USE OF SULFUR CONCRETE IN REINFORCED CONCRETE STRUCTURES

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Abstract. *This scientific article presents the results of experimental studies on the physical and mechanical properties of sulfur concrete and comparative characteristics of strength and deformation characteristics of sulfur concrete with concrete based on Portland cement. The results of theoretical studies on the use of sulfur concrete in reinforced concrete structures are highlighted.*

Keywords: *sulfur concrete, ecology, recycling, portland cement, frost resistance, crushed stone, sand, strength, sulfur, deformability, modification, reinforced concrete.*

ПРИМЕНЕНИЕ СЕРОБЕТОНА В ЖЕЛЕЗОБЕТОННЫХ КОНСТРУКЦИЯХ

Аннотация. *В данной научной статье представлены результаты экспериментальных исследований физико-механических свойств серобетона и сравнительная характеристика прочностных и деформационных характеристик серобетона с бетоном на основе портландцемента. Освещены результаты теоретических исследований по применению серобетона в железобетонных конструкциях.*

Ключевые слова: *серобетон, экология, рециклинг, портландцемент, морозостойкость, щебень, песок, прочность, сера, деформируемость, модификация, железобетон.*

INTRODUCTION

An urgent environmental, scientific, technical and technical-economic problem in Uzbekistan is the utilization of sulfur, which is formed as a by-product of oil and gas refining, the volume of which is growing every year, reaching several million tons. There is pollution of the environment with pulverized sulfur, which spreads over considerable distances in windy weather. The use of man-made waste for the preparation of building materials solves two problems at once: preventing environmental pollution and achieving economic efficiency in the preparation of concrete. Currently, the production of sulfur by the Mubarek gas Processing plant is about 3 million tons per year.

RESEARCH MATERIALS AND METHODOLOGY

The possibility of using sulfur as a binder in concrete and reinforced concrete structures was established. In recent years, technologies have been developed abroad (Canada, USA, Japan

and other countries) and compositions of structural materials based on sulfur binder have been obtained. Sulfur concretes obtained by mixing inert materials with molten unmodified liquid sulfur initially have excellent strength properties, however, under conditions of cyclic exposure to alternating temperatures, they are subject to intense destruction. This is due to the fact that after mixing inert materials with unmodified liquid sulfur in the hot state and laying such sulfur concrete, liquid sulfur quickly turns into a solid state when cooled. Recently, sulfur concretes based on modified sulfur have been developed, which have high strength properties and are able to resist corrosion of cyclically changing temperatures.

The key to the successful solution of such problems is an integrated approach to the conduct of work at each facility, which includes the correct choice of the composition of materials and the development of an effective technology of sulfur concrete. Serobeton is an artificial material, which is a hardened serobeton mixture. By composition, sulfur concrete is a composite material consisting of sulfur and inert fillers. The range of inert fillers used is wide. In this capacity can be used: crushed stone, sand, gravel, metallurgical slag and other rocks. Large oil and gas companies began to search for new directions of methods of using sulfur. As a result, new developments have emerged for the production and use of concrete based on sulfur binder. Therefore, the study of sulfur concrete based on local inert materials, industrial waste and sulfur located on the territory of Uzbekistan is the main direction of solving the problem. Analysis of the available literature on the use of sulfur concrete has shown that currently there is no information about the use of sulfur concrete in regions with a sharply continental climate, especially the influence of high temperature and low humidity on the strength and deformative properties of sulfur concrete, therefore, sulfur concrete can be considered a new material, and a new selection of the composition of sulfur concrete should be taken into account the influence of climate. It is known that the territory of Uzbekistan has a sharply continental climate, for example, in spring and autumn there is a fluctuation in temperatures. Especially temperature changes in March, August and September months can lead to the destruction of the concrete structure. The scientific novelty of this study is the use of local materials and industrial waste, as well as taking into account the characteristic features of the climate of the Republic of Uzbekistan, the development of a new composition of sulfur concrete and its introduction into production.

Table 1.

Comparative characteristics of strength and deformative properties of foam concrete and concrete based on Portland cement

№	Indicators	Units of measurement	Serobeton		Concrete based on Portland cement
			On dense fillers	On porous fillers	On dense fillers
1	Average density	Kg/m3	2300-2500	1600-2000	2200-2400

2	Compressive strength	MPa	85-102	30-50	30-60
3	Flexural strength	MPa	12-14	7-8	8-10
4	Deadlines for achieving the design strength	In days or in hours	12-24 час	12-24 hour	28 days
4	Linear shrinkage of concrete	%	0,02		0,02
5	Water absorption	%	0,9-1,5	0,7-1,1	1,0-3,5
6	Frost resistance	Cycles	300-800	to 100	100-300
7	Water resistance		20-40	10-20	8-10
8	Concreting at negative temperature		Possible		Warming up is necessary
9	Concreting under water		Possible		Difficult
10	Chemical resistance		High		Protection required

RESULTS OF THE STUDY

Theoretical and experimental studies conducted by researchers of the Namangan Institute of Civil Engineering have shown that sulfur concrete is a valuable material for the manufacture of reinforced concrete structures of buildings and structures. In terms of strength and deformative properties, sulfur concrete is not only not inferior to ordinary concrete (concrete based on Portland cement), but in some respects surpasses it. For example, the strength of foam concrete is almost twice as much as ordinary concrete, and the cost of foam concrete is two times cheaper compared to cement concrete. Comparative characteristics of foam concrete and cement concrete are given in Table 1.

CONCLUSION

It is known that the main characteristic of concrete for reinforced concrete structures is the axial compression strength of concrete. Therefore, it can be predicted that when using sulfur concrete in reinforced concrete structures, rebar savings are expected, which leads to a reduction in the cost of reinforced concrete structures.

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