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INTENSIFICATION OF THE PROCESS *CHRYSOTILE* CRUSHING

In modern conditions special meaning gets the further increase of efficiency *chrysotile cement* products, in particular, roofing *chrysotile cement* sheets, perfection of technology of their manufacture, increasing in labour productivity and improvement of their ecological safety. It is achieved due to modifying raw components (*cement*, *chrysotile*) by means of additives, changing of their structure and properties, reception of new kinds *chrysotile cement* products.

One of the major operations in manufacture *chrysotile cement* products, determining productivity of technological lines and quality of final products is *chrysotile* crushing [1].

Process *chrysotile* crushing includes infringement of modular coherence between elementary fibrils in a bunch, division of bunches into thinner fibres on planes with broken sealing, breaks and milling of fibres, formation of secondary structure due to coagulation of finely dispersed particles [2].

Various chemical additives promoting acceleration of crushing, to increase of adhesion of particles of *cement* with fibres *chrysotile* in *chrysotile cement* weight, the reduction of duration of processing, reception of a thin fibre *chrysotile* are known. Thin fibres of *chrysotile*, in regular intervals distributed in a *cement* matrix, form the reinforcing grid essentially increasing its durability at stretching, and impact strength. Mechanical properties of *chrysotile cement* are determined by many factors: the contents of *chrysotile* and its quality (average length of fibres and their diameter), uniformity of distribution of fibres in *cement*, its chemical and mineralogical structure and a fineness of a milling, density of *chrysotile cement* stone, conditions of hardening, etc.

The durability of *chrysotile cement* products depends on their density. Frost resistance of such products makes: in density of cycles 1,57 g/sm³-25; in density 1,65 g/sm³- 50 cycles; in density 1,80 g/sm³- 100 cycles of freezing and thawing [3].

Now to produce disperse *chrysotile* we apply grinding mills, counterflow amalgamators, homogenisators, paper-making desintegrators, drum-type refiners, spherical mills, hammer mills of a wet grinding, ultrasound equipment and microsprays.

With the purpose of an intensification of the process *chrysotile* crushing and improvement of quality of *chrysotile cement* products we use the additive *sodium liquid glass*. Introduction of the additive in amount 0,1-0,5ml/10g of *chrysotile* carried out at a stage of *chrysotile* crushing of marks A-5-65 - 100 % and *chrysotile* charge of structure A-4-30 (15weights %), A-5-65 (55 weights. %),

A-6-45 - (30 weights. %) deposits of Bazenov. Properties of *chrysotile* and *chrysotile* charge are presented in table 1. Introduction of *liquid glass* promotes increase in a degree

of *chrysotile* crushing and *chrysotile* charge on 18-22 % that is important for reception of products with demanded properties.

Table 1

The degree of *chrysotile* crushing

The name of object research	Humidity, weights. %	The Degree of crushing <i>chrysotile</i>
<i>Chrysotile</i> control	64,8-67,6	75,8-76,3
Modified <i>chrysotile</i>	66,4-70,6	94,7-98,0
<i>Chrysotile</i> control charge	63,5-68,0	73.4-76,6
<i>Chrysotile</i> charge, modified	68,0-70,2	91,0-95,0

Technological tests of *chrysotile cement* suspension and *chrysotile cement* on modified *chrysotile* (table.2) have shown, that ablation of *cement* at a filtration of *chrysotile cement* suspension in baths of mesh cylinders has decreased on 0,6036 g/l, that explains by increasing of a

Table 2

Technological properties of *chrysotile cement* suspension and operational characteristics of *chrysotile cement*

Way of introduction of the additive	The Index of the sample	Ablation, g/l	Density kg/m ³	Water absorption, weights. %	P o - rosity, vol. %
At <i>chrysotile</i> crushing in a hydrofluffer	The Method of moist pressing				
	K ₁	-	1940	19,4	41,6
	Θ ₁	-	2170	19,0	36,9
	The Method of a filtration				
	K ₂	0,9615	1600	18,6	34,2
At hardening into solution of <i>liquid glass</i> in dampener	Θ ₂	0,3579	1800	18,0	29,0
	Θ ₃	-	1570	13,8	21,7
	Θ ₄	-	1670	12,4	20,7
	Θ ₅	-	1740	10,5	18,3

chrysotile crushing degree, so, by a greater surface of coupling of fibres *chrysotile* with *cement* particles that promotes increasing in density *chrysotile cement* on 200 kg/m³, to

reduction, accordingly, water absorptions on 0,6 weights. % and porosity on 5,2vol. %.

