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DEVELOPMENT OF SCIENTIFIC BASES OF TECHNOLOGY OF MANUFACTURE OF HIGH-TEMPERATURE STABLE MAGNESIUM BRICKS FROM PRODUCTS OBTAINED FROM LOCAL RAW MATERIALS OF TURKMENISTAN (DOLOMITE, BISCHOFITE)

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Abstract:
This study explores the development of high-temperature stable magnesium bricks derived from locally sourced materials in Turkmenistan, specifically dolomite and bischofite. Magnesium oxide (MgO), the main component of magnesium bricks, is obtained from these minerals, which are abundant in Turkmenistan. The paper investigates various methods for the extraction of magnesium oxide from dolomite and bischofite, analyzing the chemical and mineralogical compositions of these minerals. The research includes laboratory experiments on several methods of extracting magnesium oxide, with the identification of optimal techniques that minimize the use of external chemicals. A technological scheme for the production of magnesium bricks, utilizing magnesium oxide synthesized from local raw materials, is presented. The final product demonstrates promising mechanical strength and high-temperature stability, making it suitable for industrial applications.

Keywords: Magnesium bricks, Magnesium oxide, Dolomite, Bischofite, High-temperature stability, Chemical extraction, Local raw materials, Turkmenistan, Building materials, Magnesium synthesis.

The fact that our Turkmenistan has huge reserves of various underground and surface resources leads to an increase in the number of raw materials exploration, development and processing industries. In particular, the number of modern enterprises in the oil and gas, chemical, energy, transport and communication, mining, construction, agricultural, textile, and food industries is increasing. Prior to this, the need for important industrial products and resources is met at the expense of our local wealth and brought to the external market. The development of these industries, in turn, is directly related to the need for treatment and economical use of water resources, including wastewater. This is especially important in our low water, warm and dry weather conditions.
As you know, Turkmenistan has a lot of minerals and large reserves. Therefore, the future of the chemical industry is growing. In addition to the basic products, the chemical industry also produces a number of wastes. In this regard, more emphasis is placed on the sustainable and integrated use of local mineral resources. Because our country ranks first in the world in terms of hydrocarbon resources and types and reserves of mineral raw materials. One of the priorities is to provide the domestic market with a wide variety of our own products and high-quality products, and to increase the production of export products in high demand in the world markets. As such, great importance is attached to the efficient and integrated use of large, sometimes unique mineral resources, as well as to other sectors of the industry. In particular, minerals in the Koytendag region, in the Garabogaz waters, in the natural aluminosilicas and in other mineral raw materials contain valuable minerals that are suitable for industrial extraction.

Possibilities of magnesium extraction from Dolomite and bischofite

Today, the production and export of various types of building materials on the basis of local raw materials is the main requirement of the time. This research also includes the importation of imported high-temperature magnesium bricks based on local raw materials available in Turkmenistan. The main component of magnesium bricks is magnesium oxide (MgO), which is found mainly in Turkmenistan in the form of Dolomite ($MgCO_3 \cdot CaCO_3$) and bischofite mineral ($MgCl_2 \cdot 6H_2O$).
Dolomite ($MgCO_3 \cdot CaCO_3$) is a natural mineral and its main composition is a mixture of magnesium and calcium carbonates. Dolomite reserve was recorded at Kelete mine in Bäherden district of Ahal province and its age dates to the late Jurassic and Oxford periods. It weighs 2.83g/cm^3, water absorption is 0.2%, its actual cellularity is 0.56%, its air tightness limit is 1000-1100 kg/cm^2 in dry conditions, and the remaining reserves as of 01.2012 are about 3353 thousand tons.

In addition to Baherden district of Ahal province, Dolomite mineral is also registered in Koytendag district of Lebap province under the name "Akanshor" and its geographical location is 15 km west of Magdanly. The density of this mineral is 2690-2750 kg/cm^2, the water absorption is 2.1-16.4%, the cellularity is 16-36%, the compressive strength when dried is 3.2-23.8 MPa, and the water-saturated state is 2.4-15 MPa. The industrial reserves of this field are approximately 24021.8 thousand tons, including 2530.6 thousand tons of A grade reserves, 6009.6 thousand tons of grade B reserves, and 15481.6 thousand tons of grade C1 reserves.

