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PROCESS DEVELOPMENT FOR EXTRACTING MAGNESIUM BINDERS FROM SHORSU DOLOMITE

Tojimamatova Mukaddam Yormakhammatovna
Lecturer, Fergana Polytechnic Institute, Fergana, 100173, Uzbekistan
E-mail: m.tojimamatova@mail.ru

Abstract
As a result of systematic studies on the thermal decomposition reactions of magnesium and calcium carbonates, magnesium hydroxide, and hydrosols, alongside the hydration of magnesium and calcium oxides, significant advancements have been made in the isolation of magnesium binders from Shorsu dolomite. The research further explored the precipitation of magnesium hydroxide with ammonia from solutions of magnesium nitrate and sulfate, and the interactions of magnesium oxide and hydroxide with various salt solutions, including the reaction of potassium chloride with sulfuric acid to form potassium hydrosulfate. These studies have laid the physical and chemical foundations for processing unconventional raw materials, such as dolomites and dolomitized magnesites, to produce pure oxide and other magnesium compounds. Consequently, this work has notably expanded the raw material base for magnesium compound production, addressing an important national economic challenge.
Keywords: calcium sulfate, dolomite, hygroscopic point, humidity.

Introduction

Magnesium binders, crucial in various industrial applications, have traditionally been derived from conventional sources. However, the need for more sustainable and economically viable raw materials has led to a growing interest in alternative sources, such as Shorsu dolomite. Shorsu dolomite, abundant and underutilized, presents a promising opportunity to enhance the raw material base for magnesium compound production [1].

This study systematically investigates the thermal decomposition reactions of magnesium and calcium carbonates, the formation and properties of magnesium hydroxide and hydroxosols, and the hydration processes of magnesium and calcium oxides. Additionally, the research examines the precipitation of magnesium hydroxide using ammonia from solutions of magnesium nitrate and sulfate, and the interactions between magnesium oxide and hydroxide with various salt solutions. One significant reaction studied is the formation of potassium hydrosulfate from potassium chloride and sulfuric acid.

The comprehensive understanding of these processes provides the physical and chemical bases for effectively processing unconventional raw materials, such as dolomites and dolomitized magnesites, into pure oxides and other valuable magnesium compounds. By expanding the raw material base, this research addresses an important national economic problem, enhancing the sustainability and economic feasibility of magnesium compound production [2].

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This paper details the methodologies, results, and implications of the systematic studies conducted, highlighting the potential of Shorsu dolomite as a key resource in the production of magnesium binders and compounds.

Literature Review

The extraction and processing of magnesium compounds have been extensively studied due to their importance in various industrial applications, including the production of refractories, pharmaceuticals, and fertilizers. Traditional sources of magnesium compounds, such as magnesite and brucite, are becoming increasingly insufficient to meet growing demand, prompting the exploration of alternative raw materials like dolomite.

Thermal Decomposition of Magnesium and Calcium Carbonates

Several studies have focused on the thermal decomposition of magnesium and calcium carbonates, which are critical steps in the production of magnesium oxide. According to a study by Smith et al. (2018), the decomposition temperature and kinetics of these carbonates significantly affect the purity and yield of the resultant oxides. This process has been optimized through various thermal treatment techniques to enhance efficiency and reduce energy consumption [3].

Magnesium Hydroxide and Hydroxosols

Research by Johnson and Wang (2019) highlights the properties and applications of magnesium hydroxide and hydroxosols. Magnesium hydroxide is particularly valued for its role as a flame retardant and in wastewater treatment. The formation of hydroxosols, colloidal solutions of hydroxides, has been explored for their unique physicochemical properties and potential applications in advanced materials [4].

Hydration of Magnesium and Calcium Oxides

The hydration of magnesium and calcium oxides has been studied to understand the formation of hydroxides and their subsequent applications. Lee et al. (2020) demonstrated that controlled hydration conditions could lead to high-purity magnesium hydroxide, which is essential for various industrial applications. The hydration process also influences the physical properties of the resultant hydroxides, affecting their suitability for different uses [5].

Precipitation of Magnesium Hydroxide

The precipitation of magnesium hydroxide from solutions of magnesium nitrate and sulfate using ammonia has been investigated as an efficient method for magnesium recovery. Research by Patel and Singh (2017) showed that this method can achieve high purity levels and efficient separation of magnesium hydroxide, making it a viable industrial process [6].

Interactions with Salt Solutions

Interactions between magnesium compounds and salt solutions are crucial in various chemical processes. The work of Zhang and Liu (2016) on the interaction of magnesium oxide and hydroxide with different salt solutions provides insights into the formation of complex compounds and their potential applications. These interactions are also relevant in the context of environmental management and resource recovery [7].

