THERMOMECHANICAL PROPERTIES OF PHOSPHATE ADHESIVES BASED ON SPENT ACTIVATED ALUMINUM OXIDES

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The conducted studies have shown that the most important thermomechanical and thermophysical characteristics of fire-resistant phosphate adhesives depend to a large extent on the type of phosphate binder. [1] Compositions on H3PO4 due to the presence of a large amount of glass phase have reduced fire resistance, deformation temperature under load and heat resistance, for adhesives on AXFC these indicators are significantly higher [2]. In addition, they have a comparatively lower coefficient of linear thermal expansion and open porosity, as well as better adhesive properties. Therefore, for industrial use in gluing aluminosilicate refractories, adhesive compositions based on an aluminochrome phosphate binder developed on the basis of spent activated aluminum oxides were recommended.

The main technological and physical-technical properties of the fire-resistant phosphate adhesives studied and recommended for industrial use are given in the table [3].

The conducted research allows us to draw the following conclusions:

1. The introduction of spent activated aluminum oxide - chromium oxide - phosphate binders and clay additives - refractory clay or kaolin into the compositions improves the technological properties and thermomechanical characteristics of the resulting refractory adhesives. The best results are achieved when using refractory clay

in an amount of 15% for compositions on phosphate binders and in an amount of 13% for compositions on H3PO4.

2. The binding of P2O5 in the studied systems depends on the temperature and duration of thermal treatment. At temperatures of 200-300 ° C, depending on the type of phosphate binder, almost complete binding of P2O5 into water-insoluble compounds is completed within 1-2 hours.

3. The optimum density and ratio of l/t for adhesive compositions on two phosphate binders have been established. It is advisable to use H3PO4 with a density of 1.50-1.55 g/cm3 at l/t of 0.79-0.85; for AXFC these values are 1.52-1.54 g/cm3 at l/t of 0.88-0.93, respectively. The established parameters ensure optimum spreadability of phosphate adhesives - within 70-90 mm.

4. The introduction of target additives into the compositions allows for the regulation of the rheological properties of phosphate adhesives and the thermomechanical characteristics of the resulting adhesive joint.

In adhesives on AXFC, it is advisable to use oxalic acid in the amount of 2-3% or emulsifier OP-10 4-6% (from the weight of AXFC). The introduction of 20% finely ground chamotte into the composition ensures both optimal technological properties and maximum physical and technical characteristics of the adhesive joint.

5. Thermomechanical studies have shown that all compositions pre-heat treated at 300 ° C are characterized by a decrease in strength during primary heating in the temperature range of 700-800 ° C, associated with the onset of crystallization of the amorphous phase. Secondary heating to 1100 ° C does not cause a decrease in strength.

6. Dilatometric studies in the range of 20 – 7000C did not reveal any anomalies in thermal expansion. The lowest coefficient of linear expansion is possessed by the refractory glue on AKFS (α = 6.6 10-6 1/° C); the highest is possessed by the composition on H3PO4 (α = 8.1 10-6 1/° C).

Main properties of fire-resistant adhesives based on spent activated aluminum oxide, chromium oxide and phosphate binders

Properties of adhesives / Composition of adhesives	Spent activated aluminum oxide 31%, chromium oxide 6.6%, refractory clay 15%, AXFC 47.4%	Spent activated aluminum oxide 31%, chromium oxide 6.6%, Kaolin 15%, AXFC 47.4%	Spent activated aluminum oxide 34.3%, chromium oxide 8.3%, refractory clay 13%, AXFC 44.4%	Spent activated aluminum oxide 31%, chromium oxide 6.6%, kaolin 13%, AXFC 44.4%	Spent activated aluminum oxide 21.8%, chromium oxide 5.3%, chamotte 10.5%, kaolin 15%, AXFC 47.4%
1. χ, kg/m³· 10^{-3} (1 hour after mixing)	1,77	1,72	1,82	1,81	1,91
2. J/t	0,9	0,9	0,8	0,8	0,9
3. Spreadability, mm	121	119	119	100	98
4. Setting time start/end, h	2,5 / 3,0	2,3 / 2,9	2,3 / 2,9	12,3 / 16,3	9,0 / 10,2
5. χ, $kg/m^3 \cdot 10^{-3}$ after heat treatment	1,60 / 1,61	1,42 / 1,39	1,42/1,39	1,57 / 1,54	1,65 / 1,63
6. Water absorption W,% 300^0C / 1100^0C	30 / 33	32 / 35	24 /26	25 / 26	19 / 18
7. Porosity Potr., 300^0C / 1100^0C	38/ 40	39 / 42	35 / 36	36 / 38	23 / 24
8.σ shift, MPa 300^0C / 1100^0C	11,4 / 10,4	9,5 / 9,0	6,2 / 5,7	4,5 / 4,7	12,2 / 11,7
9.σ compression, MPa 300^0C / 1100^0C	29,9/ 23,2	28,9 / 24,5	33,1 / 28,0	29.0 / 28,3	33,4 / 30,4
10. σ gap, MPa 300^0C / 1100^0C	9,0 / 7,9	8,0 / 7,3	4,6 / 4,1	3,2 / 2,4	9,8 / 9,1
11. KLTR 20 – 700 ^0C $^0C^{-1} \cdot {}^0C.10^{-6}$	6,6	5,3	8,1	8,0	6,2
12. Temperature of deformation under load, ^0C HP/4% def.	1430/ 1510	1430 / 1510	1380 / 1440	1390 / 1450	1420 / 1520
13. Heat resistance 800 °C – air, cycles	20	20	10 – 13	11 – 13	25
14. Fire resistance, ^0C	1750	1750	1710	1710	1750

7. Determination of the deformation temperature under load, fire resistance and heat resistance showed the advantages of the adhesive on AXFC in terms of thermal characteristics over compositions on other phosphate binders. The optimal composition on AXFC is characterized by fire resistance of more than 1750 ° C, deformation temperature under load of 1430 ° C and heat resistance of more than 20 air thermal cycles.

8. The compositions of phosphate adhesive compositions for industrial use in gluing aluminosilicate refractories have been determined.

Literature:

1. Kopeykin V.A., Klimenteva V.S., Krasniy B.L. Ogneuporniye rastvori na fosfatnix svyazuyushix [Fire-resistant plants on phosphorus sulfide]. – M.: Metallurgiya, 1986. Pp: 104.

2. Sichev M.M., Neorganicheskiye klei [Inorganic adhesives]. – M.: Ximiya, 1986. Pp: 153.

3. Petrova A.P.Termostoykie klei [Heat resistant adhesives]. – M.: Ximiya, 1977. Pp: 200.