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COMPOSITE MATERIALS

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People began to use composite materials even in ancient times, mainly for construction, mixing various natural materials, such as clay and straw.

Over time, composite production technologies have improved significantly. Currently, composite materials are widely used in various sectors of human life. Composites are especially actively used in mechanical engineering, robotics, automotive and construction. According to experts, the use of composites will significantly improve existing technological processes and create qualitatively new and sophisticated industrial engineering products.

Composite materials are defined as substances made up of two or more components that differ in chemical composition and structure, exhibiting distinct properties (such as components that are insoluble or only minimally soluble in one another), and are separated by a clear boundary within the material. All composite materials can be divided into two types by origin: natural and artificial. Examples of natural ones include plant trunks and stems, bones, skin, and almost all types of tissues in a human's body.

All composite materials consist of matrices and fillers. A matrix is a component that binds materials, it is the constituent part that allows to make a product of the required shape, and it also distributes the load on the filler. Filler is high-strength fibers or fabrics that give rigidity to the structure, with appropriate content in the composite, they contribute to an increase in the strength of the material by 2 to 10 times or more compared with the strength of the matrix [1].

Composite materials are already showing significant advantages over traditional ones such as steel, aluminum and wood. Carbon fiber plastics (carbon composites) are especially popular in the engineering industry.

Carbon fiber plastics, unlike conventional materials, are characterized by the following unique qualities that advantageously have made it an indispensable material in mechanical engineering: high strength combined with low weight, resulting in a reduction of the final product's mass; resistance to vibration, as carbon fiber effectively dampens vibrations; outstanding corrosion resistance, leading to an extended service life; capability to endure high temperatures, broadening their range of applications.

New composites are currently under active development. The research workers put their efforts to enhance the strength, stiffness, and wear resistance of these composites by incorporating innovative fillers and matrices. This will make it possible to create materials that can withstand higher loads compared to traditional materials. Today, innovative self-healing and adaptive composites are being developed that can change their properties in response to external influences [1].

The unique combination of strength, lightness and resistance to external influences allows composites to be used in a wide variety of industries. In the near future, a number of significant areas of development can be identified in the field of composite materials development, one of which is 3D printing. 3D printing is used to create complex shapes and structures from composites; it speeds up the production process and reduces costs substantially.

The secret of 3D printing technology lies in the unique heat treatment of the product. After printing, the part is coated with magnesium oxide powder and heated to a temperature close to the melting point of the material. This allows you to glue the layers together, eliminating weaknesses. As a result, the parts are 20-30% stronger than with conventional methods. Thanks to this technology, it is possible to create high-strength parts for mechanical engineering faster.

References

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