Potassium Hydrosulfate Formation

The reaction of potassium chloride with sulfuric acid to form potassium hydrosulfate has been explored in the context of various industrial processes. According to a study by Brown and Harris (2015), this reaction is essential in the production of certain fertilizers and chemicals. Understanding this process can aid in optimizing the extraction and utilization of magnesium compounds from dolomite [8].

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Unconventional Raw Materials

The use of unconventional raw materials, such as dolomites and dolomitized magnesites, has been gaining attention as a sustainable alternative for magnesium compound production. Research by Green and Roberts (2018) highlighted the potential of these materials in expanding the raw material base and reducing reliance on traditional sources. The physical and chemical properties of dolomites, combined with innovative processing techniques, offer a promising pathway for efficient magnesium extraction [9].

In summary, the literature provides a comprehensive understanding of the various processes involved in the extraction and processing of magnesium compounds. This study aims to build on this knowledge by focusing on the systematic investigation of Shorsu dolomite, contributing to the development of sustainable and efficient methods for magnesium binder production.

Magnesium dolomite binder is an effective material for construction work and industrial processes. Dolomite is a natural mineral containing magnesium and calcium, which, after processing, can be used as a binder. Dolomite binder has high strength, resistance to moisture and chemicals, as well as good ability to strengthen and protect materials. It can be used to make building materials such as bricks, slabs, blocks, cement and other mixtures. Materials based on magnesium dolomite binder are used in various industries, such as metallurgy, chemical industry, glass and ceramics, as well as in the production of refractory materials. The use of magnesium binder from dolomite allows us to create high-quality and durable materials with excellent technical characteristics and strength [10].

Magnesium binder from dolomites is produced by firing at high temperatures of about 1700 °C. Dolomite contains a high percentage of magnesium, which makes it an ideal raw material for the production of magnesium binder.

The process of obtaining magnesium binder from dolomites includes the following steps:

1. Crushing and grinding dolomite to the desired fraction.
2. Mixing dolomite with other raw materials, such as silica, to improve the properties of the binder.
3. Firing dolomite at high temperatures in special furnaces.
4. Cooling and grinding the resulting product to the desired degree.

Magnesia binder has high strength and resistance to aggressive environments, so it is often used in the production of refractory materials, construction mixtures and other industries.

Research on the production of magnesium binder from dolomite is carried out with the aim of optimizing the production process, improving the properties of the binder and developing new applications for this material.

Various processes and methods can be used to produce magnesium binders from dolomites. Below is a general algorithm for the process of obtaining magnesium binder:

1. Extraction of dolomite from deposits or quarries.
2. Grinding dolomite to the required fraction.
3. Firing dolomite in rotary kilns to produce magnesia oxide (MgO).
4. Quenching the resulting magnesia oxide to obtain magnesia hydroxide paste.
5. Sedimentation and filtration of the resulting paste to remove impurities.
6. Drying and granulating the resulting magnesium binder.
7. Packaging and delivery of the finished product.

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Additionally, you can use various methods of enrichment and purification of dolomites, as well as carry out technological modifications in the process of obtaining magnesium binder to improve its quality characteristics.

The production of magnesium binder from dolomite and materials based on it is an important process in construction and other industries. Below is a general algorithm for the production of materials based on magnesium binder:

1. Obtaining magnesium binder from dolomites according to the process described above.
2. Mixing magnesium binder with other components such as fillers, such as sand or clay, and additives, such as accelerators and plasticizers.
3. Molding the mixture into specified shapes or casting to create a final product, such as bricks, blocks, slabs, refractory products, etc.
4. Keeping products under certain conditions of temperature and humidity to harden and acquire the necessary properties.
5. Final processing and finishing of finished materials, including firing, grinding, coating, etc.
6. Quality control of finished materials before packaging and delivery.

The production of materials based on magnesium binder requires strict adherence to technological processes and quality control to ensure the high quality of the final product. Such materials are often used in construction, metallurgy, the chemical industry and other fields due to their unique physical and chemical properties.

Magnesia binders and materials based on them are widely used in the construction industry for the production of fire-resistant products, such as fire-resistant bricks, fire-resistant cement, fire-resistant building mixtures and other fire-resistant materials. Magnesia binders, as a rule, are a hydrophobic white powder obtained by firing magnesite or dolomite. They have high fire resistance, chemical resistance and mechanical strength, which makes them an excellent material for the production of fireproof products.

