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TECHNOLOGIES FOR ARTIFICIAL MARBLE PRODUCTS

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Abstract
The main directions of economic and social development of Uzbekistan for the period until 2025 and the construction development program in the light of the Decrees of the President of the Republic of Uzbekistan emphasize the solution of the most important tasks of capital construction - reducing the cost of building materials, products and structures by reducing the materials-intensive products, saving raw materials, fuel, energy, metal, cement and other building materials, which helps reduce the cost of buildings and structures, reduce specific.

Keywords: marble, fine-grained concrete, physical and mechanical properties, strength, size, slab.

Introduction

Currently, Uzbekistan is developing the extraction of marble and the production of marble products. According to JSC "Uzstroymaterialy", Uzbekistan ranks second in CIS after Russia by reserves of natural stones. The world famous Gazgan marble, especially white one, is very popular. The main deposits of which are located in Samarkand and Kashkadarya regions [2].

The potential capacity of domestic marble quarries allows producing up to 190 thousand m3 of marble annually. At present, six large marble deposits are under industrial development in the country: Gazgan and Nurata (Navoi region), Zarband (Samarkand region), Savuk Bulak and Tomchi Ota (Kashkadarya region) and "Oksok-ota" (Tashkent region).

Gazgan" colored marble deposit is located in an urban-type settlement in Nurata district of Navoi region, Uzbekistan. The settlement is located near the ancient mound of the same name; 76 km from Navoi railway station (a junction of lines to Bukhara, Samarkand and Uchkuduk). It is known as an area rich in marble and stonecutters [1].

Marble is fine-grained, multicolored: cream, gray to black with gradual transitions of color in one slab. Well polished. It is processed in "Gazganmramor" JSC. Useful thickness of marble is represented in the form of layer deposit, extending in the latitudinal direction in the form of a narrow strip of shale. The thickness is broken by explosion-induced cracks running in various directions, as a result of which the

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marble easily splits into fragments of various sizes along the microcracks. The deposit is composed of two varieties of marble (white and gray) separated by shale porosity.

In the southern part of the deposit, in addition to the white marble variety, there are interlayers of pink, dark, and smoky marble. The thickness of the white marble varies from 12 to 45 m. White marble has a medium-grained structure, shell-shaped fracture, and massive texture. The northern part of the deposit is composed of gray marble with a smoky tint. This type of marble contains interlayers and small lens-shaped sections of white marble. The thickness of gray marble varies from 6 to 34 m, the thickness of interlayers of other colors varies from 5 to 30 cm, the structure of gray marble is fine-grained, the texture is massive. Table 1 shows the chemical composition of marble.

The Gazgan quarry produces marble for crushed stone. Waste after its extraction and processing is not recycled, which negatively affects the environment. In this regard, we have developed and some options for technological disposal of waste. They are based on the fact that the screenings of this quarry has decorative properties, which can be used in the manufacture of artificial marble products based on polymer resins in the form of small architectural forms, statues, statuettes, balls and other figures, bas-reliefs, frescoes, etc.

Consider some of the properties of rocks used in the manufacture of artificial stone products, the test, which was carried out directly in the quarry. Table 2 shows their physical and mechanical properties.

Table 1 Chemical composition of marble (in percent, %)

Field name	**Gazgan**
SiO_2	0,8-1,0
Al_2O_3	0,2-0,3
TiO_2	0,01
Fe_2O_3+FeO	0,1-0,2
CaO	53,0-55,0
MgO	0,01
K_2O	0,1
Na_2O	0,1
P_2O_5	-
CO_2	42,0-43,0
SO_3	-

Marble withstands 25 cycles of alternate freezing and thawing. Losses and weight at this is insignificant: 0,3-0,5%, which corresponds to mark F 25. Porosity of white marble is 0.5-2.58. Water absorption 0,04-0,68 %. Softening coefficient 0.9.

Coefficient of hardness according to the scale of Prof. M. Protodiakonov:

For marble 6

Flint 6-7

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According to their properties the marble of Gazgan deposits meets the requirements of GOST 8267-93 crushed stone and gravel of dense rocks for construction works (put into effect from January 1, 1995 instead of GOST 8267-82, GOST 8267-82, GOST 10264-82, GOST 23250-78, GOST 26873-86). Which means they are also suitable for the production of decorative polymer concrete products [1,p.541-542]. As basic we offer two technological manufacturing of decorative products based on marble crushing waste with the use of polymeric resins as binders because they are sufficiently transparent and do not degrade the properties of the marble crumb and allow to produce without prior grinding and polishing the front surfaces of products. The difference of technological processes is the use of molding materials. The considered type of products is a flat products made of decorative crushed stone and sand, as well as the earthenware on inorganic (cement) or synthetic binders. These products are designed for external and internal lining of buildings and constructions (mainly for flooring).

