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Mechanical Activation of Low-Grade Phosphorites by Acid Salt and Physico-Chemical Investigation of Obtained Samples

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ABSTRACT: The article discusses the mechanical activation study of low-grade phosphorites of the Central Kyzylkum with acid salts and provides a comprehensive thermal analysis of the obtained samples by mechanical activation of phosphorites.

KEYWORDS: dynamic thermogravimetry, phosphorite ore, mechanical activation, curve, phosphate raw materials, phosphate fertilizers.

I.NTRODUCTION

In connection with the growth in the extraction of phosphorites and the production of phosphorus fertilizers, the problem of developing new effective technologies for processing substandard fine fractions of phosphorite raw materials into complex phosphorus and phosphorus-containing fertilizers is an important national economic task.

Today, the Kyzylkum phosphorite complex is the main resource base of the republic's enterprises producing phosphate fertilizers. The raw material base of the Kyzylkum Phosphorite Complex (KPC), which is under construction, is based both on the reserves of the Dzheroyskoye deposit, and due to the involvement of new deposits of Karakata, Northern Dzhetymtau and others with predicted resources of phosphorite ores of more than 5.0 billion tons. The Dzheroy phosphorite deposit of the Central Kyzylkum region has no analogues in the CIS countries in terms of reserves and estimated resources, their quality, mining-geological and mining-technical conditions of development and is among the top ten deposits in the world. Reserves of phosphorite raw materials by industrial categories up to a depth of 40 - 50 meters are estimated at 303.6 million tons of ore, 57.7 million tons of phosphorus pentoxide, which ensures the need for agriculture in phosphate fertilizers for more than 100 years.

Classical methods for the production of phosphate fertilizers are associated with huge expenditures of sulfuric acid used to completely decompose the original ore or concentrate. In this case, the reaction product is not ready-to-use phosphorus fertilizer, but only reactive phosphoric acid, which is used to prepare superphosphate.

In recent years, activation methods seem to be fundamentally promising in the processing of phosphorites, which allow solving the issues of saving decomposing reagents and improving the quality of the products obtained. These include mechanical, chemical, thermal methods and their combinations - mechanochemical and thermochemical methods of activation [1-3].

Activation by grinding, or mechanical activation, is a new way of intensifying physical and chemical processes. It is based on a change in the reactivity of solids under the action of mechanical forces. It is already possible to determine the prospects for the use of mechanoactivation in a number of areas of science and production.

II. SIGNIFICANCE OF THE SYSTEM

In connection with the growth in the extraction of phosphorites and the production of phosphorus fertilizers, the problem of developing new effective technologies for processing substandard fine fractions of phosphorite raw materials into complex phosphorus and phosphorus-containing fertilizers is an important national economic task. The study of

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methodology is explained in section III, section IV covers the experimental results of the study, and section V discusses the future study and conclusion.

III. METHODOLOGY

For the study, we used low-grade phosphorite of the Central Kyzyl Kum with the initial composition (Table 1)

Table 1.

Chemical composition of low-grade phosphorites of the central Kyzylkum

№ samples	Name of phosphate raw material	Chemical composition of starting materials, mass. %:				
		CaO	P_2O_5	CO_2	F	CaO/ P_2O_5
1	I- layer of phosphate rock (LPR-I)	48,86	17,50	17,04	1,2	2,80
2	II- layer of phosphate rock (LPR-II)	48,60	19,03	13,15	2,3	2,56
3	Mineralized mass (MM)	41,30	12,93	17,69	2,3	3,20
4	Sludge waste (SW)	35,42	8,95	14,9	0,9	3,96

Mechanical activation was carried out on a laboratory machine - a mortar mill type RM 200 from RETSCH with a rotation speed of 100 rpm at 50 Hz. The granulometric composition after grinding the sample with the help of sieve analysis was distributed over the following fractions. Fractional analysis was performed on a RETSCH AS 200 laboratory analytical sieving machine with electronic setting of the amplitude and time for sieving loose particles. In order to determine the effect of activating additives on the degree of solubility of low-grade phosphorites, samples of various types of low-grade phosphorite were mechanically activated with the addition of acid salt NH4H2PO4 at a ratio of 5:5 in a mortar mill of the RM 200 type with an increase in the activation time to 60 min, the resulting mixture was heated to 2000C. The initial and activated samples were studied by the method of complex thermal analysis.