The basic properties of *chrysotile cement* products were studied on the samples made on *rysotile*, modified by *liquid glass* (an index of samples - Θ_1, Θ_2 , table 2). Also they studied properties of the samples hardening in a solution of *liquid glass* with various concentration: 0,5; 1,0 and 1,5 weights. % from total amount of water ($\Theta_3, \Theta_4, \Theta_5$, table.3).

It is experimentally shown, that at introduction of the additive of *liquid glass*, the durability of *chrysotile cement* samples tested in 7 - daily age, has increased in comparison with *chrysotile cement* samples on commodity *chrysotile* on the average in 1.3 times. Increase of durability at a bend of *chrysotile cement* samples on modified *chrysotile* is explained by the best adhesive properties of the fluffed up fibres of *chrysotile*, promoting to strong coupling with a *cement* stone.

The analysis of results of the tests on heat distortion temperature and cold endurance has allowed to determine that loss of durability at a bend for *chrysotile cement* samples, made on commodity and modified *chrysotile* has formed, accordingly, 9,6 and 7,6% and 7,4 and 5,7 %. Thus, loss of durability has not exceeded 10 % that corresponds to requirements of physicomechanical tests.

During definition of weather resistance, it observed not the decrease of durability *chrysotile cement* products, but, on the contrary, its increase, which has made 32.6 and 33.8 %, accordingly, for *chrysotile cement* products on commodity and modified *chrysotile*. Thus, crack formation and visible stratification were not observed.

Table 3

The limit of the strength at a bend of *chrysotile cement*

Way of introduction of the additive Strength at a bend, МПА	Object of research	Limit of durability at a bend, МПА
At <i>chrysotile</i> crushing in the hydrofluffer	The Method of moist pressing	
	Commodity (K_1)	13,0
	Modified (Θ_1)	18,5
	The Method of a filtration	
At water-saturation in a dampener	Commodity (K_2)	10,4
	Modified (Θ_2)	12,1
	Modified (Θ_3)	13,0
	Modified (Θ_4)	15,7
	Modified (Θ_5)	16,8

The growth of durability is explained by that, during 28 day of hardening the degree of hydration of *cement* increases. The increase of durability *chrysotile cement* products is connected not only with increase in a specific surface fluffed up *chrysotile asbestos*, but also

with a qualitative change of structure of its surface due to chemisorption of *silicon-oxygen anions* and cations of *calcium*, and also due to the diffusional processes, proceeding in the interfibrillar space of fibres bunches.

Conclusions:

1 It is shown, that modifying *chrysotile sodium liquid glass* promotes increase of a degree of crushing on 18-22 %, leads to reduction of ablation of *cement* at a filtration of *chrysotile cement* suspension in baths of mesh cylinders on 0,6036 g/l, to increase in density *chrysotile cement* on 200 kg/m³.

2. It is revealed, that the mechanism of modifying *chrysotile* consists in interaction of *liquid glass* with fibres and allocation of *hydrogel silica*, that promotes improvement of operational characteristics of *chrysotile cement* products. The strength of *chrysotile cement* products at a bend increases for 16 %.

The list of the used literature:

1. Shlapakov U.A. The Research of *asbestos* crushing in factory units. In b. Technology of formation of *asbestos cement* products, Kalinin, 1982, p.9-19.
2. Berney I.I. The Technology of *asbestos cement* products - M.: The Higher school, - 1977. - 230 p.
3. Popov K.N., Kaddo M.B., Kulkov O.V. Quality estimation of building materials. M.: Publishing house Assots. Builds. High schools, 1999-60p.