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Effect Of Gel Polymer Organic Mineral Addition in Cement Compositions

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Abstract: The article examines the hardening of binder compositions with the addition of gel-polymer additives in different temperature and humidity conditions. High levels of crystallization of hydrated components of the final stage of hydration have been studied, while gelpolymers not only retain moisture well in the concrete microstructure, but also actively participate in the process of structure formation.

Key words: Helpolymers GP-1, GP-2, physicochemical, physicomechanical, binder, microcracks, strength, structure, moisture.

Physical, chemical, destructive processes that occur due to gyration of the binder lead to a decrease in the physical and mechanical properties of concrete, the cause of which is associated with a large loss of moisture. As a result of a large loss of moisture in the concrete at an early age is formed a defective structure, characterized by plastic subsidence, a decrease in the degree of hydration of the cement, an increase in the formation of microcracks, micro-pores. Numerous research studies have been carried out to identify possible distortions of the concrete structure that harden under different temperature-humidity conditions. However, data on the formation of concrete structures hardened with gelpolymers are rarely given in the literature.

Based on the above, the phase composition of the concrete structure formation of gelpolymers, the nature of porosity formation, the effect of cement on the gyration process were studied.

Gel-polymers include GP-1, GP-2, which are added in the dry state, and GPK-1, which is mixed with water. The degree of hydration of the cement stone was studied using the X-ray phase method [1].

The gel polymer concrete structure is much denser than that of the control samples. The micro-pores in it are evenly distributed along the height of the sample and they have a spherical shape. These pores, which contain gelpolymer particles, serve as liquid phase reservoirs for the microsat, which in turn testifies to the high degree of hydration and increase in strength that occurs in the later stages of concrete hardening. The boundaries of the phase splits are tightly surrounded by newly formed particles of hydration products, and the occurrence of clinker grains is also observed. The results of the study of the structure of concrete are fully confirmed by petrographic and other physicochemical studies.

Derivatographic studies revealed observations of an exothermic moment associated with the combustion of organic constituents in control samples. 450, 600, 8500S moments correspond to the dehydration of Sa (ON) 2, the diffusion of Sa SO3 at 650 - 8500S. All hydration processes are completed at 8500S. Moisture loss is 13%. GP-1 gelpolymer samples have hydrosilicate water that separates in the temperature range from 1000S to 2000S, unlike control samples. The process takes place with an endothermic effect, which is characterized by a moment of 1000S.

Here, too, the exothermic effect of the combustion of organisms and the endothermic processes of dehydration of Sa (ON) 2, the decomposition of Sa (ON) 3, are also observed. Endothermic effects in the range of 6000S to 8000S testify to a much higher degree of crystallization of the tobermorite phases. The total loss is 14%, with moisture at 12% retained in the hydrosilicate gel capsules. The GP-2 sample has similar moments, but the total dehydration ends at 8500S and is 13.5%. Preserved hydrated water is 1.9% [2].

The results obtained provide the final stage of hydration with a high degree of crystallization of hydrated constituents of cement, as gelpolymers not only retain moisture well in the concrete microstructure, but also actively participate in the structure formation process. The results of the study of electron-paramagnetic resonance (EPR) spectra show that GP-2 does not exhibit paramagnetic properties. This indicates that the GP-2 maintains stability and that it does not contain free radicals.

The control sample has a factor EPR of 2.01 and a width of 135 Gs.

The GP-2 gelpolymer cement sample will have broad anisotropic properties due to external field exposure, a factor D signal of 2.01, and a singlet with a width of 160 Gs.

In this sample, the EPR signals reflect the paramagnetic centers of the interaction between the metallic nature complex and the carboxyl groups included in the GP-2. The transition to the positive side of the paramagnetic centers, which increases the activity of cement hydration products, is clearly shown. Periodic and detailed studies are needed to determine the nature of the interactions [2-3].

Electron-microscopic studies were performed by the method of direct replication on the surface of a new piece of specimen. At large magnification, structural sparseness and the presence of ridges are observed. In water, the pores connecting the canals and capillaries are directed to the concrete surface. The diffusion front of the negative effect of moisture loss is observed even in the study of the structure of the lower layers of the control sample. The bottom layer structure is sparse but much denser than the middle layer. The migration path of moisture is much more pronounced. The hydrosilicate part exhibits a low-density molded amorphous structure with tobermorite, which is in the form of fine round grains, with microcracks and micro-pores visible.

