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Short Communication

UTILIZATION OF INDUSTRIAL WASTES IN THE COMPOSITIONS OF FIREPROOF CONCRETE AND MORTARS

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ABSTRACT

Compositions containing wasted thermoplastic polyester resin along with a Portland cement, chamotte and clay have been investigated for their usage in the manufacturing of construction elements and mortars. They are applied as facing in steam generators, chimneys, fireplaces, furnaces in the ceramic industry, etc. Savings of raw materials and the environment from solid waste will be realized with the use of the investigated waste.

Keywords: energy economy, Portland cement, wasted polyester resin, fireproof concrete.

INTRODUCTION

Fireproof materials have responsible function in the development of many high temperature technological processes. Nowadays requirements and future development of industrial production, rational use of energy as well as environmental protection contribute to the increase of their importance [1].

The most important part in the field of fireproof materials are the fireproof concretes in the form of construction elements or mortars. Practical use in fire-resistant concretes [1] usually have special bonding materials which forme at normal and higher temperatures a solid structure stable at the high temperatures of exploitation.

The aim of the present work is to investigate the possibility for utilization of industrial waste – thermoplastic polyester resin in the composition of fireproof concrete and mortars.

The objects of investigation are several compositions for fireproof concretes or mortars with or without wasted thermoplastic polyester resin.

The sample compositions are presented in Table 1.

EXPERIMENTAL

After preliminary fine grinding of some components they were dosed by weight and were formed standard testing samples through plastic method.

The behavior of samples A and B are completely known in the theory and in the practice they were investigated aiming evaluation and comparison with proposed compositions (Table 1).

The evaluation of quality of all samples was made on the basis of of the criterion strength of stress, respectively of samples after drying at natural conditions and samples thermally treated at 473K, 673K, 873K, 1073K and 1273K.

Table 1. Technological compositions.

Composition	Portland Cement, %	Cement Lafarge %	Quartz sand %	Chamotte %	Clay %	Polyester resin %
A	100					
B		100				
C		50	50			
D	33			50	17	
E	73				27	
F	33			33	17	17
G	69				17	14
H	67					33

Table 2. Results, received by the experiments.

Temperature of treatment	A MPa	B MPa	C MPa	D MPa	E MPa	F MPa	G MPa	H MPa
293 K	120	150	140	70	90	45	100	110
473 K	100	150	140	70	90	50	95	95
673 K	80	150	130	80	100	60	90	75
873 K	70	140	120	85	100	60	70	70
1073 K	60	140	110	85	100	70	60	50
1273 K	60	140	105	90	110	80	70	75

The number of samples for experimental investigation, analysis and evaluation was in accordance with the requirements of mathematical statistics.

The results obtained from the investigations in relation to the strength of stress for different composition are summarized in Table 2.

On the basis of the obtained results the following conclusions can be done:

• The results obtained for the samples of composition A, which entirely consists of Portland cement, completely confirmed the available data in the literature. In the practice with the increasing of the temperature of the thermal treatment the strength indices decrease. At 1073 – 1273 K this reduction is maximal.

• The results obtained for the samples of composition B, which entirely consists of Lafarge, completely confirmed the available data in the literature. In the practice the high strength indices are obtained regardless of the high temperature of the thermal treatment.

• The samples prepared from composition C in which except Lafarge quartz sand is included showed decrease of the strength indices with the increase of the temperature of thermal treatment.

• The results obtained for samples prepared from compositions D and E, where clay and chamotte are included confirmed the available data in the literature and in the practice. As a whole they have lower strength indices in comparison with those of composition A but with increase of the temperature of thermal treatment the strength is rising.

• The samples prepared from compositions F, G and H with the addition of the wasted thermoplastic polyester resin have lower strength indices. With the increase of the temperature of the thermal treatment the strength is increasing and reaches the values of this parameter for compositions D and E.

On the basis of these results and established findings it can be done the following conclusions: the reduction of the strength indices of the samples from composition A is due to the lost of hydraulic bond at temperature increase; the strength indices are increased with the increase of the temperature of thermal treatment for the samples from the compositions with added clay and chamotte. This is probably due to the ceramic bond formed at high temperatures; the decrease of the strength indices of the samples from composition C in which except Lafarge is included quartz sand eventually is due to the polymorphic transformations of the quartz.

The increase of the strength indices for compositions, which include wasted thermoplastic polyester resin according to our opinion, is due to the ceramic bond and to the bond of thermoplastic resin. On the basis of this result we can claim that construction elements or mortars produced from these compositions can work at thermal exploitation.

CONCLUSIONS

The investigated compositions with included wasted thermoplastic polyester resin along with the Portland cement, chamotte and clay can be used for manufacturing of construction elements and mortars, which are applied as facing in steam generators, chimneys, fireplaces, furnaces in the ceramic industry, etc.

The benefits from the utilization of the investigated waste are: savings of raw materials and other materials and avoiding the polution of the environment.

REFERENCES

1. S.A. Serbezov, Neformuvani ogneuporni materiali, UCTM, Sofia, 2001, (in Bulgarian).
2. Y. Inamuri, Ogneupori i ih primenenie, Metalurgiya, Moscow, 1984, (in Russian).
3. B. Kostov, V. Vulkov, Tehnologiya na svurzvashtite veshtestva, Tehnika, Sofia, 1969, (in Bulgarian).
4. J. Takamiya, Refractories Handbook, The American Ceramic Society, 1999.