during the casting of the AAC cylinders, and they were cured at ambient temperature. A set of specimens were kept in constant temperature and humidity while another set was kept outside exposed to the weather to examine the effect of weather conditions (temperature and humidity). Based on the results, the initial and final setting times of the AAC mix were found to be 35 minutes and 2 hours, respectively. The cylinders cured inside a climate-controlled room and outdoors showed an ultimate compressive strength of approximately 38 MPa and 27 MPa, respectively. The exposed surface of the AAC samples developed numerous surface cracks and microcracks after hardening indicating drying shrinkage.