

UTILIZATION OF SLAG FOR THE DEVELOPMENT OF FIRE RESISTANT GEOPOLYMERS

Konstantinos Miltiadis Sakkas, Enalos Research and Development PC
sakkasdin@yahoo.gr
Nikolaos Vagiokas, Enalos Research and Development PC
vagiokas@gmail.com

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This paper deals with the production of fire resistant materials based on the technology of the geopolymerization through a series of industrial wastes. Although the structural elements of a tunnel or a building and generally a structure are considered inflammable in a real fire situation the concrete lining can be spalled largely, sometimes perhaps entirely, with very serious consequences on cost and safety of people. For this problem, various methods have been developed, but there is always a need for developing a new material with improved fire resistance properties and low cost.

The inorganic polymers - geopolymers are a solution that meets the above requirements. The geopolymerisation process is based on a heterogeneous chemical reaction that occurs between solid materials rich in alumino-silicate oxides and highly alkaline silicate solutions. Geopolymers have very good thermal properties and can be used as fire resistant materials. In this research geopolymers are generated of two wastes generated from the Copper Industry rich in aluminium and silicon oxides.

The target of the developed materials is a) to retain their structural integrity b) to avoid spalling of the concrete c) follow the requirements of the ISO – 834 fire curve.

In the specific research it is also investigated the reduction of the density of the developed materials in order to be comparable with the commercial available materials. This is achieved either with the addition of lightweight aggregates or with the addition of foaming agents during the mixing of the materials.

Finally the technical data of these materials is presented measuring the mechanical (compressive and flexural strength), physical (setting time and water absorption) and thermal properties (thermal conductivity).

Then the materials are tested for their resistance under the ISO-834 fire curve. From the results is concluded that these geopolymers can resist the specific fire scenario that may occur during a fire either in a building or in a tunnel without yielding or spalling. Also these materials are very low-cost materials concerning that the basic raw material is a by-product which at this time is useless.