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Correlating the elastic properties of metakaolin-based geopolymer with its composition

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Abstract

Geopolymer shows great potential as a construction material with low energy consumption and carbon oxide emission. Quantitatively assessment of elastic properties of a geopolymer and understanding the correlations with its composition and microstructure are therefore very important for its rational utilization. In the present investigation, two series of metakaolin-based geopolymer (MKG) were synthesized by controlling, respectively, **mass ratio of alkali in activator to powders, namely the alkali equivalent (AE) to the aluminosilicate materials,** within a range of 10%–50% and **molar ratio of** SiO_2 **to** Na_2O **in activator, namely modulus of silicate (Ms),** within a range of 1.25–2.25. **General elastic** mechanical properties (i.e., the Young's, bulk and shear moduli and the Poisson's ratio) of the MKG specimens were evaluated from load-strain curves measured by an integrated measurement and control system and the microstructures were determined by an ESEM-EDS analysis. The experimental results, combined with the analysis of variance method, indicate that, within the test ranges, the AE dosage influences all the characteristic elastic properties of the MKG specimens, whereas the effect of Ms level is insignificant. The morphology observations of the microstructures of the MKG specimens support the mechanical results, although both the AE dosage and Ms level change the chemical composition obviously. The results in the present study may help to tailor MKG material with its composition for further engineering applications.

Keywords: Geopolymer, Metakaolin, Microstructure, Elastic property.

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