A composition for protection the stylobate in high-rise construction from the harmful effects of car exhaust gases

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Abstract. In large cities, high-rise buildings are usually located along highways with heavy traffic. The study was carried out with the aim of creating a material for protection the stylobate of a high-rise building from the harmful effects of car exhaust gases. A polymer-silicate composition based on schungite and schungisite components is proposed. The composition has the properties of a wall material resistant to the corrosive environment of car exhaust gases. The results of the composition studies are presented. The possibility of increase the durability of exterior slabs for stylobate walls of high-rise buildings is substantiated, provided the proposed material is applied.

1 Introduction

High-rise buildings and complexes are being built, united by stylobates. Walls of stylobates are faced with slabs made of artificial stone, natural stone, or concrete. Increasingly, along motorways, the content of exhaust car fumes (CO, NO, NO2, CH, SO2, etc.) in air is several times higher than the maximum allowable concentrations. When interacting with air moisture, these substances form a generally acidic wet gas environment. This aggressive environment exerts a destructive effect on the material of the stylobate facing. Theoretical justification of the process of destruction of materials for finishing the facades of buildings under the influence of automobile exhausts is given in the work [1]. There is a need to protect the cladding material from corrosion.

2 The object of the study

The object of research is the material for facing the stylobate of a high-rise building. This is a polymer-silicate composition with schungite and schungisite components. Polymersilicate was chosen because this material has long been used to work in acid corrosive environments [2]. Shungite is a natural carbonaceous mineral with high acid resistance [3, 4]. Shungisite, obtained as an easy filler based on shungite rocks, is also an acid-resistant material. In addition, an important factor is the proven positive impact of schungite for the human body. Small and large fractions of schungite and shungizite were used. The

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compositions have been developed with a density of 1000 to 1200 kg / m3. The compositions differed in the size of the schungisite fractions and in the type and size of fractions of small fillings based on schungite and schungisite. The physical and mechanical properties of the developed compositions are given in the article [5, 6]. The studies were carried out according to standard methods.

This article presents the results of research on the operational properties of the material. Studies were carried out in accordance with the requirements to materials for facing facades of civil buildings The studies were carried out according to standard methods [7, 8].

3 Results

The results of testing the material to water absorption are shown in Table 1.

Table 1. Water absorption of the material by volume,%

Time, day	Compositions		
	1	**2**	**3**
2	6,0	5,5	5,8
30	10,0	9,6	9,8

It follows from Table 1 that the water absorption of the material is much lower than the water absorption of expanded clay concrete and other lightweight concretes on a cement and a polymer-silicate binder.
The results of the acid resistance tests are given in Table 2.

Table 2. The results of the acid resistance tests.

Compositions	Compressive strength of control samples, R, MPa	Concentration of sulfuric acid in s solution,%	Test period, days		
			30	**270**	**360**
1	12,8	4	0,91	0,96	0,92
		24	0,94	0,97	0,97
2	12,0	4	0,89	0,80	0,81
		24	0,99	0,82	0,84
3	16	4	0,89	0,88	0,87
		24	0,90	0,97	0,98

Figure 1 shows the results of study of moisture absorption by the material for 30 days.

All compositions have a dense structure. The results of the studies showed that the acid resistance coefficient of the proposed compositions is from 0.8 to 0.99. These indicators correspond to the requirements of regulatory documents and even exceeds these requirements. It was influenced by high acid resistance of shungizite, which is about 96%. According to Table 1, it can be concluded that the chemical resistance coefficient increases with the concentration of the sulfuric acid solution. Structure of the material becomes denser. The formation of a dark contour along the perimeter of the cross section of the sample indicates the process of compaction of the structure.

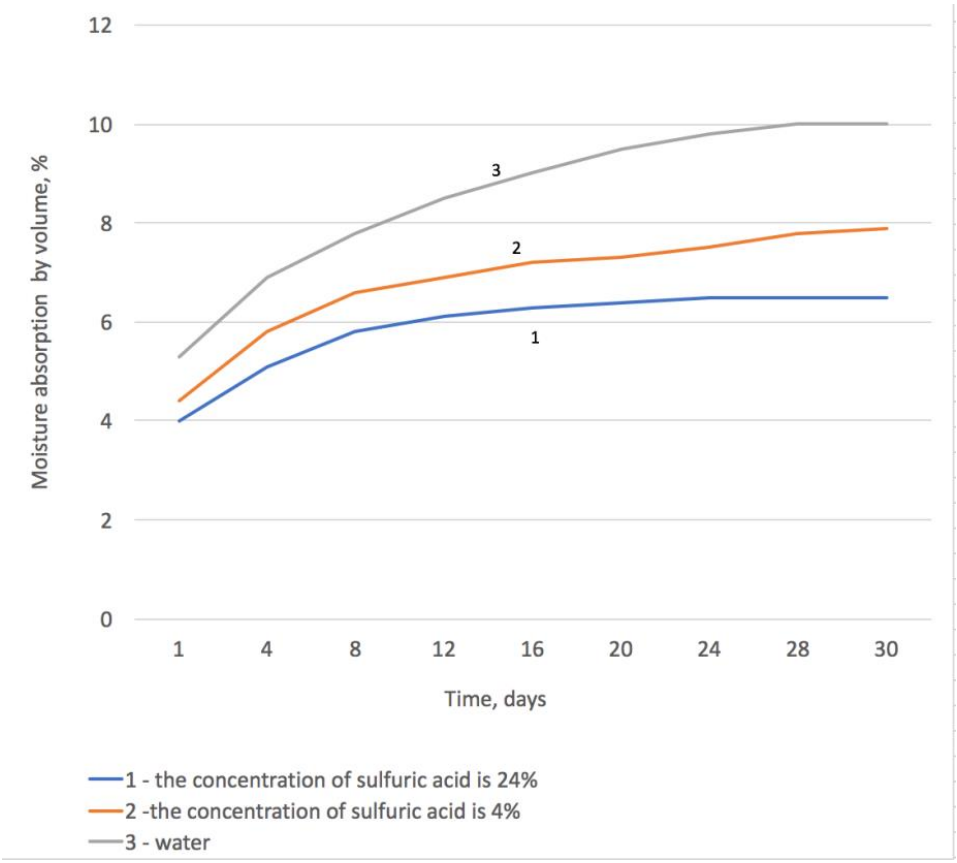

Fig. 1. The results of moisture absorption by the material for 30 days.

No changes in the samples were observed after two years of testing in a solution of sulfuric acid (cracks, chips, shells, blisters). Therefore slabs can be used without additional surface protection. According to water absorption, as an indirect indicator of penetration, the compounds meet the requirements of the standards for lightweight concrete for use in an acidic wet gas environment. The coefficient of stability of the composition in water is 0.83-0.86 at a rate of 0.8.

To conduct tests on weather resistance, the samples were installed on the site close to the highway with intensive traffic. After three years of testing, the compressive strength of the samples was determined. The coefficient of weather resistance after three years of testing was 0.91-0.96. The surface condition of the samples after three years of testing was satisfactory.

5 Conclusion

As a result of the research it was established that the polymersilicate composition with schungite and schungisite components satisfies the requirements for facing the stylobate part of the high-rise building. It is concluded that the use of the developed and investigated composition will increase the durability of the stylobate facing without an additional protective layer. Facing lits from this material are proposed for use in the construction, repair and reconstruction of stylobates of high-rise buildings.

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