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ACTIVATED TUFFITE AS AN ACTIVE POZZOLANIC ADDITIVE

Abstract. The article discusses the possibility of obtaining composite cements based on Portland Cement clinker and calcined tuffite. The results of standard and special physical-mechanical tests of Portland cement with heat-treated tuffite additives are presented as a hydraulic additive. It is shown that the active mineral additive tuffit, calcined at 600 °C is suitable for production sulfate resistance cement.

Keywords: portlandcement, pozzolan, methods of testing additives, heat-treated tuffits, slaked lime, active additives.

Introduction

Construction and technical properties of the portland-pozzolana cement depends by nature and amounts of the active mineral additive, which is contained in it. The activity of the additive and the nature of products of its interaction with the hydrated minerals of the Portland cement have significant effect on durability, density, water resistance and a salt resistance of the hardening portland-pozzolana cement.

Due to the expansion of amount of the materials applied as active mineral additives interest in studying of the mechanism and chemist of an action of tuffit, hydraulic active mineral additives of a new type increases. Pocket-tuffit breeds owing to specificity of chemical and mineralogical composition (high percent of calcareousness and existence of a significant amount of a clay component) are a new type of active mineral additives. The specificity also consists in the low content of silicon dioxide and rather high content of alumina. At the same time was the possibility of their use as active mineral additives of natural origin is proved.

For the final conclusion on use of the burned tuffit standard physical-mechanical tests of activity of tuffit additives, burned at 600 °C were carried out.

1. Determination of activity of the burned tuffit testing in mix with a Portland cement. At the same time that additive which, in the optimum dosage being added to a Portland cement is considered more active, gives the last through the smallest period the same mechanical durability, which the Portland cement taken for testing has. Results of the specified physical-mechanical tests are given in (tab. 2).

2. Determination of activity of the burned tuffit in mix with extinguished lime. The method is based on determination of mechanical durability of solutions from mix of the knitting substance with the studied additive, and the last is considered that more active, than solution at an optimum dosage of additive has big mechanical durability. That dosage for which the sum of values of strength at a bend in 28 days, 3 months and 6 months will be the greatest is considered an optimum dosage of additive and extinguished lime.

Results of physical-mechanical tests are given in tab. 3. The received results of standard tests show that the tests of lime applied in work represent the construction air fast-extinguished lime of the first sort.

Table 1. – Determination of activity of additives testing in mix with a portland cement

Name of components of mixes	Composition of mixture	Volume weight. kg/m ³	Grindingsub tlety			Normal den- sity at%		Grabbing terms in an hour -min.		Strength in mix MPa at												The sum of indicators of strength at a bend in 28 days. 3 and 6 months	
										compression						bend							
										day		month				day		month					
										3	28	3	6	12	7	28	3	6	12				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21			
PC Tuffit	80 20	907	0.56	3.10	96.34	25.75	7.44	3-50	5-00	26.1	48.5	50.3	51.9	59.7	2.6	3.5	3.9	4.6	3.9	12.1			
PC Tuffit	70 30	900	0.56	2.98	96.46	26.20	7.10	3-20	4-20	27.0	41.8	44.9	59.4	67.1	2.4	3.1	4.0	4.3	4.2	11.5			
PC Tuffit	60 40	867	0.53	2.38	97.09	25.00	7.05	3-10	4-55	28.0	47.2	51.0	62.1	55.1	2.6	3.2	4.4	4.1	4.1	11.8			
PC Tuffit	50 50	840	0.51	2.08	97.41	26.75	7.50	3-25	5-15	15.8	3.8	37.7	43.4	59.5	2.2	3.1	3.8	4.1	4.3	11.1			
PC Tuffit	40 60	808	0.49	1.78	97.73	27.50	7.67	3-29	5-23	10.0	21.6	22.1	34.0	40.6	1.5	2.0	3.7	3.9	4.0	9.7			

PC – Portland Cement; Tuffit – burnt tuffit at 600 °C

3. Determination of activity of the burned tuffit in mix with extinguished lime and plaster. When studying activity of the burnt tuffit in mix with hydrate lime and plaster, two -water plaster served (5% in terms of 100% of CaSO₄·2H₂O). Results of the specified studying are given in (tab. 3).

The high-level overview of results of physical-mechanical tests active finely dispersed the burned tuffit both in mix with a Portland cement, and with extinguished lime shows that educated knitting do not show abnormal properties and the received indicators of physical-mechanical definitions quite keep within existing rules (volume mass, normal density of the test, grabbing terms, mechanical durability, etc.)

Processes of solidification of each look knitting, put trials, submit respectively to patterns of solidification of portland-pozzolana cement or limy and puzzolan-knitting.

