

The Effect of Addition of Pozzolanic Tuff on Geopolymers

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ABSTRACT

A new geopolymerization process was developed by activating local raw kaolinite with quartz and tuff fillers and alkaline sodium hydroxide solution. The new geopolymers were cured at 80 °C for 24 hr. The effect of addition of pozzolanic tuff on the physical and chemical properties of the geopolymers was investigated. The results have indicated that the replacement of 50% pozzolanic tuff gave the maximum compressive strength after 14 days curing time under dry and wet conditions. The decrease in quartz filler has decreased the compressive strength. The geopolymer specimen's exhibit maximum mechanical strength (55 MPa) after heat treatment at 500 °C before it has dropped down to 14.2 MPa at 900 °C. The mechanical performance remarkably has increased at a temperature higher than 900 °C and reaches its maximum (68.3 MPa) at 1100 °C before the collapse of the geopolymer as a result of melting in the furnace at 1200°C and devitrification upon cooling. Crystalline sodium and/or calcium aluminum silicate phases are responsible for the high compressive strength.

The high strength, heat resistance, low production cost, low energy consumption, and low CO₂ emissions suit the use of the geopolymers as a green construction material. The lower densities of the geopolymers obtained by the addition of 50 % tuff enable their use as an insulating material. Heating the geopolymer at 1100°C for 24 h did not show a collapse of the texture and this is an important indication of refractoriness.

