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Composite Gypsum-Containing Materials Based On Local and Secondary Raw Materials in the Conditions of Uzbekistan

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ABSTRACT: In connection with the growth of industrial, civil and housing construction in Uzbekistan, the demand for finishing building materials based on cement and gypsum has sharply increased. The most widely used materials for the interior decoration of buildings under construction are materials based on gypsum. The article is dedicated to this material.

KEYWORDS. Gypsum system, filler, water repellent, defoamer, heat resistance Portland cement, slaked lime, ground silica.

I. INTRODUCTION

Since independence and the establishment of market relations in the Republic of Uzbekistan, fundamental changes have taken place in all branches of industrial production, including in the construction industry. Due to the growth of industrial, civil and residential construction, the demand for finishing building materials based on cement and gypsum has increased dramatically. Gypsum-based materials are the most widely used for interior decoration of buildings under construction [1]. Their advantages are significantly lower than for lime and cement production, fuel consumption during production, sufficiently high strength, fast hardening and rapid strength gain. Gypsum and gypsum-lime plasters have low thermal conductivity, are able to provide optimal humidity in the room, the material consumption per unit of the treated surface is significantly less compared to lime-cement plasters. Gypsum putties are characterized by almost complete absence of shrinkage, as a result of which they have increased crack resistance, good adhesion and sanding ability. They are compatible with all types of water-dispersion paints for construction purposes. The insufficient use of gypsum binders is due to their low values of strength and water resistance, as well as the lack of high - quality modifying chemical additives in the domestic market, which are necessary to give the mixtures special properties (water and weather resistance, vitality).

II. LITERATURE REVIEW

A generalized formulation of the gypsum system used for the production of both products and inorganic powder composite materials based on it. It consists mainly of a gypsum binder, where various fillers, fillers and modifiers are introduced:

- gypsum binder (possible addition of lime, Portland cement);
- filler/filler;
- setting retarder;
- water-retaining and / or rheological additive;
- hydrophobizator;
- defoamer (if necessary);
- air intake (if necessary).

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For the production of gypsum binders [6], natural dihydrate gypsum, anhydrite, clay gypsum, as well as some industrial waste consisting mainly of dihydrate or anhydrous calcium sulfate or a mixture of them (phosphogypsum, borogypsum, citrogypsum, etc.) are used as the main raw materials.

Waste from the production of phosphoric fertilizers and extraction phosphoric acid contains impurities of fluorine, phosphoric acid, sodium, potassium, which pollute the environment. The intensification of agricultural development leads to an even greater increase in the production of phosphorus fertilizers, and, consequently, an increase in phosphogypsum waste. Therefore, solving the problem of recycling these wastes is of great importance for the development of the country's economy and improving the environmental situation in the region [2, 5]. The most promising of the outlined areas of utilization of phosphogypsum should include its processing into phosphogypsum binders, which are suitable for the manufacture of a wide range of construction products, dry building mixes, self-leveling floors, etc. [3, 4].

At cost, gypsum materials based on phosphogypsum binders are about two times cheaper than mixtures obtained from natural gypsum, since their production excludes the stages of extraction, crushing and grinding of rock, which are the most energy-intensive in the production of gypsum binders. Due to the fact that phosphogypsum has been stored in dumps for several decades, due to precipitation, evaporation, weathering, and long-term storage, it acquires new properties that distinguish it from the newly obtained content of fluorine, water-soluble P205 compounds, and alkali metal salts.

Fillers and fillers in the production of composite gypsum-containing materials for construction purposes are used to give gypsum binders special properties, namely: to increase strength, weather, water and heat resistance, as well as to save the gypsum binder itself. As fillers and fillers, Portland cement, slaked lime, ground silica - and carbonate-containing materials, CHPP ash, fine-ground blast furnace slags, etc. are used.

III. METHODOLOGY

Depending on the type of fillers and fillers, changing their content and ratio, it is possible to obtain compositions characterized by special properties inherent in each component. By mixing alumina cement with high-strength or construction gypsum and high-base hydroaluminate in precisely established weight ratios, a water-resistant expanding cement (VRC) is obtained, proposed by V. V. Mikhailov [7].

A.V.Volginskiy suggested gipsocarton (GPCs) and gipsoshlacobeton binders (GSCP), which is a mixture of construction or high-strength gypsum cement or slag cement and pozzolanic additive. They are characterized by a rapid increase in strength due to the presence of semi-aqueous gypsum and the ability to harden in wet conditions like hydraulic cements [6].

