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MECHANICAL PERFORMANCE OF FLY ASH BLENDED GEOPOLYMER COMPOSITE REINFORCED WITH RECYCLED GLASS FIBERS

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Abstract

This study evaluates the mechanical performance of ambient-cured fly ash-based geopolymer composites reinforced with recycled glass fibers. First, the Taguchi method was used to optimize the fly ash-based geopolymer matrix, considering the Na:Al ratio, liquid:solid ratio, and sand content. Secondly, two types of glass fibers (25 mm length and 60 mm length) have been introduced in three different amounts (1, 2, and 3 wt. %, respectively) in order to improve the flexural strength of the developed composites. Compressive strength tests and the three-point flexural method were conducted to demonstrate the effect of fiber type and amount on the mechanical performances of fly ash-based geopolymers, while microstructural analysis was used to reveal the improving mechanism caused by the bridging effect of reinforcing fibers. Experimental results showed that Na:Al of 0.75, NaOH concentration of 10.85M, Na_2SiO_3:NaOH solution of 4:1, and Sand:Fly ash of 1:1 are the optimum parameters for compressive strength, while Na:Al of 0.5, NaOH concentration of 2.96M, Na_2SiO_3:NaOH solution of 2:1, and Sand:Fly ash of 1:4 exhibit the highest flexural strength, despite the aging time (14 or 28 days). Moreover, the addition of recycled glass fiber led to an increase of up to eight times in flexural strength due to the bridging effect. However, the compressive strength slightly decreased for all mixtures due to an increase in porosity. The microstructural analysis confirmed a homogenous matrix with high adhesion to the surface of glass fibers.

Key words: eco-friendly materials, geopolymer composite, mechanical properties, recycled glass fibers

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