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INVESTIGATION OF LINEAR DEFORMATIONS OF SPECIAL SLAG-ALKALI CEMENTS

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Abstract
The purpose of our research is the directed synthesis of high sulfate hydroaluminate in the composition of the hardening products of slag-alkali binders based on blast-furnace or electro-thermophosphorus slag and alkali metal compounds forming the Na_2O-Na_2SO_4-CaO-Al_2O_3-SiO_2-H_2O system, studying the structure and phase composition over time expanding and stressing slag-alkali cement, determination of the physical and mechanical properties of the binder.

Keywords: slag, slag-alkaline component, expanding additive, linear deformation.

Introduction

The mechanism of hardening of the alkaline-alkaline earth binder system Me_2O-MeO-Me_2O_3-SiO_2-H_2O, where Me_2O-Na_2O, K_2O, Li_2O; MeO-CaO, BaO; Me_2O_3-Al_2O_3, Fe_2O_3, Cr_2O_3 based on a whole range of silicate substances and alkali metal compounds showed that the main properties of artificial stone (strength, deformability, durability) depend on the qualitative and quantitative composition of neoplasms [1]. Works in the field of targeted synthesis of new formations that impart special properties to alkaline binders have opened up new ways of using by-products of production to obtain expanding and stressing cement by selecting slag, an alkaline component, and an expanding additive [2, 3].
Expanding and stressing cement based on alumina cement and portlandcementare the most common. In recent years, compositions of expanding cement based on Portland slag cement have been developed [4]. An analysis of the hardening mechanism of these binders indicates that the basis for obtaining the effect of expanding cement is the increase in the volume of the solid phase as a result of the formation of a highly sulfated form of calcium hydrosulfoaluminate or calcium or magnesium hydroxide during hydration [5].
The purpose of our research is the directed synthesis of high-sulfate hydroaluminate in the composition of the hardening products of slag-alkali binders based on blast-furnace or electrothermophosphorus slag and alkali metal compounds forming the Na_2O-Na_2SO_4-CaO-Al_2O_3-SiO_2-H_2O, system, the study in time of the structure and phase composition of expanding and straining slag-alkali cement, the determination of the physico- mechanical properties of the binder.

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The investigated expanding and straining slag-alkaline cements were considered in the form of a system "slag - alkaline component - expanding additive". Granulated blast furnace and electrothermophosphoric (ETF) slags were used in the research. The chemical composition of the slags is given in the table 1.

Table 1. Chemical composition of slags

Type of slag	Massfraction, %									
	Sio_2	$A1_2o_3$	Fe_2o_3	Cao	MgO	So_3	MnO	FeO	S	Tio_2
ETF	41,24	2,72	0,45	44,85	5,0	0,83	2,20	-	-	-
Domains	37,40	13,67	7,97	39,92	0,72	-	-	0,5	0,99	0,45

As an alkaline component, an aqueous solution of a sodasulfate mixture (waste from the production of caproloctam) with a density of 1180 kg/m containing wt. %: %: Na_2Co_3-40; Na_2o_3-51; NaOH-2; NaCl-7.

The expanding additive, conventionally designated by us as DB-1, DB-2, and DB-3, was prepared by firing a rationally raw mixture at 1100°C with an exposure at this temperature for 1 hour.

Samples for research were made by mixing slag, previously ground to a specific surface of 300–310 m^2/kg according to the PSKh-2 device, an expanding additive and an alkaline component. The samples hardened under normal and air-dry conditions.

The phase composition of neoplasms was studied by X-ray phase and differential thermal analysis on cement dough samples, physical and mechanical properties and linear deformations according to the GOST method 11-52-74 "Expanding gypsum-alumina cement" and self-stress according to TU 21-20-48-82 "Straining cement ".

Conducted studies on the composition of neoplasms of slag-alkaline binders based on blast-furnace slag, soda-sulfate mixture and DB-1 additives, hardened during 7, 14, and 28 days under normal conditions using X-ray phase analysis, indicate the formation of a high-sulfate form of calcium hydrosulfoaluminate (HSAC), tobermorite and calcite The presence of these neoplasms is also indicated by the DTA curves. Thus, endothermic effects in the temperature range of 120-190 °C and 740-790 °C relate to the temperature of HSAC dehydration and dissociation of calcite, and exothermic effects at 880-930 °C about the crystallization of wollastonite from tobermorite.

