

## Effect of Carbon Black Nanoparticles Additive on the Qualities of Fly Ash Based Geopolymer

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**Abstract :** The aim of this study was to investigate the influence of carbon black additive on the properties of fly ash-based geopolymer. The geopolymer samples were prepared using fly ash as the primary source material, along with an alkali activator solution and different concentrations of carbon black additive. The effects of carbon black on the geopolymer binder were evaluated by analyzing the compressive strength, flexural strength, water absorption, and microstructural properties of the cured samples. The results revealed that the inclusion of carbon black additive significantly enhanced the mechanical properties of the geopolymer binder. The compressive and flexural strengths were found to increase with the addition of carbon black, showing improvements of up to 25% and 15%, respectively. Moreover, the water absorption of the geopolymer samples reduced due to the presence of carbon black, indicating improved resistance against water permeability. Microstructural analysis using scanning electron microscopy (SEM) revealed a more compact and homogenous structure in the geopolymer samples with carbon black. The dispersion of carbon black particles within the geopolymer matrix was observed, suggesting improved interparticle bonding and increased densification. Overall, this study demonstrates the positive impact of carbon black additive on the qualities of fly ash-based geopolymer, emphasizing its potential as an effective enhancer for geopolymer binder applications.

**Keywords :** fly-ash, carbon black, nanotechnology, geopolymer

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