In terms of identification of the nature of the studied additives, their tests in mix with only one extinguished lime, certainly, are of the greatest interest (tab.2). Consideration of these results regarding indicators of mechanical durability, first of all, indicates the continuous growth of durability in time, and to the annual age samples show increase in durability on average 3–5 times against branded (at the identical content of lime in mixes).

In case of tests of three-component mixes (additive + extinguished lime + plaster) some increase in absolute measures (a plaster role in three-component mixes with participation of “kipelka”, certainly, much more considerably) durability is observed.

Table 2. – Determination of activity of additives testing in mix with extinguished lime

Name of components of mixes	Composition of mixture	Volume weight. kg/m³	Grinding sub-tlety			Normal density at%		Grabbing terms in an hour -min.		Strength in mix MPa at												The sum of indicators of strength at a bend in 28 days. 3 and 6 months
										compression				bend								
										day		month		day		month						
										7	28	3	6	12	12	7	28	3	6	12		
I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
Extinguished lime (pr.№ 1) Bunrt tuftit	15 80	629	0.82	1.78	97.40	31.25	8.01	2–15	неудова.	3.4	8.4	21.3	28.0	33.4	0.6	1.5	2.8	3.2	3.3	7.5		
Extinguished lime (pr.№ 2) Bunrt tuftit	20 80	620	0.24	2.38	97.38	32.50	8.32	4–00	—	2.4	8.5	24.3	29.0	30.2	0.9	1.2	2.9	2.9	3.1	7.1		
Extinguished lime (pr.№ 3) Bunrt tuftit	25 75	617	0.26	2.42	97.32	27.00	6.95	-	—	2.9	8.1	23.8	26.3	30.2	0.8	1.3	2.3	2.8	3.5	6.4		
Extinguished lime (pr.№ 4) Bunrt tuftit	30 70	612	0.75	1.52	97.73	28.75	7.38	3–55	—	2.9	9.1	22.9	23.5	31.4	0.3	0.8	2.2	3.2	3.9	6.3		
Extinguished lime (pr.№ 5) Bunrt tuftit	40 60	610	0.48	2.00	97.52	29.00	7.45	4–05	—	3.0	7.1	20.3	24.7	29.8	0.1	0.7	2.3	3.0	3.6	6.1		

Table 3. – Determination of activity of additives testing in mixes with extinguished lime and plaster

Name of components of mixes		Composition of mixture	Volume weight. kg/ m³	Grinding sublety			Normal density at%		Grabbing terms in an hour -min.		Strength in mix MPa at												The sum of indicators of strength at a bend in 28 days. 3 and 6 months				
											compression						bend										
											day		month				day		month								
											7	28	3	6	12	7	28	3	6	12	16	17			18	19	20
I	Extinguished lime (pr.№ 1) Burnt tuftit	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21						
		15 80	627	0.36	0.96	98.68	32.50	8.33	4-10	6-00	1.1	13.3	25.7	29.3	31.2	1.4	1.9	3.0	2.4	1.8	7.3						
		20 80	617	0.34	1.18	98.48	33.00	8.45	4-15	6-20	0.7	12.4	25.9	32.1	37.5	1.2	1.8	3.3	3.8	2.3	9.0						
		25 75	612	0.33	1.20	98.47	35.00	8.95	4-25	неулова.	0.7	12.9	27.9	35.8	33.3	1.3	1.3	3.0	2.0	3.8	6.4						
		30 70	602	0.29	1.32	98.39	38.25	9.76	4-45	- // -	0.4	11.7	23.2	31.0	32.0	0.9	2.1	3.3	2.2	3.7	7.7						
		40 60	588	0.25	1.32	98.43	37.00	9.45	4-00	- // -	0.3	10.5	17.5	32.0	34.1	0.8	1.4	2.5	3.7	3.8	7.6						

Note: the third component two-water plaster (5% in terms of 100% of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$)

At tests of additives in mix with a Portland cement in our samples, continuous increase in mechanical durability was observed that should be carried only due to application of tests of the Portland cement, which showed increase increase in mechanical durability was observed that should be carried only due

to application of tests of the Portland cement, which showed increase.

On the basis of the data (tab. 1–3) obtained by us it is possible to recommend the following limits of fluctuations of an optimum dosage of the additives studied by us for knitting, provided in (tab. 4).

Table 4. – Limits of fluctuations of an optimum dosage of additives to knitting

Name of additives	Knitting	
	to Portland cements	to extinguished limes
Bunrt tuffit	20–60	85–60

Conclusion

The carried-out work allows to draw the following conclusions:

1. Indicators of activity of the tuffit additive burned at 600°C certain standard with physic mechanical tests of the samples made of tuffit mixes with a Portland-cement and extinguished lime con-

vince that standard methods reveal true activity of the studied additive.

2. Data of results of indicators of mechanical durability, first of all, indicate the continuous growth of durability in time, and to the annual age samples show incur ease in durability on average 3–5 times against branded.

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