

POROUS GEOPOLYMER COMPONENTS

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Geopolymers are based on an inorganic 3D network of alumino-silicate units usually synthesized through reaction of alumino-silicate powders in presence of a silicate alkaline solution. The rheological characteristics of the reactive mixtures and the fact that these systems can consolidate at low or even room temperature, together with their intrinsic micro- and meso-porosity and mechanical properties, are the reason why they are considered for a wide range of applications, such as construction materials, thermal insulation, filters, adsorbers and so on.

Open cell alkali or acid-based geopolymer foams were produced by direct foaming using different fabrication approaches. Potassium-based foams with a porosity up to 85 vol% were obtained from metakaolin, potassium silicate and potassium hydroxide, while metakaolin and phosphoric acid were used to fabricate foams containing an aluminum phosphate crystal phase already after synthesis at room temperature, and a total porosity of ~80 vol%.

The strength of the foams depended on the porosity of the components as well as the heat treatment temperature.

Components with designed, non-stochastic porosity were also produced by additive manufacturing, specifically Direct Ink Writing. Paste with suitable pseudo-plastic rheology were developed and we fabricated components with overhangs and spanning features, including highly porous 3D lattices.