Coal Ash-based Geopolymer Foam Using Silica Fume

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Geopolymer is an inorganic binder material having aluminosilicate 3-dimentional structure, which exhibits good mechanical and chemical properties with low CO_2 emission when compared to ordinary Portland cement. Especially, geopolymer foam that is synthesized by introducing gas within geopolymer paste and curing it features light weight and low thermal conductivity as well as fire-resistance, so it can be applied for thermal insulation, fireproofing, and lightweight building materials, etc. In this study, geopolymer foams were fabricated via reaction of free silicon existing in silica fume which produces hydrogen gas, and their properties were investigated. The geopolymer foam samples were prepared by mixing coal bottom ash, coal fly ash, silica fume, and alkali-activator for various proportions and curing them at 75°C for 48 or 72 hours. Compressive strength, thermal conductivity, and porosity of hardened geopolymer foams were measured and ATR-FTIR and TGA/DTG analyses were conducted. Their morphology and microstructure were also observed through cross-sectional photographs and SEM images of the samples.