

EFFECT OF SODIUM HYDROXIDE MOLARITY ON FRACTURE BEHAVIOUR OF GEOPOLYMER CONCRETE BEAMS

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In this present study an effort was made to know the fracture behavior of Geopolymer concrete beams with different molarities of NaOH. The beams which were made of geopolymer concrete with notches were subjected to three-point bending test and load vs. deflection curves for all the members were obtained. From the obtained data fracture properties such as fracture energy, fracture toughness and nominal stress were determined. The tests showed increasing trend in fracture property such as fracture toughness, fracture energy and nominal stress in molarity range from 12M to 14M after which it showed a decreasing trend beyond 14M.

Keywords: Geopolymer; fracture behavior; three-point bending test.

Introduction

In 1978, Joseph Davidovits developed a binder called geopolymer. Geopolymer is amorphous to semi-crystalline equivalent of certain zeolitic materials with excellent properties such as high fire and erosion resistances and high strength materials. There are two main constituents of geopolymer and they are namely source materials and the alkaline liquids. The source materials for geopolymer based on alumina-silicate should be rich in silicon (Si) and aluminum (Al) such as natural minerals like kaolinite, clays, etc. Alternatively, by-product materials such as fly ash, silica fume, rice-husk ash, slag, red mud, etc. can also be used as source materials. The choice of source materials for making geopolymer depends on the factors such as cost, availability, type of application and specific demand. The alkaline liquids used in the geopolymer are usually sodium or potassium based. The most common type of alkaline liquid used in the geopolymerisation is a combination of sodium hydroxide (NaOH) or potassium hydroxide (KOH) and sodium silicate or potassium silicate. Their mechanical properties are influenced by factors including raw materials, alkaline liquid to fly ash ratio, activator type and curing conditions. These alkaline liquids are generally used depending upon the molarity of NaOH solution such as 8M, 10M, 12M, 14M etc.

Fracture mechanics is the study of material behavior in the existence of cracks and crack like defects and provides methods to measure the fracture strength and toughness of the material. In quasi brittle materials like concrete, large fracture zone is formed which usually consumes more energy than failure. This provides a large post peak response. The fracture behavior is defined in terms of fractured energy, critical stress intensity factor and crack mouth opening displacement. Three-point bend test of notched beams is used to determine fracture properties

Methodology

A. Materials Used:

The following are the materials used in this investigation:

1. Fine aggregate (m sand) passing through 4.75mm is sieve with a specific gravity of 2.62 and fineness modulus of 2.66 and confirms to grading zone ii as per is: 383-1970 (reaffirmed 2007).