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APPLICATION OF ALKALI-RESISTANT GLASS NETS WASTE IN FIBRO CONCRETE

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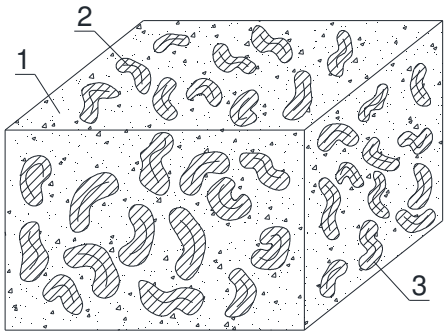
The article describes the modern building material – fibro concrete. A list of basic materials used for dispersed reinforcement for concrete is presented. The basic mechanical and physical properties of these materials are described. Also, the possibility of using alkali-resistant fiberglass waste as a fiber is considered.

Nowadays, one of the priority areas in construction is the reduction of the value of the construction project, due to the economy of materials and waste-free production [1]. One of the ways that immediately meets two criteria is the use of alkali-resistant fiberglass waste for fiber reinforcement of concrete.

Fiber concrete is a composite building material which consits of concrete with the inclusion of fibers evenly distributed throughout the volume (Fig. 1). Dispersed reinforcement of concrete increases the crack resistance and tensile strength when the material is bent. Also it slightly increases the compressive strength.



1 – concrete matrix; 2 – fiber; 3 – zone of contact interaction of the fiber and concrete
Figure 1. – Fiber concrete structure

Fiber is divided into two main groups [2,3]:

– metal – the raw material is steel. This fiber has different geometric shape and size;
– non-metal – is made from materials such as glass, cotton, basalt, acrylic, polyethylene, carbon, carbohydrate and so on.

The main mechanical and physical properties of the fibers are presented in table 1 [4].

Table 1. – Mechanical and physical properties of the main fibers

Fiber name	Density, g/sm^3	Young's modulus, 10–3 MPa	Tensile strength, 10–3 MPa	Elongation at break, %
Polypropylene	0,9	3,5–8	0,4–0,77	10–25
Polyethylene	0,95	1,4–4,2	0,7	10
Nylon	1,1	4,2	0,77–0,84	16–20
Acrylic	1,1	2,1	0,21–0,42	25–45
Polyester	1,4	8,4	0,73–0,78	11–13
Carbon	2,0	245	2	1
Cotton	1,5	4,9	0,42–0,7	3–10
Asbestos	2,6	68	0,91–3,1	0,6
Glass	2,6	70–80	1,05–3,85	1,5–3,5
Basalt	2,6	80–100	1,6–3,6	1,4–3,6
Steel fibers	7,8	200	0,80–3,15	3–4

The main advantages of fiber concrete include:

– reduction of construction costs, when replacing the reinforcing mesh or frame fiber;
– reducing the consumption of concrete;
– thanks to the fiber, the material becomes viscous, which allows to save specifications after the end of life;

– fibers can be used both in heavy and light concrete;
– use of fiber increases the crack resistance of the structure.

Analysis of the scientific literature has shown that the use of dispersed reinforcement, allows to produce building structures with increased strength, but of less weight. In addition to economic considerations, the choice of fiber is determined by the properties that a design should have to meet the specified requirements [4, 5]. Early studies on the possibility of replacing fiberglass waste with other fibers in concrete showed that the resulting durable concrete is a promising building material [6, 7].

Fiberglass waste is produced during the production of mesh for plastering works as a result of cutting off uneven edges.

Waste consists of trimming the edge with an alkali-resistant SSSh-160 (100) -1800/1800 grid (fig. 2). Characteristics of waste alkali-resistant fiberglass are presented in table 2.

