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THE INFLUENCE OF PHOSPHATE BINDER AND ACTIVATOR BINDING TO THE PHYSICAL PROPERTIES OF REFRACTORY CONCRETE

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ABSTRACT
Lately, all the more significant chemically bonded refractory materials after drying have sufficient initial strength which are important for installation in heat generators. After installing the heat aggregates is done warming up certain high temperature where the material achieves the transition to a ceramic chemical bond. This increases the compressive strength. Refractory castables consisting of fillers, binders and activator binding sites. It was shown that the very important role of bonding activator, as without it may not produce the chemical reaction between the filler and veziva.Jako is an important activator of binding selection as well as its amount in a mixture. In this paper as a filler used quartz sand, mono aluminum phosphate as a binder and illite-kaolinite clay as activator binding. The effect of the quantity of binder and activator binding on the compressive strength of refractory concrete.
Keywords: activator binding, chemical binder, concretes.

1. INTRODUCTION
In the industry of refractory materials in recent decades is increasing the production of refractory materials that are formed without heat treatment - chemical binding. Representative of these materials are certainly refractory castables consisting of refractory inert filler (mullite, chamotte, quartz sand, etc.), and the binding agent of mineral or organic origin. These concretes are different from the construction of concrete because they have a high fire resistance (over 1600 ° C) and a specific capacity (strength) at elevated temperatures, which is a key requirement that is required of structural materials that are exposed to elevated temperatures. Interest in refractory materials of this type in recent decades has increased, because their production is less complex and more economical compared to classic production of refractory materials, which implies a long process of baking. In industry, refractory materials used different phosphates that are typically added to the aggregate as aqueous solutions. In the application of: monoaluminium phosphate (46 - 50% aqueous solution) and ammonium phosphate, chromium-aluminum phosphate, and alkali metal polyphosphates, etc. Curing by binding phosphate aluminosilicate product is conditioned by forming acid phosphate, their polymerization and polycondensation in the process of heating, and also in the education of insoluble phosphate reacting phosphoric acid with the oxides of the refractory filler.
Production of refractory products based phosphate binding achieved certain advantages over conventional production: energy saving and improving certain technical characteristics. From the technical advantages of the most important are: high initial mechanical strength and resistance to slag. In the literature devoted to this issue should be noted that the impact of the activator binding decisive when it comes to speed and the degree of hardening of fire-resistant material related phosphates, and in that sense it offers a range of solutions. But in practice, there are serious problems in selecting activator binding. Its chemical character to be correlated with the composition of the refractory mass that binds the type of binder. It is very important and that the amount of activator is added to the refractory mass.

2. PREPARE SAMPLES WITH MAP AND ILLITE-KAOLINITE CLAY AND TEST RESULTS

This paper prepared samples on the basis of quartz sand deposits "Bukinje" Tuzla with the addition of binding illite-kaolinite clay deposits "Sočkovac" Gracanica as activator binding. As the binder used is synthesized 50% aqueous solution of Al mono phosphate. Addition of a binder is varied in the range of 5, 10, 15 and 20 parts by weight per 100 parts by weight of a mixture of quartz sand + clay while the clay content in a mixture with sand amount: 0, 10, 20 and 30 parts by weight. The aim of this study was to definitively determine the optimal content of the basic components in the refractory mass; quartz sand, then the amount of illite-kaolinite clay in the mass and in the end the amount of phosphate binder that is added refractory mass. The test samples were formed by the primary grain component is well mixed with a certain amount of clay in powder form. Then the solid mixture added a certain amount of binder and (if necessary) water until slightly plastic mass consistency. From thus prepared, well homogenized mass, are formed cylindrical test body dimensions: base diameter d = 50 mm and height h = 50 mm. The draft samples were annealed at temperatures of 120 ° C and 1000 ° C for 5 h. After annealing the samples are tested physical properties. Table 1. shows the contents of expressive components in weight parts, the prepared test body.

Table 1. Contents of components prepared test body

	Label the sample	Quartz sand	Clay	$Al(H_2PO_4)_3$(50 % solution)	Water
I	PGM5	80	20	5	5
	PGM10	80	20	10	2
	PGM15	80	20	15	-
	PGM20	80	20	20	-
II	PM	100	-	10	-
	PG10M	90	10	10	-
	PG20M	80	20	10	2
	PG30M	70	30	10	5

Certain physical properties of the prepared samples shown in Table 2.