IV. RESULT AND ANALYSIS

To improve the construction and technical properties of composite gypsum-containing materials for construction purposes, various additives modifiers are used, which, depending on the purpose, are divided into:

- modifying additives - regulators of rheological properties;
- modifying additives - regulators of setting and hardening processes;
- modifying additives - structure regulators;
- modifying additives for special purposes;
- modifying additives of multifunctional action.

The most significant task in the field of obtaining gypsum-containing composite materials for construction purposes is to increase the durability, weather resistance and durability of products made of gypsum binders. This becomes possible when using mechanical activation, i.e., finer grinding of the initial components, or by introducing additives into the composition that increase the water resistance of gypsum. Such additives include portland cement, active mineral additives, ash, slag, etc.

Based on the results of the analysis of literature sources and patent-information search, it was concluded that for the production of high-performance composite mixtures based on gypsum binders for construction purposes, the most promising are:

- application of mechanical activation of raw materials (gypsum, anhydrite, fillers);
- use of chemical additives to increase the durability, plasticity and work ability of solutions based on gypsum-containing materials;
- use for the preparation of gypsum binder of industrial waste-phosphogypsum, natural anhydrite and anhydrite, which is a waste of the ceramic industry;

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- selection of rational granulometric and material composition of fine aggregate and filler based on local sands and waste from the stone processing industry.

The main processes in the production of powder inorganic composite materials are fine grinding and classification of the ground material, which allows you to obtain a powder of narrow size classes. Increased requirements for a given particle size distribution and fineness of binder and filler, impose strict conditions mode chopping and grinding equipment, which should provide the fineness of more than 5,000 cm2/g. This is one of the main requirements for the production of powdered inorganic composite materials that meet the requirements of world standards. To improve the construction and technical properties of powdered inorganic composite materials (strength, density, spread ability, adhesion, weather and frost resistance), mechanochemical activation of the initial components for their production (gypsum, phosphogypsum, gypsum-puzzolan cement, fillers, etc.) is proposed, which has not yet been used in the production of powdered inorganic composite materials.

V. DISCUSSION

The basic technological scheme for the production of powder inorganic composite materials modified with chemical additives consists of the following sections:

- the site of preparation (fine grinding) of the filler;
- mixing area of components;
- the site of production of finished products;
- the packaging area.

In increasing the scientific and technical level of the technology for producing powdered inorganic composite materials, an important place belongs to the grinding process, which has a significant impact on the construction and technical properties of binders and is characterized by a high level (up to 30-40 %) of energy, metal and capital costs from the total costs of their production. The main requirements for the grinding process are a rational grain composition of binders, high energy efficiency and reliability with minimal labor and material costs.

Fine grinding, along with reducing the particle size, is accompanied by a number of physical and physico-chemical effects that affect both the efficiency of the process itself and the physical properties of the crushed materials [8]. Mechanical activation increases the activity of the crushed material as a result of various kinds of defects, an increase in the number of active centers on the surface of the particles, etc. The efficiency of mechanical activation is expressed by the increase in specific surface area, increase class 10 to 30 μm, as well as higher hydraulic activity binder.

The main part of the work carried out in the field of mechanical activation of inorganic building materials was carried out for cement. There are not so many works on mechanical activation of inorganic building materials based on gypsum binders.

Classification of gypsum binders is carried out not only by their strength indicators, but also by the degree of grinding-they are divided into binders of coarse, medium and fine grinding [9].

VI. CONCLUSIONS

1. Having analyzed the economic, environmental and technological aspects as raw materials for the production of modified inorganic powder composite materials for construction purposes based on local raw materials and industrial waste that meet the requirements of world standards in terms of their indicators (strength, durability, adhesion, atmospheric, water, frost and biostability), to accept gypsum rocks from different deposits of Uzbekistan, phosphogypsum - waste from the production of extraction phosphoric acid, fillers and aggregates from river and dune sands, limestone and marble chips - waste from the stone processing industry.
2. To improve the construction, technical and rheological properties of the developed powder composite materials based on gypsum and phosphogypsum binders, modifier additives were selected to increase the durability (increase the setting time), improve the rheological properties, water, weather and biostability.
3. The most effective way to obtain a fine powder material consisting of several components is its mechanical activation in a dismembrator, where the material is finely ground in a short time.

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