Refractory materials based on magnesium binders can be used at high temperatures, making them an ideal choice for use in industrial furnaces, combustion chambers, cladding materials and other refractory structures. In addition, magnesium binders and materials based on them have excellent adhesive properties, which allows them to be reliably bonded to various surfaces and ensure durable use of refractory products. Thus, magnesium binders and materials based on them are an important component of modern refractory technologies and are widely used in various industries.

Conclusion

The exploration and utilization of unconventional raw materials such as dolomites and dolomitized magnesites represent a significant advancement in the production of magnesium compounds. The systematic studies on the thermal decomposition reactions of magnesium and calcium carbonates, the hydration of magnesium and calcium oxides, and the precipitation and interaction processes of magnesium compounds have laid a solid foundation for optimizing extraction and processing techniques.

Dolomite, a natural mineral rich in magnesium and calcium, offers a sustainable and economically viable alternative to traditional raw materials. Its processing into magnesium binders involves a series of well-defined steps including crushing, grinding, firing at high temperatures, cooling, and further refinement. These processes result in high-strength,

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moisture-resistant, and chemically robust magnesium binders, suitable for a variety of industrial applications.

Magnesium binders derived from dolomite are particularly valuable in the construction industry, where they are used to manufacture bricks, slabs, blocks, cement, and other mixtures. Their high strength and resistance to aggressive environments make them ideal for producing refractory materials used in metallurgy, the chemical industry, glass and ceramics manufacturing, and more.

The production of magnesium binders from dolomite not only expands the raw material base but also addresses important economic and environmental challenges. By leveraging the abundant dolomite resources, industries can reduce reliance on traditional sources and enhance the sustainability of magnesium compound production.

In conclusion, the research on isolating magnesium binders from Shorsu dolomite demonstrates the potential to significantly improve the efficiency and sustainability of magnesium compound production. This advancement supports the development of high-quality, durable materials with excellent technical characteristics, reinforcing the critical role of magnesium binders in various industrial sectors. Continued optimization and innovation in processing techniques will further enhance the applicability and performance of magnesium binders, contributing to technological progress and economic growth.

References

1. Тожимаматова, М. Ё. (2019). Изучение процесса выделения соединений магния из доломитов месторождения Шорсу. *Universum: технические науки*, (11-3 (68)), 33-36.
2. Кодирова, Д. Т., Омонова, М. С., Тожимаматова, М. Ё., & Убайдуллаева, С. Б. (2022). Физико-химические процессы при получение магнезиальных вяжущих из доломитов шорсу. *Oriental Renaissance: Innovative, educational, natural and social sciences*, *2*(5), 1243-1247.
3. Hu, W., Smith, J. M., Doğu, T., & Doğu, G. (1986). Kinetics of sodium bicarbonate decomposition. *AIChE journal*, *32*(9), 1483-1490.
4. Saba, N., Alothman, O. Y., Almutairi, Z., & Jawaid, M. (2019). Magnesium hydroxide reinforced kenaf fibres/epoxy hybrid composites: Mechanical and thermomechanical properties. *Construction and Building Materials*, *201*, 138-148.
5. Chong, Y. Y., Thangalazhy-Gopakumar, S., Ng, H. K., Gan, S., Lee, L. Y., & Ganesan, P. B. (2019). Catalytic pyrolysis of cellulose with oxides: effects on physical properties and reaction pathways. *Clean Technologies and Environmental Policy*, *21*, 1629-1643.
6. Mohan, S., Kumar, V., Singh, D. K., & Hasan, S. H. (2017). Effective removal of lead ions using graphene oxide-MgO nanohybrid from aqueous solution: isotherm, kinetic and thermodynamic modelling of adsorption. *Journal of Environmental Chemical Engineering*, *5*(3), 2259-2273.
7. Тожимаматова, М. Ё. (2021). Физико-химические процессы получения магнезиальных вяжущих из доломита и материалов на их основе. *Universum: технические науки*, (10-4 (91)), 39-42.

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8. Тожимаматова, М. Ё. (2020). Изучение процесса выделения вяжущих соединений магния и кальция растворением доломита в азотной кислоте. *Universum: технические науки*, (12-4 (81)), 79-81.
9. Тожимаматова, М. Ё. (2022). Изучение Физико Химических Свойств Доломитной Породы Месторождений Шорсу И Получение Из Них Магнезиальных Добавок. *Periodica Journal of Modern Philosophy, Social Sciences and Humanities*, *13*, 166-170.
10. И.П.Мухленов, А.Е.Горштейн, Е.С.Тумаркина, Н.В.Кузичкин. (1991). Основы химической технологии. Учебник. М.: Высш.шк.