Discussion on the development trend of inorganic nonmetallic material industry

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Abstract: In the new era, social and economic development has led to the transformation and development of high-tech industries, and many new scientific and technological products have emerged. The development of various industries cannot be separated from the support of new materials. This paper describes the development of inorganic non-metallic materials, the main classification, analysis of the current development and application situation, combined with the development of inorganic non-metallic materials in the problems, to explore the future development trend.

Key words: inorganic nonmetallic materials; Industry; Development trend

Introduction

In the frontier of scientific research, materials, information and energy are the core elements of the development of modern science and technology. In the field of materials science, inorganic non-metallic materials occupy an important position. As a new type of material obtained from the processing of silicate materials, inorganic non-metallic materials with their unique characteristics are widely used in communication technology, construction production, intelligent industry and other fields. Among them, some new inorganic non-metallic materials have unique functions and uses, and play an important role in national economic construction and development.

1. The development history of inorganic non-metallic materials

Inorganic non-metallic materials after a long-term development process, the early appearance of cement, ceramics, glass and other materials. After the industrial revolution, the transportation industry, steel industry, mechanical production industry, and construction industry have developed rapidly in the world, which has spawned a more diversified inorganic non-metallic materials and formed a more detailed classification. Ceramics include metal ceramics, chemical ceramics, electric porcelain, etc.; The glass category includes optical glass, chemical instrument glass, flat glass, and graphite, carbon and other materials. After the 20th century, a large number of emerging technologies have emerged in various industries, and the performance requirements of materials in all aspects have been continuously improved. Inorganic non-metallic materials with high hardness, high strength, oxidation resistance, high temperature resistance and other characteristics, are used in biological, aerospace, industrial fields. At present, some high-tech fields in the continuous research and development and launch of new materials, but in the application and promotion of some problems, still can not fully meet the needs of modernization, only timely upgrading and improving technology, in order to improve the application value of new materials, to promote the development of China's industrial modernization.

2. Classification of inorganic non-metallic materials

(1) Semiconductor materials

Semiconductor materials have special physical and chemical properties, and the conductivity of this material is inversely proportional to the temperature change, which is widely used in the integrated circuit industry. Many materials have the characteristics of semi-conductivity, such as Se, Ge, Si, the latter two are mostly used in the industrial field, phthalocyanine, sphalerite and other compound materials also have semi-conductivity, due to the low cost of semiconductor basic materials, providing conditions for the promotion of material technology. In the preparation and processing of semiconductor materials, personnel can prepare thin film materials and single crystals according to different needs, combined with the requirements of electronic integrated application materials, accurate control of purity and ensure service life. At present, through the research and development and promotion of nanoscale semiconductor materials, relevant personnel can continuously improve the integration level of electronic chips and promote the development of the communication industry.

(2) Crystal materials

Based on the characteristics of the arrangement of crystal cells, crystal materials are mainly polycrystalline and single crystal two types, typical polycrystalline compounds are glass and ceramics, common elemental materials are silicon plate and diamond. Due to the regularity of internal particle arrangement, the physical and chemical properties of crystal materials are extremely stable, and personnel can use the way of laboratory culture to promote crystal growth and promote the innovation and development of material science. In terms of functional properties, there are great differences between different crystal materials, including optical properties and electrical conductivity, which provides the possibility for technological innovation in various fields. Take special BGO crystal materials as an example, after the internal high-energy particles and X-ray collision, with luminous characteristics, support a variety of environmental ray signal detection, in the fusion circuit processing, photoelectric conversion and other ways, BGO crystals in the industrial, physical and medical fields show strong application value.

(3) silicate material

The main advantages of silicate materials are reflected in the hardness, the common materials are ceramics, glass-ceramics, glass. In the molecular structure, the silicate material inside the stable arrangement of oxygen atoms and silicon atoms, the whole structure is tetrahedral shape, in combination with a variety of elements, will produce different uses of silicate materials. Due to the high degree of molecular combination, compared with metal materials, silicate materials corrosion resistance, pressure resistance is outstanding, personnel can use microcrystallization treatment, enhance its conductive and optical properties, replace traditional materials. Cement based on silicate materials will produce a higher hardness of the gel structure, and better insulation.

