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Properties of Limy Composites with the Addition Aluminosilicates

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Abstract

Provides information about the impact on the properties the limy composite of the synthesized aluminosilicate. It is shown that the samples of lime-based with additive aluminosilicates possess greater porosity than composites with lime binder.

Keywords: lime, mixture, synthesized aluminosilicates, porosity, strength

Introduction

For restoration and repair of the historical buildings, as a rule, use limy compositions. Taking into account, that limy compositions are characterized by slow curing periods and possess insufficient water resistance, it is offered to enter into their compounding nanosized additives - the synthesized hydrosilicates, sol of silicon acid, the organics additives [1, 2. 3]. Results of the carried out researches testify, that application in a compounding of limy finishing compositions of such additives promotes increase of water resistance, frost resistance of finishing coverings.

Methodology

In continuing further research we have established the possibility of applying in the limy compositions synthesized aluminosilicates, obtained by adding a microfine powder of aluminum in solution of silicate of sodium at a temperature of 60 ° C for 90 min [4]. Admixture is a lightweight powder light gray (particle size 2-20 mm), with a density of 0.55 ± 0.05 g / cm3. During synthesis of the additive a plenty of gaseous molecular hydrogen, which is forms pores of the various size and the form [5]. Yield of the product was 90%.
X-ray analysis showed that the mineralogical composition of additives, mainly represented by of crystalline aluminum hydroxides - bayerite - α- Al (OH) 3 and boehmite - γ-AlO (OH). The amorphous phase is represented by nanostructured aluminosilicates.

Taking into account high porosity of the synthesized additive, it is offered to apply her at manufacturing of thermal insulation plaster compositions. By development of a compounding of plaster mixes applied hydrated lime with activity of 84%.The contents of the additive is 1-30 % from weight lime

Proposed to be produced limy composite binder (LCB) with application of the synthesized additive in quantity of 5-10 % from weight lime. In work influence of properties of the additive on physicomechanical properties of limy samples (tab. 1) Temperature conditions were varied to adjust the properties of the additive. In work applied solution of silicate of sodium with the silicate module 2,9. By development of technology of synthesis applied the following ratio of components (aluminium: solution of silicate of sodium: water):

1 Composition -1:4:7;
2 Composition - 1:8:14

As criterion of optimization of a mode of synthesis has been accepted the parameter of durability of a limy composite. In work applied hydrated lime activity of 84 %. Water-lime relation W/L made W/L = 1. The samples harden in air - dry conditions at temperature 18-20ºC and relative humidity of air of 60-70 %. By preliminary researches it is established, that the optimum ratio of the additive makes 5-10 % by weight of lime.

The analysis of the data resulted in tab. 1 testifies, that samples on basis LCB possess the greater porosity in comparison with composites on limy binder. So, porosity of control samples makes 53,81 %, and on basis LCK - 67,18-69,84 %. Despite of increase in porosity, samples at basis LCB are characterized by the increased durability 1,71-2,32MPa (at the contents of the additive of 5 %) and 2,21 - 2,86 (at the contents of the additive of 10 %).

Decrease in density of samples on basis LCB is observed, if the additive synthesized within 1,0 hour at temperature 60ºC . The further increase in temperature and time of heat treatment promotes some increase of density of limy samples. Despite the increase in porosity of the samples basis the LCB, they are characterized by high strength, which, in our opinion, due to the chemical interaction with lime aluminosilicates. X-ray analysis data show that the mineralogical composition of the samples on the basis of LCB presented hydrocarboaluminates calcium, d, A (4,613; 2,5289), hydroaluminate calcium d, A (4,099; 3,948; 3,6187; 2,8432), hydroaluminosilicates calcium, d, A (5,016; 3,1816), calcite, d, A (3, 0079; 2.7542), calcium hydroxide, d, A (3,1816; 2,6433), sodium hydroaluminosilicates, d, A (3,6896 ; 2.9214; 2.6708) [6].

Limy samples on basis LCB are characterized by great values of factor of a softening. Coefficient softening point is depending on the synthesis conditions and the additive content of Ks = 0,41-0,72. Additive synthesized at a lower aluminum content, contributes to a greater increase in water resistance of composites (Ks = 0,49-0,72)

Table
Properties lime composite depending on the mode of synthesis of the aluminosilicate additive (10%)

Mode synthesis	Water absorption by weight,%	Strength, MPa	Density, g / cm^3	Porosity,%			softening coeffi-cient
				general	open	closed	
1	2	3	4	5	6	7	8
Control (without the additive)	49,6	1,0	0,94	53,81	38,9	11,1	0,37
Composition 1. Temperature 60°C, time of heat treatment of 30 minutes	67,4	,21	0,809	68,85	54,58	14,28	0,67
Composition 1. Temperature 60°C, time of heat treatment of 1 hour	74,2	,63	0,694	73,29	51,54	21,75	0,42
Composition 1. Temperature 60°C, time of heat treatment of 2 hour	65,6	,7	0,747	71,23	49,06	22,17	0,62
Composition 2. Temperature 60°C, time of heat treatment of 30 minutes	66,7	,31	0,841	68,26	56,92	14,08	0,67
Composition 2. Temperature 60°C, time of heat treatment of 1 hour	67,2	,66	0,791	69,55	53,24	16,31	0,50
Composition 2. Temperature 60°C, time of heat treatment of 2 hour	61,7	,86	0,843	67,51	52,09	15,46	0,53
Composition 2. Temperature 80°C, time of heat treatment of 30 minutes	63,6	,6	0,844	67,51	53,61	13,90	0,68

Table (Continued)
Properties lime composite depending on the mode of synthesis of the aluminosilicate additive (10%)

Composition 2. Temperature 80°C, time of heat treatment of 1 hour	58,8	,51	0,881	66,10	51,80	14,30	0,68
Composition 2. Temperature 80°C, time of heat treatment of 2 hour	61,3	,77	0,794	69,45	48,65	20,80	0,72

Conclusions

This LCB is recommended to use in the manufacture of thermal insulation plaster compositions.

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