The mineral is produced by the Turkmenmineral Production Association of Lebap province, which produces about 3,000 tons of caustic Dolomite per year. Dolomite is widely used in many building materials and glass production.

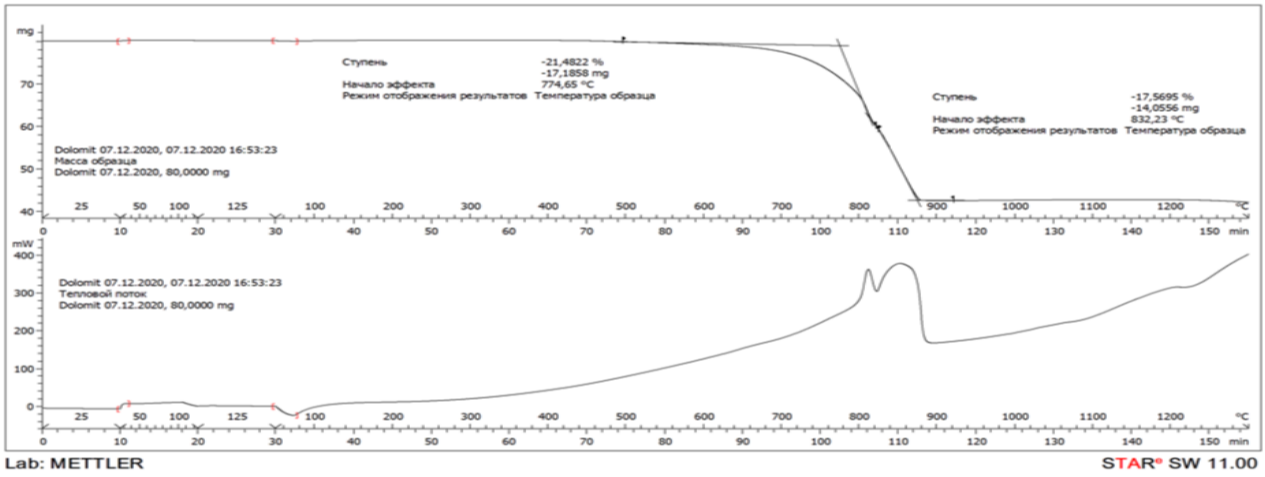
Bischofite (MgCl2 · 6H2O) is a hexane of magnesium chloride produced by Garabogazsulfat Production Association in the Balkan province of the country. Bischofite is used in the production of building materials, the extraction of magnesium oxide and magnesium metal, the addition of sulfur oils to energy plants, the protection of wood materials from fires and insects, the removal of defoliants from cotton leaves and other purposes.

Possibility to chemically and thermally extract magnesium from Dolomite and bischofite

There are currently several methods to extract magnesium oxide from Dolomite. One of them is the thermal method, which is performed by heating Dolomite ore at high temperatures. That is, the specimens were first tested on a TGA / DSC1 thermogravimetric device manufactured by the Swiss company Mettler Toledo at 13000C and subjected to mass loss and heating at a different temperature in the muffle furnace (7000C - 13000C) its mass loss and changes in mineral composition were monitored by X-ray analysis and changes in chemical composition by X-ray fluorescence spectrometry.

As can be seen from Table 3, the mass loss of Dolomite specimens can be seen to form a permanent mass after a temperature of 9500C. This is explained by the complete disintegration of the magnesium carbonate and calcium carbonate in the dolomide.

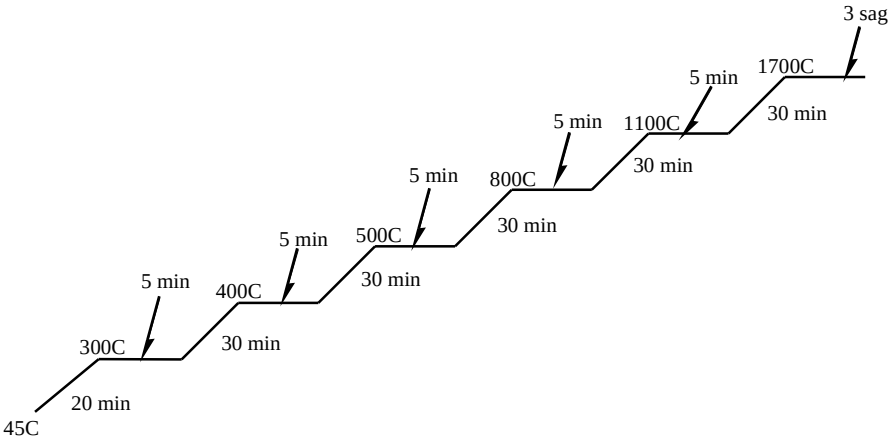
Result: The chemical composition of magnesium oxide synthesized in method I preserves the field sputum or aluminosilicate compounds present in the Dolomite mineral. In methods II, III and IV, the chemical spheres or aluminosilicate compounds of calcined dolomide dissolve under acidic action and silicon is retained. In methods V and VI, magnesium oxide with a purity of 96% is formed.