(4) New materials

In the field of inorganic non-metallic materials, there are some new materials, such as photosensitive materials suitable for photoelectric display, high-purity silicon materials suitable for new communication equipment, superhard materials suitable for mechanical products, these materials and common organic matter and metal are obviously incompatible. Compared with metal bearings in traditional mechanical products, superhard materials have superior wear resistance, experience long-term mechanical production friction, but also with a unique structure, to maintain a smooth surface.

3. Development and application of inorganic non-metallic materials industry

In the era of rapid progress and update of modern science and technology, China has vigorously introduced support policies, constantly improve the inorganic non-metallic materials industry system, support enterprises to expand the scale, research and development of more new materials, achieve standardized development, and improve the suitability of industry output and social needs. Through the research and development and promotion of new materials, China will accelerate the pace of green sustainable development and reduce the pressure on resources and energy. At present, many new materials and special materials have entered the production process, which will provide impetus for social and economic development.

(1) Application in the field of construction engineering

In the field of construction engineering, materials such as ceramics, cement and coatings are used in a wide range and high frequency, which is of extraordinary significance to the development of the construction industry. In the use of building ceramics, the new ceramic material as a whole is composed of coarse aggregate and particle form, which is suitable for the construction of external walls, which can not only stabilize the building bearing structure, but also show superior thermal insulation and thermal insulation performance on the basis of achieving energy saving and environmental protection goals. Compared with the traditional cement needs to consume a lot of energy, the new cement material to support the secondary processing, not only to ensure economic benefits, but also to maintain good water permeability function, to meet the needs of sponge city construction. On the construction coating, the inorganic non-metallic material of diatomaceous earth is integrated, which has stronger adsorbability, and the personnel only need to brush one layer to achieve good results.

(2) Applied to the field of national defense equipment

Inorganic non-metallic materials show strong advantages in the construction of national defense equipment. In the construction of national defense, common material materials include ceramics, artificial crystals and inorganic fibers, which improve the safety of equipment. In the fields of laser, communication, electronic countermeasures and ballistic guidance, artificial crystal materials have high application value. Ceramics are widely used in remote sensing systems and aero engines because of their flexibility and tolerance. New materials based on quartz glass and rare earth materials are widely used in the field of spacecraft, aircraft and aviation glass.

(3) It is used in the field of smart industry

At present, inorganic non-metallic materials have changed the development pattern of traditional microelectronics. In the field of microelectronics design, based on the support of glass ceramic materials, electronic equipment can not only maintain a stable operating state in high temperature environment, but also extend the service life. Currently, artificial intelligence requires the support of a variety of sensor devices. Sensing parts based on composite oxidized inorganic materials have enhanced recognition and sensing ability and alarm detection function. In the field of medical repair, resin materials have a polymer structure, stronger robustness and plasticity, will reduce rejection phenomenon, more suitable for human needs. In the field of smart industry, inorganic non-metallic materials with the advantages of ductility, stability, precision, etc., make the sealing effect of equipment stronger and enhance the practical value of equipment.

4. The problems existing in the development of inorganic non-metallic materials

In the process of the development of new inorganic non-metallic materials, there are still some technical bottlenecks, and domestic personnel need to clarify the next research and development direction. First of all, inorganic non-metallic materials are related to the transformation and development of many industries, which requires new materials to have mass production conditions, and material quality and grade to meet modern production and application standards. Secondly, in terms of material type, the types of inorganic non-metallic materials are not rich enough, especially the materials required for some advanced products, still need to be imported from abroad, and it is difficult to achieve comprehensive research and production. Especially in the field of power design and production, circuit equipment needs to be configured with electromagnetic shielding glass, but domestic shielding glass production is difficult to reach a higher level, unable to meet the needs of high-tech industries. In addition, in the current production process, although China's inorganic non-metallic material preparation process is becoming more and more perfect and advanced, it still needs to consume a lot of energy, and it is difficult to adapt to the concept of sustainable development and green development. Taking the field of construction engineering as an example, the demand for cement materials in modern construction projects is increasing, but the current resource application planning lacks science, and it is easy to waste resources.

