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Preparation and Performance of Low Content Carbon Geopolymer

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Due to the low CO_2 emission of geopolymers compared to Portland cement, interest in their use as binding cement has increased in recent years. The main goal of this research is to relate the green and sustainable characteristics to the good mechanical and chemical properties of fly ash-based geopolymers. For those purposes, samples of different ratios of fly ash (FA) and metakaolin (MK) were prepared. Mineralogical characterization of the geopolymer samples conducted using X-ray powder diffraction (XRD) showed that in the geopolymer synthesis reaction new amorphous phase was formed. Diffuse reflectance infrared Fourier transform spectroscopy (DRIFT) confirmed characteristic bands of Si-O and O-Si-O groups at 1045 cm^{-1}. Compressive strength analysis revealed that the optimal ratio of FA and MK is 50:50 and exhibits the highest value, while X-ray photoelectron spectroscopy (XPS) analysis revealed the total reduction of carbon content in the alkali activated geopolymer with optimal stoichiometry 50:50. The results of this research indicates the possibility to obtain a geopolymer material with almost complete absence of carbon, which implies further application as a material with very high environmental potential and zero carbon emission.

Keywords: carbon reduction; compressive strength; geopolymer; metakaolin; fly ash.