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S. Lapovska


T. Lihvar


M. Gudkova

S. Lapovska, Ph.D., Deputy Director for Research,
State Enterprise «Scientific Research and Desing Institute of building materials and products»,
professor Department of building materials,
Kiev University of Construction and Architecture,
04080, Kyiv, Kostyantinivska str., 68,
e-mail: mit@kievweb.com.ua, tel. (044)425-37-75, (050)311-26-35
T. Lihvar, Scientist State Enterprise «Scientific Research and Desing Institute of building materials and products»
04080, Kyiv, Kostyantinivska str., 68,
e-mail: mit@kievweb.com.ua, tel. (044)425-37-75, (063)965-82-48
M. Gudkova, student, KNUBA
Povitroflotsky pr., 31, Kiev, 03680
e-mail: mit@kievweb.com.ua, tel. (044)425-37-75, (063)965-82-48

Лаповська С. Д., д.т.н.,
заступник директора з наукової роботи ДП «НДІБМВ»,
професор кафедри будівельних матеріалів Київського національного університету будівництва і архітектури (КНУБА),
04108, м. Київ, вул. Костянтинівська, 68,
e-mail: mit@kievweb.com.ua, tel. (044)425-37-75, (050)311-26-35
Лихвар Т. О., н.с.,
ДП «НДІБМВ»,
04108, м. Київ, вул.Костянтинівська, 68,
e-mail: mit@kievweb.com.ua, tel. (044)425-37-75, (063)965-82-48
Гудкова М. О., студентка, Київський національний університет будівництва і архітектури (КНУБА)
Повітрофлотський пр., 31, Київ, 03680
e-mail: mit@kievweb.com.ua, tel. (044)425-37-75, (063)965-82-48

REINFORCEMENT OF AUTOCLAVED AIR CONCRETE WITH BASALT MICROFIBER

АРМУВАННЯ АВТОКЛАВНОГО ГАЗОБЕТОНУ БАЗАЛЬТОВОЮ МІКРОФІБРОЮ

АРМИРОВАНИЕ АВТОКЛАВНОГО ГАЗОБЕТОНА БАЗАЛЬТОВОЙ МИКРОФИБРОЙ

Annotation. The article describes the first experiments on the reinforcement of autoclaved aerated concrete (AAC) with basalt microfiber. The aim of the work is to obtain AAC with improved bending and compression characteristics. The first results obtained using basaltic microfiber for reinforcing AAC are analyzed.
Key words: autoclaved aerated concrete, reinforcement, microfiber, basalt, bending strength.
Анотація. У статті описані перші досліди з армування автоклавного газобетону базальтовою мікрофіброю. Метою роботи є отримання автоклавного газобетону з покращеними характеристиками на згин і на стиск. Проаналізовано перші отримані результати використання базальтової мікрофібри для армування ніздрюватого бетону.
Ключові слова: автоклавний газобетон, армування, мікрофібра, базальт, міцність при згині.
Аннотация. В статье описаны первые опыты по армированию автоклавного газобетона базальтовой микрофиброй. Целью работы является получение автоклавного газобетона с улучшенными характеристиками на изгиб и на сжатие. Проанализированы первые полученые результаты применения базальтовой микрофибры для армирования ячеистого бетона.
Ключевые слова: автоклавный газобетон, армирование, микрофибра, базальт, прочность при изгибе.

Modern trends in the development of the construction complex are increasingly focused on improving competitiveness, developing and implementing fundamentally new design solutions that ensure resource and energy saving, and as a result, high technical and economic indicators and consumer quality of buildings.

As you know, products made from autoclaved aerated concrete are distinguished by good enough strength, high thermal insulation ability and significantly affect the energy savings necessary for heating objects while ensuring a healthy microclimate in the premises. This modern high-tech building material is best suited to the conditions of sustained development, both in the production process and in application.

Today, the operational properties and high economic efficiency of the production and application of AAC have led to an intensive increase in its production. Annual global production of material for today is about 45 million m^3 produced at 200 plants in 50 countries. Output of concrete products are: Belarus – 300 m^3 / 1000 people. Poland – 100 m^3 / 1000 people. In Ukraine with the full use of all available facilities for the production of aerated concrete, this figure could reach 50 m^3 / 1000 people.

An important characteristic of AAC is its density, that is, the mass of one cubic meter of material, which can range from 150 to 1100 kg/m3. Most often for the production of structural elements use concrete with a density of 500-600 kg/m3. The lower the density, the better the heat protection, the less the consumption of material, labor and energy resources. However, one should not forget about the factor preventing the decrease in density: there is a regularity – the higher the porosity (the lower the density) of the material, the lower its strength.

Role dispersed reinforcement composed of cement concrete is marked in many domestic and foreign sources. Analysis of publications suggests improving the structural characteristics of the starting material resulting particulate reinforcement, which leads to improved service properties and increasing longevity products and designs. Increasing the ratio of ultimate tensile strength tensile and compressive Rbt / Rc, which is achieved by dispersed reinforcement, is a means of improving the concrete as a construction material. Integral properties of fiber-reinforced concrete, like any other composite specifies the properties of its components (fiber and concrete matrix), and the presence and degree of their collaboration. Fiber in this work is provided by fiber coupling and anchoring in the concrete.