5. The development trend of inorganic non-metallic materials industry

(1) Greening

In the context of the dual-carbon strategy, the development of various industries needs to adhere to the concept of sustainable development and control the environmental impact of project construction within a reasonable range. In the research and development of new material technology projects, relevant personnel should adhere to the principle of green development, low carbon energy saving, from a multi-disciplinary, all-round start, research the preparation technology and green production process of coordinated development of the environment, so as to replace harmful and toxic elements, harmless treatment of harmful liquids, recycling waste. In order to change the development of the traditional inorganic non-metallic materials industry, the industry should establish the scientific concept of development of "comprehensive, coordinated and sustainable development", coordinate the relationship between the production environment and the production pollution of inorganic non-metallic materials, research and development of new manufacturing and synthesis processes, and reduce pollution energy consumption; Through the research and development of waste gas scientific treatment technology, adjust the use of mineral resources structure, reduce production energy consumption, improve product performance, create a high output, low energy consumption of new material production system, promote the industry to the green direction of development. For example, in the construction of modern smart cities, people can improve the technical level of inorganic non-metallic materials recycling to create more ecological cement products.

(2) Low-dimensionalization

From a macro point of view, low-dimensionalization refers to the development of material quality structure to fibrosis and film. In photonics, optoelectronics, microelectronics equipment, small parts need to meet the integration needs, the volume of each part is shrinking at the same time, to undertake more and more complex functions, the current inorganic non-metallic materials have been difficult to keep up with advanced technology needs. In order to meet the high integration needs of current information function products, industry personnel should increase technology research and development efforts, actively connect with domestic and foreign technologies, design thinner and smaller materials, and promote the development of new materials to the direction of low dimension. At the same time, the functions of information function equipment in the new era are increasingly diversified, which requires industry personnel to use material films and coatings to change the performance of structural materials, such as wear resistance, toughening, strengthening and so on. For example, in the development of microelectronics industry, through the research and development and application of thin film materials, relevant personnel can improve the precision of microelectronics and improve the level of light signal modulation.

(3) Compounding

Composite refers to the personnel by integrating other materials with inorganic non-metallic materials, to increase the function of new materials. In the process of industry development, personnel should be based on the industry's new demand for materials, clear research and development direction and objectives, bring together the advantages of the three categories of materials, build a multi-interactive technical model, and promote the development of inorganic non-metallic materials to the direction of composite. With the continuous reduction of the composite size of the material, it will reach the molecular and nano levels, and adapt to the needs of more complex high-tech industries, such as the hybrid composite materials based on salivary, nanowires and sensitized dyes, which are suitable for solar cells; Based on organic molten salt and carbon nano materials, with high electrical conductivity.

(4) Intelligentization

In the era of digitalization and artificial intelligence, many new sensor and control systems have appeared in the social field, and the research and development of new materials urgently needs to develop in the direction of intelligence, and needs to have the characteristics of sensitive acceptance of external environmental changes to achieve rapid feedback. At present, some mature intelligent materials are widely used in ferroelectric ceramic equipment and multi-piece piezoelectric equipment by virtue of non-metallic material characteristics, and the sensing signal function and feedback operation function are independent of each other. At present, based on the needs of intelligent building and intelligent industry, industry personnel should prepare monomer intelligent materials by combining materials with different functions, so that it can develop in a highly intelligent direction and meet the needs of intelligent construction in various industries.

6. Conclusion

In summary, from the physical and chemical characteristics of the performance of the composite, polymer inorganic non-metallic materials show a broad application prospects, different industries can integrate it with the existing processing and production technology, promote modern technological innovation and development, reduce production and operation costs, improve economic benefits. Industry personnel conform to the trend of social development, through strengthening the research and development of new materials technology, to promote the inorganic non-metallic materials to green, low-dimensional, compound, intelligent direction of development, for the whole society of high-tech industry development and national economic development contribution.

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