The introduction of gel polymers leads to the condensation of hydrosilicates. In the micro-pores, a membrane covering the surface of the pores is observed, which affects the process of formation of the structure, which is directed by the extraction of elongated pores of the membrane. The results obtained to determine the degree of hydration of the studied specimens are presented in Table 1, which results in the arithmetic mean of several individual values obtained for each section of the slab under consideration.

Table 1

The degree of hydration of gelpolymer cement compositions

№	**Намунанинг тури**	**Петрографик маълумотлар бўйича, %**	**Рентген маълумотлари бўйича, %**
1.	Назорат намуналари	45-48	43-50
2.	ГП-1	52-55	45-58
3.	ГП-2	47-52	43-45
4.	ГПК-1	43-45	46-49

From the indicators given in Table 1, gelpolymer samples are characterized by a much lower level of hydration, which in turn leads to rapid evaporation of moisture not only from the upper layers, but also from the lower layers, ie at a depth of 0-0.1 mm, as well as hydration of cement stone. is also related to the heterogeneity of the process and structure formation.

Table 2

Macro porosity of gel polymer cement compositions

Гельполимернинг тури	Намуна қатламлари	Жами макроғоваклик қисмининг юзасига нисбатан % да	Жами ғоваккликка нисбатан дифферинциаллашган ғоваклик, % да ғоваклар ўлчами (мкм)								
			10-30	35-50	50-75	100-150	200-350	350-450	500-700	800-1000	1000
Назорат намуналари	Устки Ўртадаги	10,6 9,6	7,0	4	3	2	1	0	0	-	-
ГП-1	Устки	5,5	3,0	3	2	0	0	0	0	-	-

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	Ўртадаги	4,8									
ГП-2	Устки Ўртадаги	4,6 3,6	4,0	4	3	2	-	-	-	-	-
ГПК-1	Устки Ўртадаги	7,3 5,0	2,0	4	3	2	-	-	-	-	-

Considering the differentiated porosity, the pores from 0.01 to 0.2 mm accounted for 68%, and the porosity of the maximum size of 0.5 mm and above was 8.5%. The structure of the cement stone with the edges of the pores compacted consists of blocks of hydrosilicates, ohangaron cement Sa SO3, the hydrosilicate gel is slightly denser, the hydrosilicate crystals are mainly relatively unevenly spaced.

By analyzing the results of total and differentiated pores (Table 2), we observe a sharp decrease in aggregated porosity and medium-sized pores. In this case, the predominant size of the pores for gelpolymer concretes is 0.015 ...... 0.012 μm compared to control samples, where the majority of witnesses are 2.5 μm. If the porosity concentrated in the control samples was 10.6%, in gelpolymer samples this figure is 5.5%. These compositions are characterized by the absence of pores with a size greater than 0.5-0.8 mm.

The introduction of gel polymers affects not only the total number of pores and differential microporosity, but also the formation and formation of pores and their distribution across the sample size [3].

If we see mostly uneven elongated, chain-thin plastic pores at the top of the polymer specimen, here we encounter mostly insulated, micro-porous, non-interconnected, smooth-edged pores sufficiently evenly distributed throughout the sample size. The inclusion of gel polymers in the concrete has a positive effect on the degree of hydration, accelerating the hydration process and creating conditions for its smooth occurrence. In contrast to the control samples, in some cases the oscillation of the hydration level is not significant (5-10%), but the dispersion of the clinker particles is much more rapid. If in the control samples the hydration process is 48%, in gelpolymer samples and especially in the GP-2 sample this process is 65-67% (Table 1).

There is also a decrease in the size of clinker granules (7-8 times): in control samples their size is 0.1-0.2 mm, and in gelpolymer samples their size is 0.03-0.05 mm.

Based on the research, the following main conclusions can be drawn:

- gelpolymers retain moisture in the concrete structure and participate in the process of structure formation, providing the final stage of hydration with a high degree of crystallization of hydrated constituents;
- for gelpolymer concrete is characterized by a monolithic-block structure, which provides the formation of a directed structure of hydrosilicates and the growth of tobermorite phases. The absence of large pores and the distribution of micro-pores along the length of the block growth, the presence of hydrated phases, the formation of layers of gelpolymer pores testify to the relatively closed distribution of large evaporation planes, the sufficiently even distribution of spherical micro-pores by volume [4].

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