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Prospects for the Use of Coal Ash in the Construction Industry

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Abstract
The article describes the definition of coal ash, its composition, structure, areas of application in the construction industry. In addition, comments were made on the formation, reaction and resistance of the concrete structure to aggressive environments when coal ash is added. The main conclusions are presented at the end of the article

Keywords: Coal ash, concrete, energy efficient construction, aggressive environment, reaction, application in construction industry.

Introduction

Coal ash is a finely dispersed material consisting of particles up to 0.14 mm, formed by burning solid fuel in Gres, after which it is captured by electrostatic precipitators and enters dry storage silos using pneumatic transport.

The composition and structure of coal ash depends on many factors:

* type of fuel used;
* ash content of burnt fuel;
* delicacy of processing during its preparation;
* chemical composition of the mineral part of the fuel, etc.

Coal ash is used in the construction industry in the following cases:

*to improve the properties of heavy concrete: instead of a part of sand, as an independent component and instead of a part of cement.

*in light concrete production. Low-cement concretes are used in the preparation of road foundations. Coal ash is also used in slag silicate concrete used for repairing roads, airfields, bridges, as well as in the construction of acid-resistant floors in chemical workshops, livestock complexes, metallurgical industry.

*in the production of foam concrete, its inclusion in the foam concrete mixture increases the overall stability of the mixture during the period between the start and end of the cement mixture, which prevents the movement of components and prevents negative effects.

The formation of the structure.

Coal ash easily replaces cement in the production of mortar, concrete and finished products. It is used as an additive to cement, while not reducing its activity, in the preparation of concrete for road construction, and as an additive to clay in the production of tiles and bricks.

Reaction.

The effect of coal ash is greater the smaller the particles are (the specific surface area of the particles in coal ash cements reaches 5000 cm2/g). In each individual case, there is an optimal ash dose that allows the best performance. Optimumness is easy to determine - we plot a graph where the ash dosage is left as a percentage along the abscissa axis, and the plasticity of the mixture, determined by the turbidity test on the vibrator, is located on the ordinate axis

Thus, the inclusion of ash in the mixture allows to reduce the consumption of mixing water, increase the uniformity and density of the concrete mixture based on M-500 cement and improve its laying, create the best conditions for deconstruction with the same workability.

The addition of ash to the concrete mixture (in the range of 30-100 kg/m3) allows to improve its granulometry and eventually correct the composition of sands with insufficient small fractions.

Coal ash can even replace part of the sand (for example, by 20-30%). In construction conditions, the inclusion of coal ash is recommended, especially when there is a stiff, lean mixture with a small consumption of cement. The increased amount of ash helps to speed up the setting time, which can also be adjusted with additives in the cold season. The setting time varies significantly in the same plasticized mixtures (20-30) at normal temperature (20-5% ash content). Recent studies have shown that there are very effective hardening accelerators used in the cold season, which reduce the setting time and achieve very early mechanical strength Among them, sodium aluminate 2 Na20-Al203 and caustic soda Naoh show themselves to be the best. These additives are used in the range of 0.2-0.5% of sodium. A high amount of aluminate or sodium silicate causes uniform gelatinization in water-filled spaces. Such a change in the shear limit can be useful in the production of concrete products with immediate demolding.

Lowering the heat of hydration.

The heat of hydration released during installation decreases in proportion to the ash content. This feature is of interest in concreting massive structures in the hot season.

Capillary absorption and cold resistance.

With the addition of fly ash to cement, capillary water absorption increases by about 20-10% for every 10% of ash. Laboratory tests revealed a slight decrease in frost resistance. This decrease is insignificant with 20% ash content and does not exceed the permissible limits with equal workability of the mixture. However, it is known that frost resistance can be improved by airing. The best protection against freezing of hardened concrete is the inclusion of air-tight admixtures. In general, Coal Ash cements require a slightly higher admixture to produce the same amount of air. The reason for this, no doubt, lies in the fact that some of the surfactant is absorbed by the ash.

Aggressive water resistance.

It can be said that the use of cements containing 20% ash or the inclusion of coal ash in the concrete mixture increases the resistance of the material in aggressive waters when fully submerged. This increase is explained by the fine distribution of ash, the increase in the absolute volume of the binder, the presence of a small amount of lime and, most importantly, the decrease in the content of tricalcium clinker aluminate (the main element that contributes to the destruction).

Summary of the advantages and disadvantages of using coal ash.

The use of coal ash provides the following advantages:

* decrease in the price of the binder; slight improvement in handling;
* a slight increase in final strength;
* developed reaction;
* reduction of shrinkage and initial heat release during hydration;
* extension of the crack formation period during the ring test;
* increased resistance to fresh and sulfate waters;
* reduction of large mass of concrete; increase fire resistance and thermal shock resistance;
* lower clinker consumption and more stable binder.

Among the disadvantages of using coal ash, the following should be noted:

* discoloration of cement;
* reduction of initial strength, especially at low temperatures, although cement with ash can grind finer, with the same performance, water consumption is slightly reduced;
* reduction of frost resistance, although there are means to increase it (using airtight additives);
* The use of ash increases the number of controlled mixture components.

In conclusion, it should be noted that the advantages of coal ash far outweigh the above disadvantages.

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