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ABOUT PORTLAND CEMENT CLINKER MANUFACTURING PROCESS

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ABSTRACT	KEYWORDS
A summary of research on process studies in the manufacture of Portland cement clinker.	Portland cement, kilinker, wet method, dry method.

Introduction

The crushed and thoroughly mixed raw material mixture is burned in cement kilns at a temperature of 1350-1450°C. The burning of the raw mixture is carried out mainly in rotary kilns in both dry and wet production. The rotary furnace consists of a long cylinder placed at a slight angle 3-40 and covered with fire-resistant armor. the length of the hearth (khumdon) is 95-150-185-230 m, the diameter is 3-4-7 m.

Rotary ovens (khumdons) work according to the opposite or right law. Raw materials in the form of powder (dry method) or slurry (cold method) are sent to the furnace from the upper (cold) side of the automatic furnace, and burned (a mixture of natural gas, fuel oil, air and coal powder) in the form of a 20-30-meter flame from the lower (hot) side. is blown. The raw material occupies only a part of the cross section of the furnace, and it is in the furnace at 1-2 revolutions/min. while rotating at a high speed, it shoots through different temperature divisions and slowly moves down towards the direction of the burning gases. For incineration, rotary kilns with cyclonic heat exchanger are used, which heat the raw mixture to a temperature of 800-850°C to partially remove carbon gases.

The dry raw material mixture from the silos is directed to the receiving hopper 1 of the furnace using a pneumatic pump, where the material is transferred to the belt conveyor 3 using an elevator 2, and from it falls to the battery cyclone 4. With the help of return gases from cyclone 5, it is fired from cyclones 6,7 and falls into furnace 8. The raw mixture slowly heats up to 800-900°C when it is fired from cyclones and falls into cyclone 7. In the system, the flow of gases moves through the smoke absorber 10. 200°C processed gases are cleaned of dust using electrofilters in cyclone 9. After firing the zones of high temperatures, the clinker is cooled under the influence of cold air flow. The clinker comes out of the furnace with a temperature of 1000-1100°C, is heated to a refrigerator and cooled there to a temperature of 30-500°C. The cooled clinker is sent to the storage warehouse and then to the crusher. Crushed clinker is stored in climate-controlled or open warehouses, and from there it is transported to mills for cement production.

The exhaust gases are thrown into the pipeline by means of a smoke extractor 13 through a gas exhauster and a system of electrofilters. The raw solid enters the waste hopper 3 and then the heat exchanger 5. The gas returned from the humdon is directed to the ball mill 9 with the help of a fan 8.

Processes involved in clinker burning in rotary kilns. Combustion of raw materials and extraction of cement is carried out by complex physical, physico-chemical processes. The incineration temperature determines the nature of the process. Sludge (raw material mixture) is dehydrated and thickened in the presence of gases (300-600°C). Then it turns into large particles. Sludge is directed along the length of the furnace, organic additives in the raw mixture burn at 400-500°C, and kaolinite is dehydrated, forming Al2O3 2SiO2 as follows.

In the construction department, the falling raw material dries as the temperature continuously increases from 600°C to 700°C. The dried material is pulverized, and as it spins, the pulverized raw material is broken into smaller forms.

At a temperature of 700-800°C, other clay components are dehydrated and this is called the heating section. These two divisions occupy 50-60% of the length of the furnace in the point method of production. In the dry method, raw material demand is reduced due to evaporation.

At a temperature of 750-800°C and above, a solid reaction begins between its ingredients, and granules of various sizes are formed.

The length of the decarbonization unit is 20-23% of the length of the furnace. In this section, the temperature of the substance being burned rises from 700°C to 1100°C. Here, the process of separation of calcium and magnesium carbonate salts ends and a large amount of free calcium oxide - SO2 is formed. The section with a temperature of 900-1100°C is called a calcium enrichment section.

In the melting section 1300-1450°C (the duration is 10-15% of the furnace) the temperature of the furnace reaches the highest temperature (1450oC) for the substance being burned. This is necessary for the partial dissolution of the substance and formation of alite 3CaO, SiO2. At 1300°C, 20-30% of the volume of the substance being burned (relatively easily soluble minerals C3A, C4AlF, MgO, CaO and impurities) melts. When the temperature rises to 1450°C, 2CaO SiO2 and CaO dissolve in the clinker liquid, and alite 2CaO SiO2 is formed from them in the solution. Alite is poorly soluble in solution, as a result of which minerals are separated from it in the form of small crystals. The process of alite formation ends when the substance is in the melting compartment for 15-20 minutes. Due to the continuous flow of the substance during the rotation of the furnace, small particles are mixed with granules. The decrease in temperature from 1450°C to 1300°C leads to the solidification of MgO (in the form of periclase) in the solution, which ends in the cooling section that follows the melting section. In the cooling unit, the temperature of the clinker decreases from 1300°C to 1000°C; here its structure and clinker composition including alite C3S, belite C2S and other minerals including periclase, vitreous phase and secondary constituents are completely formed. Clinker should not contain more than 0.5-1% of free lime CaO.

Clinker comes out of the rotary kiln in the form of dark gray or greenish gray granules. The clinker comes out of the furnace at 1000°C, is cooled to 100-200°C in different types of refrigerators, and is stored in a warehouse for a week or two.

The dry method of cement production has been greatly improved in recent years. The most energy-intensive process, the decarbonization of raw materials, is taken from the rotary kiln, and this process is transferred to the decarbonizer, which is faster and uses the heat of the (return) gases. Raw flour first enters the system of cyclone devices, where it is heated with suspended (returning) gases and transferred to the decarbonizer until it is hot.

