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PORTLAND CEMENT PRODUCTION AND ITS METHODS

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ABSTRACT	KEYWORDS
A brief summary of research into Portland cement manufacturing methods.	portland cement, clinker, mineralogical composition, alite, belite, tricalcium aluminate, aluminoferrite, dry method, dry method.

Introduction

Production of Portland cement is carried out in the following order:

A) extraction of raw materials from mines and transportation to the factory;
B) Preparation of raw mixture;
C) Burning the raw mixture for baking and clinker production;
D) Adding gypsum to clinker with two active mineral additives and producing portland cement;
E) Placing and storing the finished product in warehouses (silos).

All technological processes are aimed at obtaining clinker with the required composition and quality. Preparation of the raw mixture consists in crushing and mixing the components in the specified ratio, which ensures completeness of the reactions between the components and homogeneity of the clinker. The raw material mixture is prepared semi-dry by dry, wet and hybrid methods. The most common cold method attracts attention with the simplicity of gathering raw materials and their homogenization. In addition, this method creates the best sanitary and hygienic conditions for the work of employees. However, this method does not require large power consumption. The dry method does not require much power consumption compared to the wet method and has a relatively large advantage. Heat consumption during combustion is reduced by 40%. The disadvantage of this method is the complexity of its technology and the need for a lot of technological equipment. However, according to the set of technical and economic indicators, the dry method of clinker production is more economical than the dry method. Therefore, this method is widely used in our country. In the hybrid method, the raw material mixture is prepared in the dry method and burned in the dry method.

Wet Method

In this method, if the raw material is small and has a high moisture content, it is left and fired in the technological plan of the rock.

Softer rocks (clay and boron) are ground into 10-cm-sized balls in a roller mill and then mixed with water in a muddler. The raw material mixture in the form of a liquid flowable substance-slurry has a moisture content of 35-45%. Mud tank is a round reinforced concrete reservoir with a diameter of 10 m and a height of 2.5 - 3.5 m. It is covered with cast iron plates. At the back of the auger, a cross-shaped crosshead is rotated to crush the clay. Clay is mixed with water in small pieces. Haskash breaks large children into small grains, no larger than 3-5 mm in size, which are easily dissolved in water. The resulting slurry is sent together with crushed limestone to the waste hoppers of the raw mill with pushers for feeding. If boron is used as a raw material for carbonate, then it is first (after grinding) mixed with clay in a furnace, and then crushed in a mill. Large, undissolved grains of clay accumulate at the bottom of the container and are periodically removed.

The second component of the raw mix - limestone is crushed in two stages: The first is crushed in a lunge crusher, and the second is crushed in a hammer crusher. It is sent to the Ball Mill through continuous working weighing dosers with an automatic controller that allows maintaining a precise ratio between the components of the raw mixture for feeding mainly with clay slurry by means of conveyors.

After filling in the mill, the slurry is pumped into the vertical and horizontal slurry pools with a suction pump. This is due to the fact that the chemical composition of the raw material may change due to the non-homogeneous nature of the raw material, and the quality of the cement depends on the chemical composition of the raw material mixture.

The slurry from the mill is first transferred to the horizontal basin. Sludge with a different composition is transferred to the second vertical pool. Knowing the exact chemical composition of the slurry in these two containers, the required slurry composition can be calculated.

Sludge adjustment is carried out in a horizontal basin. The chemical content of the slurry is continuously monitored with an automatic sampler and X-ray quantimeter, which ensures constant determination of CaO, SiO_2, Fe_2O_3, Al_2O_3 .

Dry Method

The most cost-effective way is to process the raw flour in a closed cycle with separators and in simultaneous sliding and drying mills. Such mills are used if the moisture content of raw materials does not exceed 8-10%. In this method, the raw materials (limestone, clay, etc.) are dried after grinding and combined in a ball mill until 6-10% residue remains on a No. 008 sieve. Raw flour is burned in:

1. In advance, raw flour is heat-treated and burned in short rotary kilns.

a) The substance is heated up to 800-850oC with gases from cyclone heat exchangers and partially decarbonized (30-40%);

b) in conveyor calciners (CaO-saturating devices), substances are burned due to the heat coming out of the furnaces.

Raw flour can be burned in the form of granules (rounds) in automatic mine furnaces. In dry production, cement can be burned in rotary kilns (lepol kilns) working together with conveyor calciners, as well as Shakta kilns. In this and other cases, raw flour is formed before burning it, and round particles with sizes from 5-10 mm to 20-30 mm are obtained. Plate-shaped granulators are used for this. In mine furnaces, raw round particles (granules) are first dried by flue gases. Then, when

they move down to a higher temperature zone and heat up to 400-500oC, the mineral clays in them are dehydrated.

Decarbonization is accompanied by the separation of SO2 and its reaction with carbon to form SO.

This creates a favorable environment for the Fe2O3 or FeO reduction reaction, which degrades the quality of the clinker.

Today, fluidized bed combustion technology is being produced, in which hot gases are pushed downwards and upwards through the layer of formed or finely divided raw materials with a speed of 1.5-3 m/s.

In this case, the granules are in constant motion and intensive heat exchange between gas (at a temperature of 1350-1450oC) and substances takes place. Under these conditions, the process of burning granules (formed particles) with a diameter of 2-5 mm is completed in 30-40 minutes, and high-quality cements are obtained.

The raw mixture of limestone and clay together is crushed in mills until 1-2% moisture remains. In recent years, in the cement industry, powerful cascade mills such as "Aerofol" mills without grinding agents and low-grinding mills have been used. From the drying drums, the raw material is fed to the multi-chamber pipe mills. After filtration, it flows into cyclones or separators and into silos for standardization and adjustment. In modern plants, both grinding and drying of limestone and clay are combined in ball mills.

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