A Comprehensive Study of the Polypropylene Fiber Reinforced Fly Ash Based Geopolymer

As a cementitious material, geopolymers show a high quasi-brittle behavior and a relatively low fracture energy. To overcome such a weakness, incorporation of fibers to a brittle matrix is a well-known technique to enhance the flexural properties. This study comprehensively evaluates the short and long term impacts of different volume percentages of polypropylene fiber (PPF) reinforcement on fly ash based geopolymer composites. Different characteristics of the composite were compared at fresh state by flow measurement and hardened state by variation of shrinkage over time to assess the response of composites under flexural and compressive load conditions. The fiber-matrix interface, fiber surface and toughening mechanisms were assessed using field emission scan electron microscopy (FESEM) and atomic force microscopy (AFM). The results show that incorporation of PPF up to 3 wt % into the geopolymer paste reduces the shrinkage and enhances the energy absorption of the composites. While, it might reduce the ultimate flexural and compressive strength of the material depending on fiber content.