Analysis of X-ray curves of samples of binders based on electrothermophosphorus slag, sodo-sulfate mixture and DB-1 additives, hardening under normal conditions, indicate the presence of a large amount of the gel phase in the initial hardening periods, and during subsequent hardening, reflexes related to HSAC appear. The absence of reflections of tobermoritereflexes and phases with alkali metals in the studied binders is explained by their presence in a gel-like state.

However, the presence of tobermorite in the hardening products is evidenced by the exothermic effect on the DTA curves at 870°C associated with the crystallization of wollastonite. Endothermic effects at 150-240 and 680-820 °C indicate dehydration of HSAC and decarbonization of calcite. Anological neoplasms were also identified in binders with the addition of DB-2, DB-3.

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Structural features of the processes of structure formation determine the difference in the properties of binders. Analysis of the obtained data on the measurement of tensile strength showed that the strength and magnitude of linear deformations of cement stone on the soda sulfate mixture showed that the strength and magnitude of linear expansion deformations depend on the type of slag, hardening conditions, type and amount of expanding additive. So, the strength of the binder on blast-furnace slag with the addition of DB-1, regardless of the hardening conditions, increases significantly on the 3rd-7th day of hardening, slightly in 7-14th day, and increases intensively in the future.

A similar picture is observed during the hardening of a binder based on electrothermophosphorus slag, but with some shift. The strength increases intensively up to 7-14 days, slightly in 14-21 days, and then also intensively increases. The same features were found during the hardening of binders with the addition of DB-2 and DB-3. The magnitude of the expansion deformations of slag-alkali stone, regardless of the hardening conditions for slag-alkali stone, regardless of the hardening conditions, when using blast-furnace slag, is 30% greater than when using electrothermophosphorus slag. At the same time, expansion deformations significantly increase in 7-14 hardening times in binders on blast furnace slag, and in binders on electrothermophosphorus slag after 14 days, although the formation of HSAC was noted on 1 day.

An analysis of previous studies and the results of this work showed that the rate of ettyringitis formation and the increase in the strength of the structure largely depend on the activity and amount of the expanding additive [6, 7]. However, all the considered binders are characterized by general patterns of change in time of strength, expansion and self-stress of slag-alkaline cement stone. The first period of hardening (from the beginning of mixing to 7-14 days, depending on the type of slag and additive) is characterized by a rapid increase in strength and a slight expansion and self-stressing of the cement stone, the second period (up to 14-21 days) - a slight increase in strength (or even its decrease), a significant increase in expansion, a slow increase in structural self-stressing. In the third period (more than 14-21 days), there is an increase in strength, stabilization of expansion, and self-stress of the hardening stone.

By regulating the factors that cause the expansion and strengthening of the structure, and selecting the compositions of slag-alkali cement in order to achieve the optimal content of crystalline and gel-like phases of calcium hydrosulfoaluminatein the hydration products, non-shrinking, expanding, and straining cement were obtained.

Literature

1. Gluxovskiy V.D., Krivenko P.V., Pashkov I.A. i dr.: Shlakoshelochnye betony na osnove melkozernistyx zapolniteley. -Kiev, Vysshaya shkola, 1981.- 244 s.
2. Krivenko P.V. Spetsial'nye shlakoshelochnye sementy. -Kiev.: Budivel’nik, 1992.-S 101-131.
3. Sultanov A.A., Negmatov Z.Yu., Krivenko P.V., Skurchinskaya J.V.: Vyajushie, a.c.n 1761706, SSSR, 1991.

ISSN: 2776-1010 Volume 3, Issue, May, 2022

4. Negmatov Z.Yu., SultanovA.A., Krivenko P.V. Osobennosti tverdeniya shlakoshelochnyx bezusadochnyx i rasshiryayushixsya sementov / V kn. «Nauchno-teoreticheskie i prakticheskie issledovaniya v oblasti stroitel'stva I arxitektury». Sb. Nauchnyx statey.- Samarkand.: SamGASI, 1993,- 36 s.
5. Z.Yu.Negmatov, A.E.Ochilov, M.S.Maxammatov. Special properties of alkali-aktivated binders// GCCSA-2021-6th Global Congress on CContemporare Scienes & Advanceements. Hosted online ffrom Rome, Italy, June 5 th, 2021, 56-58.