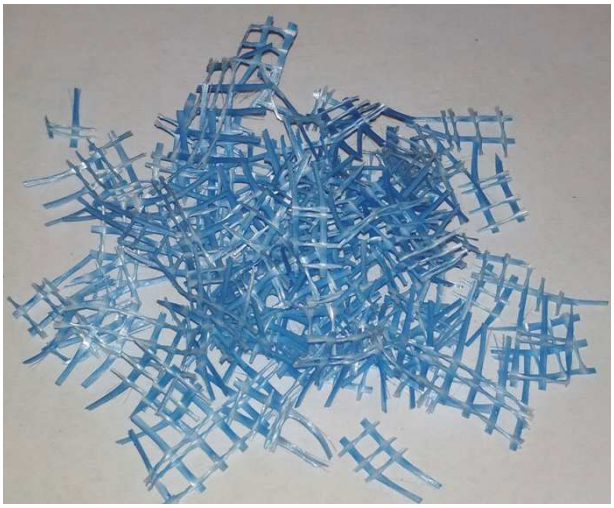


Figure 2. – Alkali-resistant fiberglass waste

Table 2. – Waste characteristics of alkali-resistant fiberglass

Fiber Properties	Value
Fiber length, mm	20-200
Nominal weight, g/m^2	160
Explosive loading, N	1800
Chemical resistance	Very high
Electrical Conductivity	Very Low

The use of waste alkali-resistant fiberglass as a dispersed reinforcement of concrete gives a double economic effect. On the one hand, the use of fiber reduces the overall cost of construction, on the other hand - the use of waste will bring additional profits to the organization and solve the problem of disposal. Hence, the use of fiber improves the mechanical and physical properties of concrete. The resulting fiber-reinforced concrete surpasses traditional concretes in all indicators. Also, the possibility of using alkali-resistant fiberglass waste as a fiber for dispersed reinforcement of concrete is noted.

REFERENCES

1. Национальная стратегия устойчивого социально- экономического развития Республики Беларусь на период до 2030 года [Электронный ресурс] // Министерство экономики Республики Беларусь. – Минск, 2015. – Режим доступа: www.ecomony.gov.by/ru/nac-strategia.pdf/// – Дата доступа: 12.03.2017.
2. Характеристика фибробетона [Электронный ресурс] // Все о бетоне. – 2017. – Режим доступа: http://kladembeton.ru/vidy/drugie/fibrobeton.html. – Дата доступа: 02.03.2017.
3. Камеко, О.А. Фибробетон: композитный материал нового поколения / О.А. Камеко // Труды молодых специалистов Полоц. гос. ун-та. – Вып. 89 Прикладные науки. Строительство. – 2017. – С. 68–71.

4. Парфенова, Л.М. Физико-механические свойства бетонов с полиакрилонитрильными волокнами / Л.М. Парфенова, М.С. Качан // Вестн. Полоц. гос. ун-та. Сер. F, Строительство. Прикладные науки. – 2011. – С. 30–34
5. Клюев, С.В. Дисперсно армированный стекловолокном мелкозернистый бетон / С.В. Клюев, Р.В. Лесовик // Бетон и железобетон. – 2011. – С. 4–6.
6. Юрьев, А.Г. Дисперсно армированный мелкозернистый бетон с использованием техногенного песка / А.Г. Юрьев, Р.В. Лесовик, Л.А. Панченко // Бетон и железобетон. – 2006. – С. 2–3.
7. Хватынец, В.А. Тенденции в области совершенствования конструкций при проектировании и строительстве автомобильных дорог / В.А. Хватынец, Л.М. Парфенова, Д.Н. Шабанов // Современные направления в проектировании, строительстве, ремонте и содержании транспортных сооружений : материалы II Междунар. студ. конф., Минск, 2018. – С. 51–55.
8. Хватынец, В.А. Создание высокопрочных оснований за счет дисперсного армирования цементной матрицы / В.А. Хватынец, Е.А. Трамбицкий, Д.Н. Шабанов // Вестн. Полоц. гос. ун-та. Сер. F, Строительство. Прикладные науки – 2018 – С. 56–59.
9. Камеко, О.А. Современные тенденции в сфере экологизации экономики Беларуси [Электронный ресурс] / О.А. Камеко, С.Н. Костюкова // Устойчивое развитие экономики: международные и национальные аспекты : электр. сб. статей II Междунар. науч.-практ. конф., посвящ. 50-летию Полоц. гос. ун-та, Новополоцк, 7–8 июня, 2018 г. / Полоц. гос. ун-т. – Новополоцк, 2018. – С. 838–842.