Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 77 (1998)

Artikel: Use of basaltic fibers in concrete and thermal insulation
Autor: Leshava, Tengiz / Gigineishvili, Johni / Tsitsilashvili, Otari
DOI: https://doi.org/10.5169/seals-58232

Use of Basaltic Fibers in Concrete and Thermal Insulation

Tengiz LESHAVA
Director
TbilZNIIEP
Tbilisi, Georgia

Johni GIGINEISHVILI
Head of Department
TbilZNIIEP
Tbilisi, Georgia

Otari TSITSILASHVILI
Vice-Director
TbilZNIIEP
Tbilisi, Georgia

Summary

The basaltic fibrous concrete represents wide group of new building materials consisting of concrete and basaltic fibers in the form of artificial threads of different diameter and length(among others in the form of bar reinforcement).The theoretical and experimental researches let us to conclusion, that structural elements (such as wall panels, slabs, partition elements etc.) of basaltic fibrous concrete are much stronger, more stable for aggressive force, lighter and more effective for producing than the traditional ones. It is possible on the basis of results of express-analysis methods to say, that durability of basaltic fibrous concrete structures surpasses of traditional ones.

Keywords: basalt, fiber, reinforcement, concrete, thermal insulation, effective, structure, composite, material, technology.

1. Introduction

Now it is well known many various methods of dispersed (fiber) reinforcing of concrete in the building field. Among others the reinforcing of concrete with steel wire pieces of different diameter and length is particular popular. As a reinforcing agent are also used the unbroken glass fibers. But the development of production of such concrete is delayed mainly because of the increasing lack of materials for glass fibers. And here is given results of researches of dispersed and with unbroken bar reinforced concrete structural elements, in which basaltic fibers were used as a reinforcing agent.

2. Modification of Reinforcing Basaltic Fibers

A short list of qualities of basaltic fibers and products made of them is following:

- stableness for corrosion (12-5 times more than metals);
- frost- and heat-resistance (-265 C, +900 C), non-toxic;
- high durability showings (1900-2400 MPa when diameter of a fiber is 9-12 mcm);
- construction elements are sometimes 3-10 times stronger, than analogous traditional constructions made of steel and concrete;
- lightness (decrease the weight of construction elements 5-20 times);
- do not create hindrance for radio and television waves and are dielectrics;

- heightened water-resistance;
- when fibers are received as mineral wool, meet the requirements to be raised to heat-insulating materials.

There are modifications of basaltic fibers used for reinforcing of concrete in our experimental work:
- bundled basaltic threads, which were saturated with polymer bonding adhesive (basaltic plastic reinforcement in the form of bar);
- basaltic rough fibers (0.18-0.20 mm in diameter and 20-25 mm in length);
- basaltic "stapel" fibers which are bundled from 200 pieces of threads of 0.009-0.012 mm in diameter and 35-50 mm in length.

3. Research about Anchorage Basaltic Fibers in Concrete

Determining of effects from using basaltic fibers for reinforcing of concrete requires to answer a question, how effectively does different variations (modifications) of basaltic fibers anchor in concrete body.

The rules of distributions displacement(U), of stress level(F) and of tension(t),applied on different examples anchored in concrete, had been got on the basis of theoretical and experimental modeling.

It is also interesting to determine the anchorage length and displacement for different kinds of bar reinforcement, anchored in concrete constructions of various strength. Leaning upon results of experimental and mathematical modeling, which were executed for different force application on anchored bars, had been made conclusion, that displacement of bar reinforcement of various kind (of basaltic plastic, of glass plastic and of steel) can be calculated with using the following formula:

$$U_z = \frac{N}{3F\{E_1/[(1-2\nu_1)L_1] + E_2/[(1-2\nu_2)L_2]\}},$$

in which:
N - the force applied by the bar reinforcement;
U_z - the displacement of bar at the place of force application;
F - the cross-section-area, filled in with mortar, between yoke (fuxture) and bar;
ν_1 - Poisson's ratio for first mortar;
ν_2 - same for second mortar;
E_1 - modulus of elasticity for first mortar;
E_2 - same for second mortar;
L_1 - anchorage length of bar in first mortar;
L_2 - same in second mortar.