Increasing the production efficiency of *chrysotile cement* products

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Abstract

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 crusing [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/sm^3-25; in density 1,65 g/sm^3- 50 cycles; in density 1,80 g/sm^3- 100 cycles of freezing and thawing [3]. Now to produce disperse chrysotile we apply gringing mills, counterflow amalgamators, homogenisators, paper-making desintergrators, 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 -5-65 - 100 % and chrysotile charge of structure A-4-30 (15weights %), -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 Degreeof crushing chrysotile
Chrysotile control	64,8-67,6	75,8-76,3
Modified chrysotile	66,4-70,6	94,7-98,0
Chrysotile control charge	63,5-68,0	73.4-76,6
Chrysotile 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 *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/m^3, to reduction, accordingly, water absorptions on 0,6 weigts. % and porosity on 5,2vol. %.

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.%	Porosity, vol.%
At *chrysotile* crushing in a hydrofluffer	The Method of moist pressing				
	K_1	-	1940	19,4	41,6
	$Э_1$	-	2170	19,0	36,9
	The Method of a filtration				
	K_2	0,9615	1600	18,6	34,2
	$Э_2$	0,3579	1800	18,0	29,0
At hardening into solution of *liquid glass* in dampener	$Э_3$	-	1570	13,8	21,7
	$Э_4$	-	1670	12,4	20,7
	$Э_5$	-	1740	10,5	18,3

The basic properties of *chrysotile cement* products were studied on the samples made on rysotile, modified by *liquid glass* (an index of samples - $Э_1$, $Э_2$, 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 ($Э_3$, $Э_4$, $Э_5$, 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.

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, MPA
At *chrysotile* crushing in the hydrofluffer	The Method of moist pressing	
	Commodity ($К_1$)	13,0
	Modified ($Э_1$)	18,5
	The Method of a filtration	
	Commodity ($К_2$)	10,4
	Modified ($Э_2$)	12,1
At water-saturation in a dampener	Modified ($Э_3$)	13,0
	Modified ($Э_4$)	15,7
	Modified ($Э_5$)	16,8

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. 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.

On the basis of the received results on intensification *crysotile* crushing due to introduction of the additive *sodium liquid glass* the technological scheme of manufacture of roofing *chrysotile cement* sheets (fig. 1) is modernized. For industrial realization of the given development it is necessary in addition to determine the capacity for storage of *liquid glass* and the batchbox.

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/m^3.
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 %.

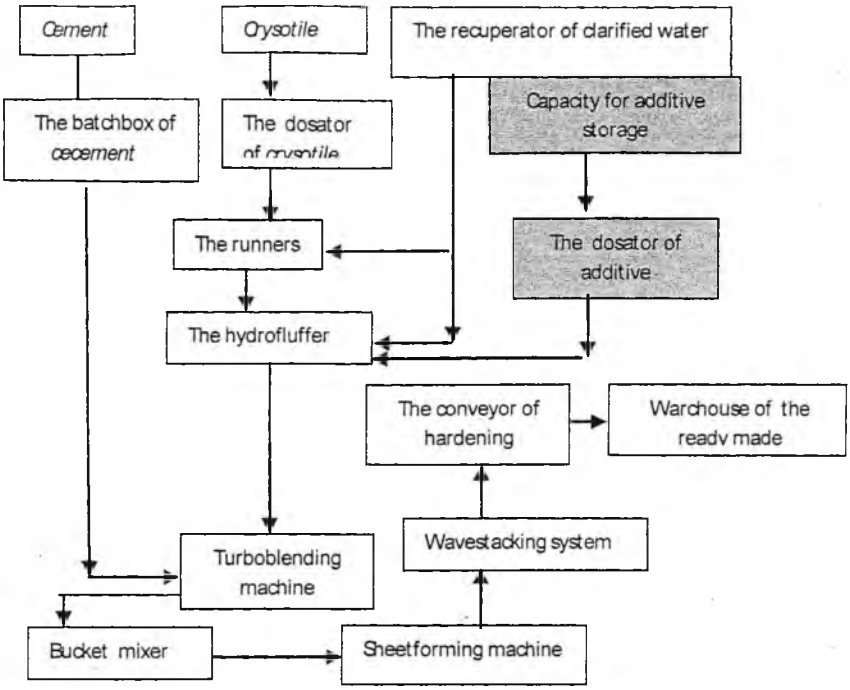

Fig.1 The Modernized technological scheme of manufacture of roofing *chrysotile cement* sheets

References:

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 - ".: The Higher school, - 1977. p. 230.
3. Popov .N., Kaddo M.B., ulkov O.V. Quality estimation of building materials. M: Publishing house Assots. Builds. High schools, 1999, p. 60.