IV. EXPERIMENTAL RESULTS

The obtained derivatograms of low-grade phosphorites with the addition of acidic salts NH4H2PO4 are shown in Figures 1 and 2. Complex thermal analysis, including differential thermal analysis, thermogravimetry and determination of the rate of mass change, was carried out in the laboratory of the Navoi State Mining Institute using a synchronous thermogramimetric analyzer TGA-DTA/DSC of the company Setaram Lab Sys Evo GNR Nord. The device is designed to measure thermodynamic characteristics (heat and temperature of phase transitions and physicochemical reactions), as well as to register changes in the mass of solid and powder materials in the temperature range from 25 to 1600°C. Research conditions: temperature range from room temperature to 900 °C. Temperature change rate - from 0.01 to 100°C/min; the sensitivity of the 3D sensor is 0.5 mV/mW and the high heating/cooling rate of the oven is 100°C/min, the speed of the chart strip is 2 mm/min. The shooting was carried out in the atmosphere of air

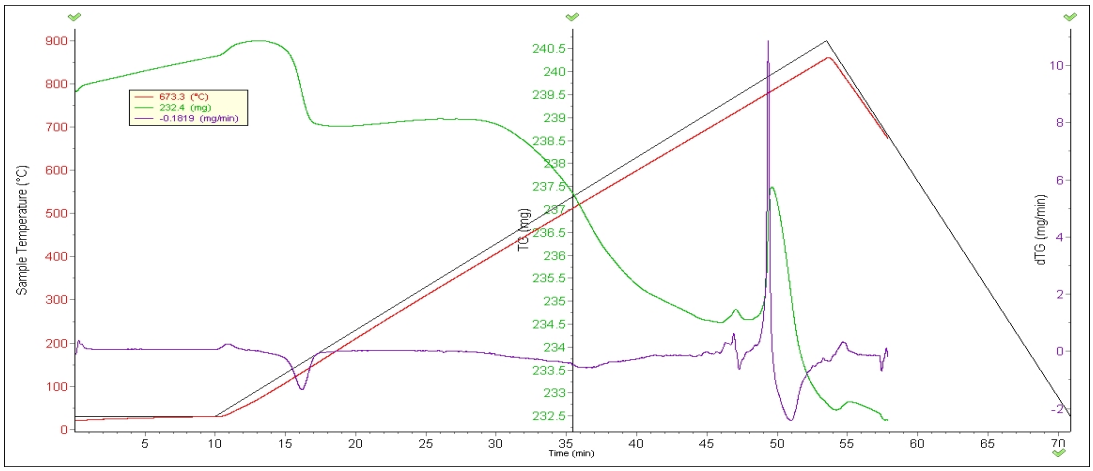

Fig.1. Derivatograms of low-grade phosphorites with additives

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acid salts NH4H2PO4. 1 - Temperature curve; 2- curve of dynamic thermogravimetric analysis line (DTGA); 3- curve of dynamic thermogravimetric analysis line product (DTGP); Curve 4-DSC.