Table 2 Physical and mechanical properties

Field name	**Gazgan**
Volumetric mass g/cm²	2,64-2,71
Tensile strength (MPa) kgf/cm²	96,8-159,0 (968-1596)
Abrasion resistance g/cm²	1,69-2,28
Water absorption %	0,04-0,68
Density g/cm²	2,71-2,73
Porosity %	0,5-2,58
Softening coefficient	0,9
Frost resistance (number of cycles, frost resistance coefficient)	25

GOST 24099-80 divides decorative boards into three types:
1 - pressed or molded (equivalent name - mosaic tiles);
II- sawn from artificial blocks;
III - bonded from pieces of stone of any shape.
The pattern on the surface of the tiles can be different: I type - mosaic, brecciated, ornamental; II type - mosaic or brecciated; III type - mosaic, brecciated, ornamental.
Mosaic face surface is obtained with the use of decorative gravel, brecciated - from pieces of natural stone of arbitrary shape (flat or volumetric chips) or a mixture of chips and decorative gravel, ornamental - from elements of natural stone regular shape.
Slabs of I and III types are produced one-or two-layered, while slabs of type I may be unreinforced or reinforced with a metal mesh; slabs of type II are always one-layered. In Russia decorative boards are produced exclusively in rectangular form, their dimensions (in accordance with GOST 24099-80) are shown in Table 3.

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Table 3 Dimensions of decorative slabs of marble raw material waste (GOST 24099-80), mm

Board type	Length	Width	Thickness
1	200-800	200-600	10,15,20,25,28,30,35,40
II	200-1500	200-1200	10,15,20,25,30,35,40
III	200-600	200-600	10,15,20,25,30,40

Physical and mechanical properties of the material of the slabs must meet the following requirements.
Compressive strength of concrete, MPa, not less:
for slabs of type I 20
for type II boards 30
Tensile bending strength, MPa,
not less 3
Water absorption, %, not more 8
Abrasion resistance of floor boards, g/cm2, not more 2,2
Frost resistance of slabs for exterior cladding, cycles, not less..... 50
The texture of the front surface of decorative boards can be polished, glossy, polished or sawn (the latter - only for boards type II).
The minimum value of the coefficient of stone saturation of decorative slabs depending on their type should be the following:
I type ..... 0,65 (for products of the highest quality category - 0.75)
II type 0,70 (0,75)
III type:
ornamental 0,90 (0,95)
brecciated 0,75 (0,80)
Requirements for the quality of decorative plates produced in several Western European countries, regulated by the standard of France, which determines a fairly high quality of this product. In particular, the ultimate strength in compression must be at least 40MPa, and allowable deviations from the specified dimensions
When the length is the width of the slabs >300 мм ±0,3 mm
When the length is the width of the slabs <300мм +0,1% of the length or plate width
By plate thickness ..... 0.9 mm, respectively
Slabs decorative on the basis of a natural stone - the most mass kind of the production received from a waste stone mining (mainly from volumetric slag of the carbonate rocks, processed at first on decorative crushed stone) and in a smaller degree, - from waste stone processing production (from volumetric and flat slag). In the countries with the developed technique of manufacture of facing materials from a natural stone to the questions of release of decorative plates give the big attention, for what the corresponding material and technical base is created.

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Conclusion

The use of waste as secondary raw materials can reduce the volume of accumulated and newly formed mining waste. The widest application of waste products of mineral raw materials extraction found in building branch. Production of composite building materials from mining wastes deserves special attention here. Marble mining wastes processing for production of mineral-polymer materials is one of the most important tasks, both in the sphere of environmental protection and economics. However, the possibility of using waste marble dust in the production of mineral-polymer construction materials requires additional theoretical and practical study.

Thus, development of marble mining wastes recycling technology is urgent both from the economic and socio-ecological points of view. Moreover, steam consumption is reduced to 120-130 kg against 450 kg in conventional conditions.

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