Alunite is a highly basic Al-Cl calcium silicate containing 2.5% chloride. In this case, the clinker is crushed 3-4 times lighter, which allows reducing the power consumption of the crusher and reducing the number of crushing tools. Alunite cement hydrates faster in the early stages. However, constructions using this type of cement are observed to erode quickly. Today, the erosion resistance of concrete made from this cement is being thoroughly studied.

Clinker felt. Most properties of Portland cement, in particular, its activity, speed of hardening, are determined not only by its chemical and mineralogical composition, but also by the degree of fineness of the product.

The size of cement powder mainly consists of particles from 5-10 mm to 30-40 μm. The degree of fineness of Portland cement is represented by the surface of the residue and powder on the sieve No. 02, No. 008. In modern plants, cement #008 is used until 5-8% remains on the sieve, and the surface area is 2500-3000 cm2/g. If the fineness level of cement exceeds 7000-8000 cm2/g, then its strength and hardening speed will also increase.

This technological process is carried out in open or closed cycle separation devices. One of them is a tube mill in the form of a drum, which is covered with steel armor plates and divided into two or four chambers by perforated barriers. The raw materials are sieved using steel balls (for coarse crushing chambers) and cylinders (for fine crushing). In open-cycle operation, the material enters the large filtration chamber through the pores, and the particulate material exits the small filtration chamber.

It is recommended to add surfactants to increase the efficiency of the clinker drying process. The amount of these substances is determined by experiment. Gypsum stone is added to the clinker (so that the total content of SO3 in cement does not exceed 3.5%) during filling to slow down the retention of Portland cement. The produced cement is transported to the storage warehouses through air blowers.

Storage of clinker. Hot clinker cannot be fed to the mills, it can be done only after its temperature drops to 50°C. This problem is due to the dehydration of the two-water gypsum in the mill, where the hot clinker slip may exceed the standard requirements. It is possible to lower the clinker temperature to the required limits by keeping it for a certain period of time. Another goal is to store clinker and to create a backup ground to ensure the proper operation of cement mills during the repair work of kilns.

The clinker is stored in warehouses equipped with bridge-type cranes, the height of which is 3-6 m. Kiln clinker contains a certain amount of free calcium oxide CaO, the preservation of clinker allows to improve the quality of lime and cement.

References

1. Maxmudova N.A. Bog‘ lovchi moddalar T., TAQI, o'quv qo'llanma 2012. - 118 b. «Kolorit», Xarikov. 2004. 158 s.
2. Ziyodulla, J. (2022). ENHANCEMENT OF PORTLAND CEMENT CLINKER ACTIVITY USING INDUSTRIAL WASTE INCLUDING GYPSUM. Galaxy International Interdisciplinary Research Journal, 10(11), 1102-1104.
3. Ziyodulla, J. (2022). COMPOSITION, STRUCTURE AND PHYSICAL-CHEMICAL PROPERTIES OF PHOSPHOGYPSUM. Galaxy International Interdisciplinary Research Journal, 10(11), 1105-1107.

4. Maxmudova N.A. Bog‘ lovchi moddalar T., TAQI, o'quv qo'llanma 2012. - 118 b. «Kolorit», Xarikov. 2004. 158 s.
5. Abduhalimzoda, Abdurahimov Abdukarim. "TECHNOLOGY OF PREPARATION, TRANSFER AND PLACEMENT OF FILLING MIXTURES." *Galaxy International Interdisciplinary Research Journal* 10.11 (2022): 1098-1101.
6. Abduhalimzoda, Abdurahimov Abdukarim. "STUDY OF PRODUCTION OF LIGHTWEIGHT CONCRETES BASED ON EXPANDED CLAY." *American Journal of Pedagogical and Educational Research* 13 (2023): 19-22.
7. Turapov, F. Kh. "USE OF HEAT INSULATION WALL MATERIALS IN CONSTRUCTION." American Journal of Technology and Applied Sciences 5 (2022): 27-30.
8. Kh, Turapov F., et al. "Features Of The Structure Formation Of A Filling Mixture Based On Industrial Waste."
9. Abdumo’ minov O.R.. “EFFICIENT USE OF LOCAL WASTE IN THE PRODUCTION OF BUILDING MATERIALS” International Scientific Research Journal (WoS). I2776-0979, Volume 3, Issue 8, Aug., 2022. 374-376
10. Abdumo‘ minov, Odina, and Ramazon Rajabov. "PROSPECTS FOR CONSTRUCTION MATERIALS PRODUCTION." *International Bulletin of Engineering and Technology* 3.6 (2023): 23-27.
11. Ilhomova, Ziyodullayeva Madina. "THE EFFECT OF A CHEMICAL ADDITIVE ON THE PROPERTIES OF A CONCRETE MIX." *Academicia Globe: Inderscience Research* 3.5 (2022): 1-2.
12. Ilhomovna, Ziyodullayeva Madina. "Classification Of Work on White Cement in The Production of Marble Quarry Waste and Barium Products Based White Cement." *Texas Journal of Multidisciplinary Studies* 3 (2021): 70-71.
13. Ilhomovna, Ziyodullayeva Madina. "OBTAINING COLD-RESISTANT BARIUM CONCRETE BASED ON WHITE CEMENT USING MARBLE QUARRY WASTE." *Galaxy International Interdisciplinary Research Journal* 9.12 (2021): 504-505.
14. Rakhimov Sh.T., Khudoinazarova K. J., & Zhovliev Z. (2022). DEVELOPMENT OF OPTIMAL COMPOSITIONS AND RESEARCH OF PHYSICO-MECHANICAL PROPERTIES OF FINE-GRAINED CONCRETE. *Galaxy International Interdisciplinary Research Journal*, *10*(11), 761– 764.