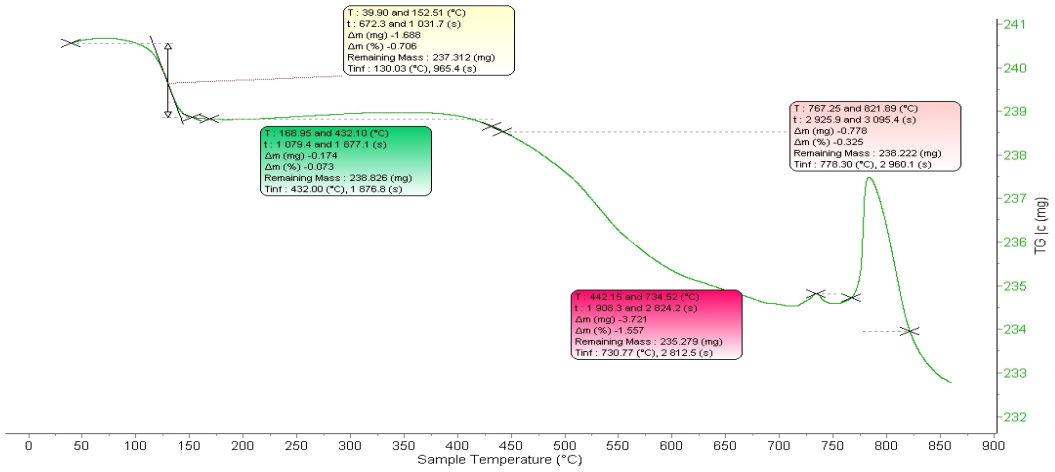

Fig.2 Thermogravimetric line of low-grade phosphorites with additions of acid salts NH4H2PO4

The analysis shows that in the temperature range of 200-215ºC, the change in endothermic peaks, as well as weight loss, is from 0.655 to 1.035, which is due to the removal of adsorbed moisture. During this interval decomposition occurs, i.e. 1.6% decomposition. A detailed analysis of the dynamic thermogravimetric analysis curve and the DSK curve is shown in Table 1 below. At a temperature of 734-850ºC, it gives a sharp jump in the exothermic peak. Exothermic effects are fixed in a narrow interval in the form of an intense pointed and symmetrical peak, which is due to the transition from an amorphous state to a crystalline one. At a temperature of 734-850ºC corresponds to the maximum rate of decomposition of carbonates and the beginning of deep changes in the structure of phosphorite and a change in weight loss from 2.021 to 3.158. As a result of these derivatographic studies, the main weight loss occurs in the range of 160-900°C, at which 6.25% of the main weight is lost, i.e. 3.21 mg of mass. After 900ºC no change is observed. The mass remains unchanged.

Table 2

Analysis of line results of DTGA and DSK curves for (NH4)2HPO4

№	Temperature, ºC	Lost mass, %	Decomposition rate substances, mg/min	The amount of energy consumed (μV*s/mg))
1	50	0,225	0,136	1,46
2	100	0,485	0,555	2,54
3	200	0,655	0,653	1,21
4	300	1,035	0,445	2,22
5	400	1,285	2,147	2,10
6	500	1,569	1,446	3,13
7	600	1,815	1,452	1,74
8	700	2,021	2,156	1,52
9	800	2,812	1,104	1,44
10	900	3,158	1,622	2,11

V. CONCLUSION AND FUTURE WORK

In general, the whole complex of studies on the mechanical activation of phosphate raw materials, it can be stated that the mechanical activation of natural phosphate raw materials increases the reactivity of apatite, increases the

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content of soluble forms of P2O5. Based on the analysis of data from derivatographic studies, it was shown that as a result of physical and chemical transformations during the mechanochemical activation of phosphorus minerals with the addition of acid salts, new varieties of apatite are formed, which opens up the prospect of using phosphate rock instead of superphosphate.

REFERENCES

[1]. Seitnazarov A.R., Namazov Sh.S., Salimov Z.S., Mirzakulov Kh.Ch., Beglov B.M. Mechanochemical analysis of activated mineralized mass of phosphorites of the Central Kyzylkum // Khim. prom-st today (Moscow).-2003.-№4.-p.42-44.

[2]. Sultonov B.E., Erkaev A.U., Tursunova Z.M., Namazov Sh.S., Salimov Z.S. Enrichment of phosphorites of the Central Kyzyl Kum with nitric acid // Proceedings of the International Scientific and Practical Conf. "Problems of chemical technology of inorganic, organic, silicate and building materials and training of engineering personnel."-Shemkent.-2002.V.1.-S. 226-228.

[3]. Boyko V.S., Shabanina N.V. Mineralogical features of granular phosphorite ores of the Kyzyl Kum and the study of their washability. - Uzbek geologist, 1979, No. 3, p. 84-86.