Advances in Fracture Properties of Geopolymer Composites: Postprint

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Abstract

The fracture performance of concrete directly influences structural safety and durability. Investigating crack propagation behavior in concrete forms the basis for analyzing its fracture performance. Concrete, a multiphase material characterized by heterogeneous and nonlinear properties, contains numerous initial cracks within its microstructure; consequently, its fracture mechanism is exceedingly complex with multiple influencing factors. Currently, analytical methods for the fracture performance of ordinary concrete are relatively mature, with two categories of models established to address concrete' s nonlinear characteristics: the cohesive crack model for numerical analysis and the equivalent elastic crack model for analytical calculations. Furthermore, geopolymer is a low-carbon, environmentally sustainable construction material exhibiting excellent mechanical properties, durability, and high-temperature resistance. Therefore, research on the fracture performance of geopolymer composites (GPC) constitutes an essential prerequisite for promoting their engineering applications. Geopolymer exhibits brittleness similar to ordinary concrete, and researchers have investigated GPC fracture performance based on analytical methodologies from ordinary concrete fracture mechanics. This review systematically outlines the development history of concrete fracture mechanics, summarizes the primary influencing factors of GPC performance, compiles the effects of raw material composition, alkali activators, and fibers on GPC fracture performance, and provides an outlook on future research directions.

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