Microstructural and mechanical characteristics of alkali-activated green concrete using slag from electric arc furnaces as precursor and aggregate

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Abstract. Alkali-activated materials (AAM) have gained popularity in research because of their lower carbon dioxide emissions than Portland cement. Electric arc furnace slag (EAFS) exceeds landfills. Moreover, electric arc furnaces emit less CO_2 than oxygen-blast furnaces. This research is the first to suggest that mixing EAFS and metakaolin (MK) as AAM precursors could compensate for the deficiency of SiO_2 and Al_2O_3 in the EAFS and CaO in the MK, which would produce better AAM properties than using either of them singularly. Furthermore, the utilization of EAFS aggregate instead of natural aggregate in alkali-activated concrete (AAC) reduces waste materials, consumes fewer natural resources, and solves the problem of natural aggregate scarcity. This study's main objectives were to evaluate the effects of varying ratios of EAFS and MK as precursors and EAFS aggregate to natural aggregate ratios on the AAC's fresh and hardened properties. The properties under consideration are workability and cube compressive strength. The outcomes showed that increasing EAFS with decreasing MK content increased AAC workability and cube compressive strength while increasing EAFS aggregate over natural aggregate improved AAC workability and decreased cube compressive strength.

Keywords: Alkali-activated material (AAM), Workability, Compressive strength, Microstructure, Alkali-activated electric arc furnace slag