High-temperature scattering graph of the dolomite sample

Experimental work:

There are several ways to get high temperature stable magnesium bricks based on synthesized magnesium oxide. In this study, the purity of magnesium oxide synthesized by methods V and VI "A" was reduced to 0.25mm at the ZM 200 mill, a product of the German firm RETSCH. It was then moistened to 5-6%. The diagonal was then transferred to a cylindrical shape equal to 60 mm and compressed to 150 bar. After the tablet was dried for 4 h at 1000 ° C, the P310 muffle oven, a product of the German firm Nabertherm, was kept for 3 hours at 1700°C. A sample of magnesium oxide for adjusting the temperature of the muffle oven was monitored by a Nietzsche-based DIL402 PC dilatometer with a mass loss rate of 100 degrees Celsius per 1000 degrees Celsius and accordingly the temperature program of the muffle oven was developed:



Mufel oven temperature program

Conclusion:

1. The mineralogical and chemical composition of dolomide and bischofide, which will be used in the synthesis of magnesium oxide, has been studied. The possibilities of enriching dolomite in various ways (calcification, fractionation, flotation by granulametric composition) were also analyzed.

2. In laboratory conditions, 6 methods of extracting magnesium oxide based on local raw materials (from dolomite and bischofite) were analyzed. The use of sulfuric or hydrochloric acids, which are precursors in I-V methods, and sodium hydroxide (NaOH), which is imported into the red currency, reduces the production of magnesium oxide (MgO).

3. A convenient (combined) method of extracting magnesium oxide (MgO) to be synthesized in industry under laboratory conditions has been studied from Dolomite and bischofite.

That is, methods VI and VI “A” were chosen as the optimal method. The advantage of this method is that no external chemicals are used in the production of magnesium oxide, and the formation of hydrochloric acid other than the main product. Magnesium oxide with a purity of 88.92% and a purity of 96.46% by method VI "A" were synthesized in these methods.

4. The scientific basis for the production of magnesium bricks on the basis of synthesized magnesium oxide has been analyzed and a technological scheme has been developed. That is, magnesium oxide, which has a purity of 96% synthesized according to VI "A" method, adds 10% to 12% of the total mass of alumina silicate (clay), which is a production waste of the Turkmen "Aynaonumleri" enterprise of the Ministry of Industry and Construction Production, High temperature stable magnesium bricks were obtained under laboratory conditions as described above.

5. The mechanical strength and high temperature stability of the prepared magnesium sample were determined.

REFERENCES

1. "State Program for the Comprehensive Development of Chemical Science and Technology in Turkmenistan for 2021-2025" approved by the Resolution 1957 of the President of Turkmenistan dated October 16, 2020

2. AINSCOW W.S., GADGIL B.B., 1988, Process for producing magnesium oxide, U.S. Patent No. 4720375, January.

3. AKARSU A, 2004, The Research of Obtaining High Purity MgO from Icel-Yavca Dolomite, Cukurova University, Ph. D. Thesis, Adana, Turkey.

4. ALKATTAN M., OELKERS E.H., DANDURAND J.L., SCHOTT J., 1998, An experimental study of calcite and limestone dissolution rates as a function of pH from -1 to 3 and temperature from 25 to 80 o C, Chemical Geology, 151, 199-214.

5. DING Y., ZHANG G., WU H., HAI B., LIANGBIN W., QUIAN Y., 2001, Nanoscale magnesium hydroxide and magnesium oxide powders : Control over size, shape, and structure via hydrothermal synthesis, Chemistry of Materials, 13, 435-440.