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CHARACTERISTICS OF COMPOSITE POLYMER MATERIALS AND COATINGS.

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Abstract: Composite polymer materials and coatings are currently widely used in various industries due to their highly effective mechanical, chemical and physical properties. These materials are often a combination of polymers and other components to achieve optimal performance characteristics such as high strength, corrosion resistance and wear resistance. Composite polymer materials have a number of advantages, including lightness, low production costs and the ability to create specialized coatings for protection from external influences.

Keywords: Composite polymer materials, Polymer coatings, Mechanical properties, Corrosion resistance, High strength, Protective coatings, High performance properties, Construction materials.

Main part: Composite polymer materials and coatings are one of the most important and promising areas of modern materials science. They are distinguished from other traditional materials by their unique properties. The main parts provide detailed information on the composition, production processes and main characteristics of composite materials and coatings.

1. Composite materials and their composition: Composite materials are created by combining two or more components. They consist of the following components: Matrix-Composite is the main part of the materials and consists mainly of polymers. The matrix maintains the shape of the material and provides its strength; Fillers are usually fibers (for example, carbon, aluminum or glass fibers) that improve the mechanical properties of the material. Fillers provide strength, dimensional stability and other special properties of the material. Composite materials are created using various manufacturing processes, such as molding, pressing, working with thermoplastic or thermosetting polymers.

2. Characteristics of composite polymer materials: Composite polymer materials have high strength and durability, and are characterized by the following main characteristics: a). Lightness and high strength: Polymer composites are often light and they have high strength. Thus, they are widely used in the automotive, aviation, and space industries. b). Corrosion resistance: Polymer composites are generally resistant to water, chemicals, and other external influences. These properties allow them to be used in harsh conditions and aggressive environments. v). Thermal insulation: Polymers retain heat well, and composite materials can be produced using special polymers designed to work at high temperatures. c). Flexibility: Composite materials can be made into different shapes and sizes, which allows them to be used in many industries.



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3. Composite coatings and their properties: Polymer coatings are mainly used to protect the surface of materials. They protect materials from corrosion, chemical effects and other external factors. The main features of composite coatings are: Protective Properties: Composite polymer coatings are effective in protecting metallic materials from corrosion. Such coatings are used in processing in harsh environments, for example, in marine conditions.

Insulation: Polymer coatings are used as thermal and electrical insulators. This allows them to be widely used in the electrical and electronics industry.

Aesthetics: Composite decking comes in a variety of color and texture options and is also used for design purposes.

4. Fields of application of composite materials and coatings: Composite polymer materials and coatings are used in many industries. Their most common areas are: Composite materials are widely used in aviation and space because they are light and strong. These materials are used in aircraft construction, rocket parts and other aerospace equipment. In the automotive industry, composite materials are widely used due to their lightness and high strength. This, in turn, improves the fuel efficiency of vehicles. Composite materials are used in the construction of buildings and other structures, especially because they are resistant to temperature and corrosion. Polymer coatings are used as protective coatings for electronic devices, and are also widely used due to their insulating properties.

The production of composite polymer materials and coatings is carried out through various technologies. These methods allow controlling the properties of materials, including mechanical strength, corrosion resistance, thermal and electrical conductivity. Below are the main methods of manufacturing composite polymer materials:

The molding method is one of the most common methods in the production of composite materials. In this method, a polymer matrix and fillers (such as glass or carbon fiber) are placed in a mold and heated, then twisted or pressed under high pressure.

Pultrusion method is a continuous process of manufacturing composite materials. In this method, fillers and polymer matrix are combined and passed in the form of a tube or profile. When the materials are converted into composites, they are processed automatically, the advantage of this method is that the production process is very efficient and economical. The pultrusion method is mainly used in the production of pipes, profiles and other structural materials.

The vacuum infusion method is a low-pressure method of manufacturing composite materials, in which the filler materials and the polymer matrix are combined under vacuum pressure. In this method, the materials have a hard and precise shape, high strength and good corrosion resistance. The vacuum infusion method is a widely used and very effective method, especially in the production of large devices, ships and aerospace equipment.

Composite polymer materials and coatings are increasingly important in today's industry and technology. The high mechanical, chemical and physical properties of these materials make it possible to use them in many fields. Composite polymer materials are



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widely used in various branches of industry and technology due to their lightness, strength, corrosion resistance and good insulation properties.

Manufacturing methods such as molding, prepreg technology, pultrusion, vacuum infusion, and 3D printing ensure high quality of composite materials and coatings. Each method has its own advantages, which make it possible to use them effectively and economically in various industries.

Composite materials and coatings are especially effective in aviation, automotive, construction, electronics and other high-tech industries. Not only do they extend the life of materials, but they can also be environmentally sustainable because of greater recyclability and energy efficiency. The importance and future of composite polymer materials and coatings in the industry is huge. Their high mechanical and chemical properties, lightness and durability make them ideal materials for use especially in automotive, aviation, construction, shipbuilding, and other high-tech industries. However, it will be appropriate to discuss some important aspects of them. As composite polymer materials are especially plastic-based materials, their environmental impact and environmental issues are of serious concern. Polymeric materials do not degrade naturally and can remain in the environment for long periods of time. Therefore, development of processing technologies of composite materials and creation of environmentally sustainable options is an urgent issue. Although composite materials production methods such as prepreg technology, vacuum infusion or pultrusion are effective in obtaining high quality materials, sometimes the production processes can be very complex and expensive. New technologies, especially automated and optimized production processes, must be developed. Although composite polymer materials are designed for long-term performance in many applications, in some cases the durability of the materials may be limited. For example, they may be sensitive to certain chemicals or high temperatures. Therefore, it is necessary to better understand and modify the factors affecting the long-term performance of materials. This, in turn, makes it possible to ensure production processes and the length of the useful life of materials.

Conclusion: Composite polymer materials and coatings have become one of the integral parts of modern industry with their high mechanical, chemical, and physical properties. They are light, durable, corrosion resistant and have high performance characteristics and are widely used in automotive, aviation, construction, shipbuilding and other industries. The processing and production of polymer materials through new technologies offers many useful opportunities. In the future, composite materials will have higher quality and their use in various industries may expand. They play an important role in ensuring not only strength, but also environmental stability. Therefore, the development of the field of composite materials and coatings will help to meet the new needs of the industry, and their importance is expected to increase in the future.

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