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GYPSUM CONCRETE AND ITS APPLICATION

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Abstarct.
Gypsum concrete and its properties, production technology. Theoretical foundations of gypsum concrete, research of its optimal composition. Theoretical fundamentals, possibilities of gypsobecont are analyzed, prospects of use and recommendations are made.

Key words: Gypsum concrete, building, water-resistant, fireproof.

Introduction.

Construction gypsum, as the most common binder for the production of gypsum concrete products and parts, has a number of positive properties and, first of all, is distinguished by its speed of setting and hardening. This ensures quick removal of gypsum concrete products from molds and high turnover of molding equipment. Products made from gypsum concrete have a relatively low volumetric weight, they are fireproof , have good sound insulation and other positive properties. Along with this, the production of gypsum concrete products is limited due to the increased water demand of the gypsum concrete mixture, insufficient density and strength of gypsum concrete, low water resistance and its increased plastic deformations (creep), which manifest themselves especially when the products are moistened.

Research methodology.

In recent years, waterproof gypsum-cement-pozzolanic binder (GCPV), proposed by A.V. Volzhensky , has been widely used . This binder is obtained by thoroughly mixing from 50 to 75% semi-hydrous (construction or high-strength) gypsum with, respectively, from 50 to 25% pozzolanic Portland cement.

Gypsum-cement- slag binder (GCSHB), containing 65-70% semi-hydrous gypsum, 30-50% ground blast furnace slag and 5-10% Portland cement, has increased water resistance . The quality of this binder increases with the introduction of up to 15% pozzolanic additive.

To slow down the setting of gypsum, various surfactants of organic origin are used, such as keratin retarder, BS and SSB retarder. The latter is not only an effective retarder, but also a plasticizer at the same time. It is introduced into the gypsum concrete mixture in an amount of 0.2-0.5% by weight of gypsum; at the same time, the water requirement of the mixture is reduced by 10-18%.

As gypsum setting accelerators, it is recommended to use finely ground gypsum dihydrate in an amount of 1-2% by weight of the gypsum.

Materials of mineral and organic origin are used as fillers for gypsum concrete. The first include fuel and porous blast furnace slags, slag pumice, crushed brick stone, expanded clay, pumice, tuffs, etc. The listed materials can serve as fine aggregate, but with a grain size of less than 5 mm or natural sands. When choosing the type of aggregate, preference should be given to porous aggregates with a rough surface, which increases the adhesion of the hardened gypsum to the aggregate grains.

Preparing a gypsum concrete mixture using mineral porous aggregates can significantly reduce the consumption of gypsum, improve the structure of the material, and also reduce the deformation of gypsum concrete products when their humidity changes. The correct choice of the type and granulometric composition of porous aggregates makes it possible to obtain gypsum concrete products of a given strength and volumetric weight, which also meet the requirements of sound insulation.

Fillers of organic origin (sawdust, crushed wood waste, tow) provide gypsum concrete products with low volumetric weight. These fillers have good adhesion to hardened gypsum, however, their use significantly increases the water requirement of the mixture and the gypsum concrete does not produce a sufficiently rigid skeleton capable of absorbing shrinkage stresses when the products dry.

Result.

The composition of gypsum concrete is selected according to a method developed for lightweight concrete with porous aggregates, taking into account the factors on which the properties of ordinary concrete depend.

To preliminary determine the consumption of materials in test batches, you can use tabular data for vibrating gypsum slag concrete , obtained using building gypsum with a strength of 75-100 kg/cm^2 (Table 1).

Table-1

Approximate compositions of gypsum slag concrete

Gypsum concrete grade	Composition by weight	Water to gypsum ratio W/G	Gypsum consumption, kg/m^3	Water consumption, l/m^3
70	1: 1.5-1: 2.0	0.6	450-500	270—300
50	1: 2.5-1: 2.75	0.67	350-400	245-280
35	1:3.5	0.8	300	240

Taking into account the recommendations of this table, compositions with three gypsum consumptions are selected. For each composition, three test batches are prepared under laboratory conditions, one of which has the water consumption indicated in the table, and the other two are prepared with a water content that differs by ±5% from the first batch.

From such gypsum concrete mixtures, control cube samples are made, which are tested after drying. Based on the test results, the optimal water content is determined, as well as the consumption of gypsum and other components per 1 m3 of gypsum concrete.

Conclusion.

Properties and applications of gypsum concrete:

The strength of gypsum concrete largely depends on the type of gypsum binder, the composition of the mixed binder, the type of aggregate and the water-binder ratio. For the manufacture of products, as a rule, gypsum concrete with a compressive strength of 35 to 100 kg /cm^2 is used.

