Contemporary Generation Additives For Modification Of Cements And Other Knitting Building Materials

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Abstract: The article discusses some issues of creating new modifiers based on local raw materials and modified ash and slag waste of the Novo-Angren TPP, containing phosphogypsum-waste of “Maham-Ammophos” OJSC and cement modification processes.

Index Terms: activation, adsorption, ash and slag of the Novo-Angren TPP, mechanochemical modification, microwave processing, modification, strength, phosphogypsum, raw materials, waste.

1. INTRODUCTION

Currently, an urgent problem is the creation of new additives for cements and other dispersed building materials. At the same time, it is becoming increasingly common, as in simplifications of production technology, to obtain a simple in hardware design, but an extremely effective method of mechanochemical activation. The kinetics of mechanochemical activation of dispersed materials has been the subject of many works [1-3], which is associated, in particular, with the need to create a mathematical model that allows one to evaluate the sorption properties of additives without conducting expensive and lengthy experiments. However, at present, the creation of such a unified model of mechanochemical activation is complicated by the lack of theoretical ideas about the mechanisms of activation of molecules from solutions, which are usually based on the study of the possibility of applying various theories of mechanochemical activation on solid surfaces. From a practical point of view, two established patterns are of great importance. The first determines the dependence of the sorption efficiency of compounds of the same homologous series on their molecular weight at the initial stage. The second regularity, determining the structure of the surface layer, creates the theoretical basis for the targeted choice of additives in specific cases, i.e. the activation process goes towards aligning the polarity of the phases of the substrate and the solution to be purified the more efficiently, the greater the initial difference in polarities. It also follows that the activation of compounds less polar than water will occur more efficiently on the surface of a non-polar substrate (coal, vermiculite, etc.), and the more intense the less the solubility or hydrophilicity of the substance. Due to the fact that universal sorbents based on vermiculite have a high cost and a big problem of their regeneration, therefore, the search and creation of new cheap and effective modifiers for cements and cementitious materials is very relevant today. We propose using such a modifier as a microwave-modified ash-slag of the Novo-Angren TPP containing phosphogypsum - a waste of “Maham-Ammofos” OJSC. The resulting modifier is a fine powder with a number of valuable properties that determine its scope: high degree of dispersion; high chemical resistance in different environments; well-developed active specific surface; environmental friendliness and safety of use.

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2 METHODS OF RESEARCH

We conducted experimental studies on the use of microwave-modified ash and slag from the Novo-Angren TPP containing phosphogypsum as a modifier of cements and cementitious materials. Studying the properties of modified ash and slag of the Novo-Angren TPP containing phosphogypsum - waste of “Maham-Ammofos” OJSC and cement modification processes showed that microwave treatment of ash and slag Novo-Angren TPP containing phosphogypsum, as a modifier of cements and cementitious materials. A study of the properties of modified ash and slag of the Novo-Angren TPP containing phosphogypsum - waste of “Maham-Ammofos” OJSC and cement modification processes showed that microwave treatment of the ash and slag of the Novo-Angren TPP increases its specific surface area, while the sorption site decreases (although it significantly exceeds the size of the adsorbed molecules themselves) (Table 1).

In accordance with the sizes of the adsorption site, we can conclude that as a result of adsorption of active centers on the surface of the cement a monolayer is formed, consisting of adsorbed molecules, the series is very small and is only due to the dissociation (at certain pH values) of the functional groups — SiOH – AlOH and SiOH – RON formed on crystal faces.

Therefore, minerals of a 2: 1 type are of greater importance. A large negative charge is concentrated mainly on the basaltic surface of elementary packets and is neutralized by the exchange cations of alkali and alkaline earth metals, located mainly in the inter-packet spaces and aqua-complexes that communicate between packages. Microwave activated minerals of ash and slag of the Novo-Angren TPP are highly dispersed, have a developed surface and are good modifiers.

3 RESULTS

Table.1 *The chemical composition of the components of the ash-slag + phosphogypsum mixture.*

Name of component	The content of the mass fraction of oxides, %							
	PC	Si O2	Al2 O3	Fe2 O3	Ca O	Mg O	SO 3	P2O 5

Ash and slag	7,97	54,82	21,34	3,18	5,72	1,30	0,56	0,14 *
Phosphogypsum	19,61	3,04	0,74	0,78	29.44	0,25	43,22	2,42 *
* Mass fraction of water-soluble phosphates, %, in terms of P2O5.								

The SO3 content is 21.89% and 13.36% in YuUT and YuUT-2, respectively, the results of a chemical analysis of the mechanically chemically activated additives of the YuUT series indicate the possibility of their use as active mineral additives, and possibly a setting time regulator instead of gypsum stone for fire-resistant and heat-resistant cements, concretes and building structures. According to table 2, in the initial stages of hardening, the strength of cements PYuUT-2-15, PYuUT -2-20, at the age of 7 days amounted to 26.8 MPa and 24.1 MPa, respectively, which practically does not differ from the strength of the control cement PC, (26.8Mpa).

***Table 2**. Strength characteristic of cements containing microwave-emitted ash and slag of the Novo-Angren TPP (YuUT)*

Cement designation	W/C	Spray cone, mm	Tensile strength, MPa during bending and compression through, d (% at days under compression)				Cement grade
			7d		28d		
			R bend	Rcompr	R bend	Rcompr	
PC- D0	0,368	115	5,3	26,8	5,8	42,2/100	400
PYuUT-1- 15	0,356	113	4,4	21,9	5,9	43,1/102	400
PYuUT -1- 20	0,362	113	3,8	18,2	4,2	26,8/63,5	Not a match.
PYuUT -2-15	0,356	112	4,9	26,8	6,2	47,8/113	400
PYuUT -20	0,356	113	4,4	24,1	6,2	50,8/120	500

It was found that, like zeolites, along with ion exchange, physical and molecular sorption are characteristic. Physical sorption is due to the presence of some excess negative charge on the faces of crystals and surface hydroxide groups of an acidic and basic nature, capable of ionization.

The presence of phosphate and OH groups also causes a small ability to anion exchange in cement mixtures observed in layered minerals. During molecular sorption, sorbed substances are located between the planes of the packets, destroying the original aquacomplexes, but without changing the structure of the layers themselves. In this case, the distance between the layers increases, since the clay mineral swells inside the laminar, which distinguishes it from a zeolite that is not capable of swelling. Due to this, clay minerals are highly selective for organic ions and molecules, in relation to which their sorption ability is even higher than for inorganic ions. This allows you to use them for the modification of cement and cementations building materials. We consider the increase in sorption capacity during the processing of ash and slag of the Novo-Angren TPP with microwave radiation to be related, first of all, to the fact that there is a partial destruction of the aquacomplexes that communicate between the packages, which contributes to better penetration of the sorbed substances to the centers, of concentration of negative charges i.e. germ modification. The chemical activity of the microwave radiated and mechanically chemically activated additives “YuUT” in the absorption of lime was 54.5 mg, which corresponds to the minimum permissible activity characteristic of the group of artificial (technogenic) aluminosilicate hydraulic additives.

4 CONCLUSION

Therefore, the YuUT additive is a chemically active mineral additive, and is classified by its origin (manufacture) as an artificial additive of technogenic origin, acidic in chemical composition and hydraulic in chemical activity. The practical application of the development can solve many technological, economic, environmental problems not only of the industry, but of the republic as a whole.

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