Table 2. Physical and mechanical properties of samples with sand and clay with the addition of 50% solution of MAP and annealed at temperatures of 120 ° C and 1000 ° C for 5 h

Label the sample	Density (*g/cm*^{3})	The apparent porosity (*%*)	Compressive strength (*MPa*)	Linear shrinkage (%)
	1	2	3	4
PGM5	1,62 1,75	28,0 25,3	0,1 4,42	0 0
PGM10	1,63 1,77	25,5 21,8	3,93 5,11	0 0
PGM15	1,67 1,85	21,6 17,7	5,90 11,79	0 0
PGM20	1,78 1,96	15,9 11,5	9,82 17,68	0 0
PM	1,55 1,60	28,2 28,2	3,44 3,93	0 0
PG10M	1,55 1,69	27,5 25,5	0,98 2,95	0 0
PG20M	1,65 1,78	27,0 21,6	2,95 6,88	0 0
PG30M	1,56 1,53	25,7 23,3	3,93 9,82	0 0

Note: The first value refers to the physical size of the test body dried at 120 ° C / 5 hours, and the other on the physical size of the samples annealed at 1000 ° C / 5 hours.

The results are shown in Figures.

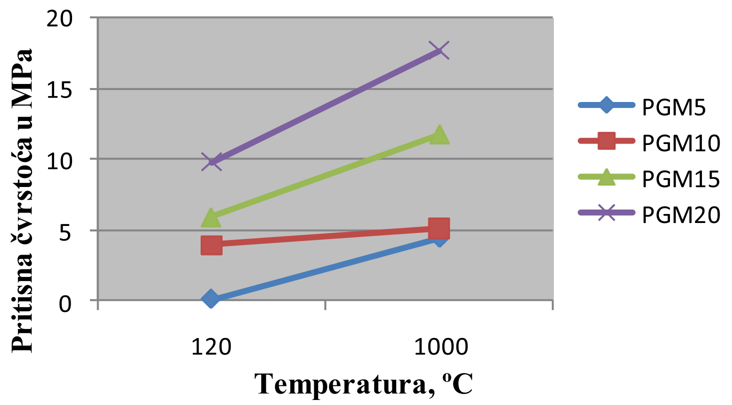

Figure 1. Depending on the compressive strength of the sample temperature labels PGMx

Figure 1. shows that with the increase of MAP and increase in temperature increases the compressive strength test body.

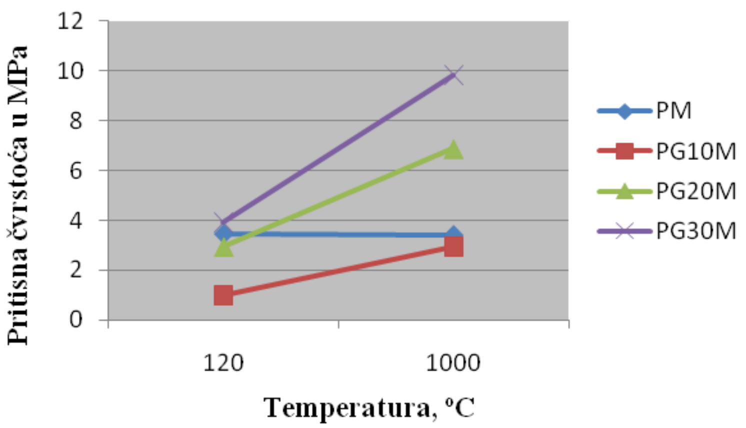

Figure 2. Diagram of compressive strength depending on temperature change test body with the tag PGxM

Figure 2 shows the dependence of the compressive strength when the temperature changes of samples, prepared with the same content of MAP (10%), but with different content of binder clay. From the diagram, it is seen that the sample without the addition of binder clay does not change the strength when the temperature changes. With increasing clay content increases and compressive strength, so that the maximum value of compressive strength has a sample with 30% clay and about 10 MPa. Addition of binders MAP quartz sand (refractory mass without the addition of activator binding) prepared test body after drying at 120 ° C and annealing at 1000 ° C showed a very low strength.

It is obvious that without additional binders (in our case illite-kaolinite clay) basic refractory material is not possible phosphate binding, or due to a lack of creating chemical bonds will occur no ceramic bond during annealing. On the other hand, the achieved strength test body (starting after drying the samples at 120 ° C, and after a final annealing at 1000 ° C of samples prepared from a mixture of: quartz sand + clay = 80: 20 parts by weight, related to 5,10,15 and 20 parts by weight of binder) are considerably higher. They are close but do not follow completely the expected regularity: increase the strength of samples with increasing participation binders MAP.

3. CONCLUSION

- In the study, the effect of content monoalumium phosphate and illite-kaolinite clay on the physical properties of phosphate-bonded refractory concrete based on quartz.

- Increasing the binder content, 50% solution monoaluminium phosphate, with the addition of clay to quartz, which acts as an activator binding, as well as increasing the annealing temperature increases, the compressive strength of prepared test body.

- The samples without the addition of clay activator binding have low initial compressive strength and does not show an increase in compressive strength with increasing temperature.

- With the increasing addition of clay to quartz, and increases the compressive strength test of the body, and samples with 70% quartz + 30% clay bound with 10% of MAP, show the highest compressive strength.

- The optimum amount of activator binding arbitration is 20% (higher amounts might decrease the refractoriness of concrete), while the optimum amount of binder 50% basic solution of MAP is from 15 to 20% compared to the refractory mass: quartz + clay.

4. LITERATURE:

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