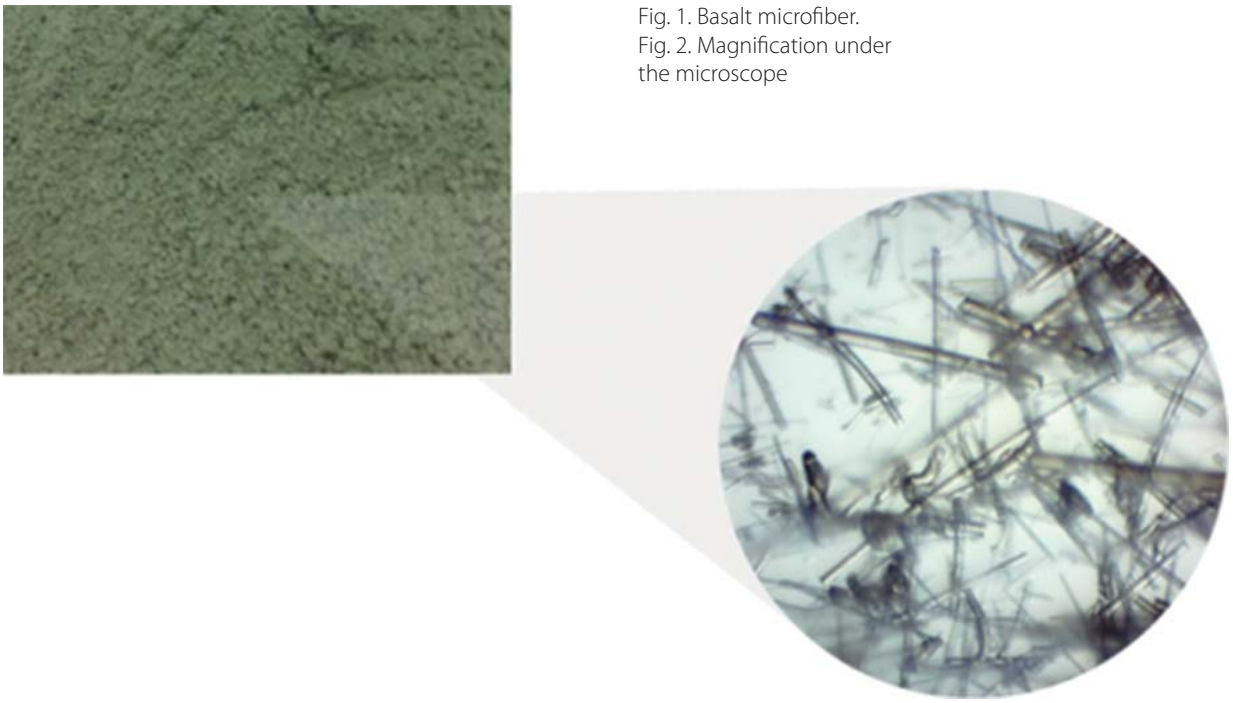


Fig. 1. Basalt microfiber.
Fig. 2. Magnification under the microscope

SE «NIISMI» proposed the use of a basalt microfiber produced by the «Magma Industry» LLC, for reinforcing autoclaved aerated concrete with low density in order to increase its flexural strength and compressive strength. Visually the microfiber is a fine-grained powder of gray-beige color, consisting of fragments of basaltic superthin fibers. The length of the fragments is determined by the method and time of grinding. Bulk density of the powder is determined by the degree of grinding and is in the range of 1.5-2 g / cm^3. The product contains fragments of fibers with a length of 25-120 μm and up to 10-20 % of fine particles of irregular shape with linear dimensions of 0.1-0.5 μm. Basalt microfiber is a non-combustible and environmentally friendly material from natural raw materials. It has low thermal conductivity and easily withstands the pressure and autoclaving temperature of the AAC.

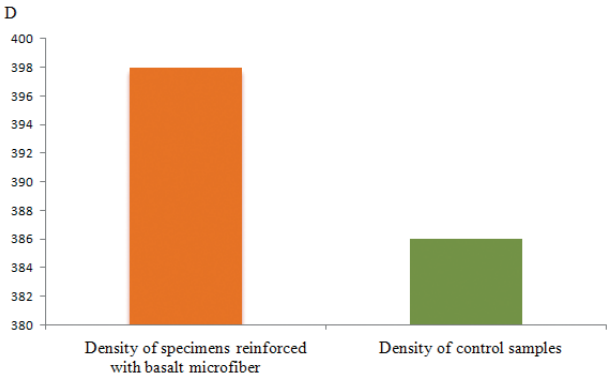
The main tasks of the work were:

- analyze the state and current requirements for the quality of raw materials used for the production of AAC;
- to carry out experimental studies and establish the regularity of the effect of reinforcement of a basalt microfiber on the flexural strength and compressive strength;
- to evaluate the technical and economic effectiveness of the proposed method for improving the performance of autoclaved aerated concrete.

We have molded the first samples of autoclaved aerated concrete reinforced with basalt microfiber. The density of AAC was 398 kg / m^3 (Table 1).

Table 1.

Difference in the density of samples



Compared to control samples without basaltic microfiber, the increase in bending strength was 8%, and the compressive strength was 10%. This result suggests that the potential of basaltic microfiber, as a reinforcing material for autoclaved aerated concrete is determined, with the correct selection of the mixture. This type of reinforcement will make it possible to expand the field of application of AAC with improved bending properties, which will in turn allow the use of AAC for the manufacture of lintel beams and large-sized products. The possibility of constructing buildings entirely from heat-efficient AAC will improve the ecology of the environment by reducing air pollution from combustion products used to generate heat energy.

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