The volumetric weight of gypsum concrete, depending on the type and porosity of the aggregate, can vary within fairly wide limits; Most often, gypsum concrete with a volumetric weight of 1000 to 1400 kg/m^2 is used. Water absorption of gypsum concrete with mineral fillers is 15-26%, and with organic fillers - 50-60%.

Gypsum concrete is characterized by reduced water resistance. Even with slight moisture, the strength of products made from them is significantly reduced; in addition, the creep of concrete in products under load increases. The softening coefficient of gypsum concrete is 0.3-0.5, while for most waterproof materials it should be at least 0.8. Although gypsum products regain their strength after drying, systematic saturation with water and drying leads to their gradual destruction.

When hardening, gypsum concrete expands (by 0.2-0.8%), which reduces its adhesion to the reinforcement. The steel reinforcement in gypsum concrete is subject to corrosion, so it is covered with protective coatings.

Using gypsum-cement-pozzolanic binder (GCPV), made on the basis of building gypsum and pozzolanic Portland cement grade 300, you can obtain concrete grades 150-200. Their softening coefficient is 0.6–0.8. In addition, concretes using the binder in question are characterized by a rapid increase in strength, which 2-3 hours after their preparation reaches 30-40% of the grade. To speed up the hardening of concrete products using GCPV, they can be steamed at a temperature of 70-80°, and after 5-8 hours the concrete strength reaches 70-90% of the final strength.

Application of gypsum concrete products

Gypsum concrete products can be used for external structural elements only if they are reliably protected from systematic moisture (by structural and other measures). Gypsum concrete products made from gypsum mixed with ground blast furnace slag (so-called waterproof gypsum) can be used in rooms with high humidity and in a number of other cases when structures cannot be reliably protected from possible moisture.

So-called “stucco” and other architectural and decorative products of complex shapes are made from gypsum, intended for finishing ceilings, cornices and walls, as well as cladding sheets (sometimes called “dry gypsum plaster”), which are thin (about 1 cm thick) slabs relatively large sizes (up to 1.2X4.2 m).
In addition, gypsum is widely used for the manufacture of fireproof slabs (mainly for partitions and internal cladding: external walls, less often for ventilation ducts and fire-retardant linings of steel columns).

Sheets and hollow products with thin walls, as well as architectural and decorative products, are made mostly from gypsum dough, consisting of gypsum , water and a small amount of various additives. It is more profitable to make solid slabs with a thickness of more than 7-8 cm , as well as hollow products with thick walls , from gypsum concrete, which includes gypsum, water, additives and fillers.

Fillers for gypsum concrete are mainly boiler slag, crushed brick and other porous aggregates with a rough surface. Gypsum adheres to them much better than with ordinary sand or gravel. To reduce fragility and increase bending strength, fibrous additives (wood or other fibers, long-fiber sawdust, shredded paper pulp, etc.) are sometimes added to the gypsum dough. To reduce the consumption of gypsum and the volumetric weight of products, a small amount of foaming additives is sometimes added to the gypsum dough.

Strength, creep and plastic deformation of gypsum concrete

The strength of gypsum concrete, in general, depends on the same basic factors as the strength of other concrete, i.e.

1. *on the quality (activity) of the binder;*
2. *on the weight ratio of water and gypsum, called the water-gypsum ratio (by analogy with the water-cement ratio);*
3. *on the strength of the porous filler used.*

The introduction of fillers (slag, crushed brick, etc.) into gypsum dough reduces the strength of the product, but reduces the consumption of gypsum by 1.5-2.5 times and reduces the deformation of the product during drying.
Vibrated gypsum concrete can be produced with a much smaller (about 1.5 times) amount of water, which makes drying easier and faster, and in some cases allows you to do without artificial drying.

The features of gypsum mortars and concretes resulting from the specific properties of gypsum include:

- a pronounced dependence of the strength of finished products on the degree of their humidity:
- drying products increases their strength, and moistening significantly reduces them;
- the difficulty of introducing a large amount of aggregates into gypsum concrete:

- for cast gypsum concrete, the maximum amount of fuel slag is about 1.5-2 vol. parts per 1 vol. part of plaster,
- for vibrated ones - about 2.5-3; It is better to pre-screen small particles of aggregates with a large surface area;
- the rapid setting of gypsum forces the introduction of retarders into the composition of gypsum concrete (animal glues, BS retarder, keratin retarder, etc.);
- Most of these retarders, being surfactants, increase the mobility of the mixture and reduce the consumption of water and gypsum in gypsum concrete. Gypsum products, especially when moistened, have the property of creep, that is, they can produce plastic deformations that increase over time even with a constant load; these deformations sometimes reach significant values.

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