THE REINFORCEMENT OF COMPOSITE MATERIALS WITH NATURAL ORGANIC FIBERS

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Abstract. Composite materials are materials that are made of two or more components and have a definite boundary between them. Fiber-reinforced metals are composite materials with reinforcement in the form of fibers with a metal matrix. Metals reinforced with fibers are used in aviation and rocket technology. Therefore, this article analyzes composite materials reinforced with organic fibers.

Keywords: material, composite materials, fibers, reinforcement, metal, matrix, carbon fibers, oxidation.

Composite materials have different properties compared to traditional construction materials. This has led to the creation of materials and structures with positive properties [3, 27-29]. Composite materials are complex materials made up of two or more constituents-components, which are connected in different ways and have their own properties.

As reinforcing fillers of metal-based fibrous composite materials, fibers and thread crystals of pure elements or difficult-to-dissolve compounds (B, C, Al2O3, Si C) are used. The properties of fiber composite materials depend on the testing scheme.

All composite materials perform well on cyclic loads. The strength of composite materials depends more on the degree of connection and integration of fibers with the matrix. The connection between the matrix and fillers can be different.

The strong bond between the fibers and the matrix of metal-based composite materials depends on their interaction and the degree of formation of a very thin (1-2 μm) intermetallic phase [1, 49-50].

Composite materials have the following set of properties:

- The composition, form and distribution of components are predetermined;
- They consist of two or more chemically different materials and are separated from each other;
- The properties of the composite material are determined by the properties of each component;
- The properties of the composite material differ from the properties of the constituents;
- The composite material is homogeneous on the macroscale, but not homogeneous on the microscale;
- This material is not found in nature and is an invention of man [6, 18-19].

Depending on the nature of the components, composite materials are divided into the following four groups:

1. Contains metal or metal alloy;
2. Contains inorganic compounds of oxides, carbides, nitrides;

3. It contains non-metallic elements, carbon, boron and xylic components;
4. The components are composed of a combination of organic substances (epoxy, polyester, phenolic, etc. resins) [5, 34-35].

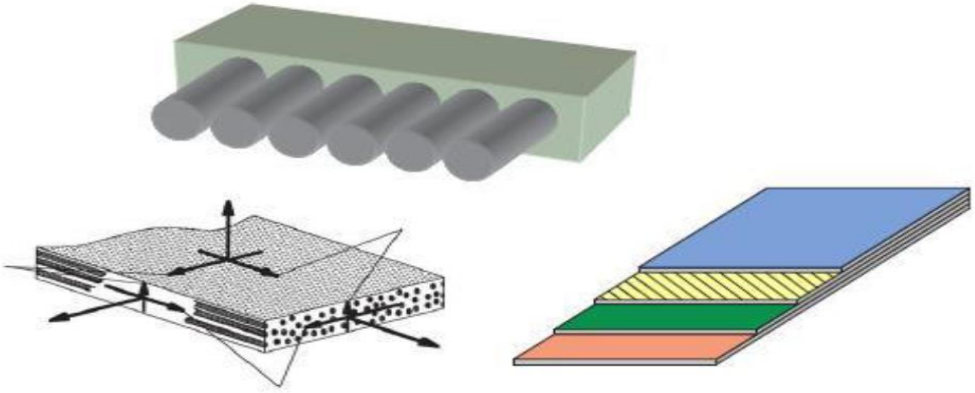

Figure 1. Schematic structure of composite materials

Composite materials have a much higher relative stiffness (E/r) and relative precision (σv/p) than modern construction materials.

The modulus of elasticity of the composite material can be increased in the desired direction by carefully placing it in that direction. The reliability of composite materials is also high. In ordinary alloys, cracking and its growth occur quickly during operation. In a composite material, cracking starts in the matrix. It can't grow because it's stuck in the filler on the road.

The volume of reinforcement in composite materials is 20-80%. The properties of the matrix determine the strength of the composite material in compression and shear. The properties of the reinforcement determine the strength and integrity of the composite material. The strength of metals and metal alloys can be increased, if a few percent of very hard inert substance are evenly distributed in them.

This dispersed phase can be metallic or non-metallic. Oxides are often used for this purpose. As in previous cases, refinement is achieved in dispersion solidification, in this case, refinement is achieved as a result of the interaction of dispersion particles with dislocations in the matrix [2, 43-44].

In this case, the polishing effect is not the same as in dispersion hardening. However, in the considered method, the concentration is maintained in the temperature body for a long time, because when choosing the dispersed particles, their lack of interaction with the matrix material is taken into account. For dispersion-harden able alloys, the effect of increasing the fineness can be reduced during high-temperature processing due to the dissolution of precipitated particles or the separated phase.

The strength of nickel alloys at high temperatures can be practically increased if 0.3% thorium oxide (ThO2) is added as fine dispersed particles. This material is known as dispersed thorium (abbreviation TD). A similar effect is observed in the aluminum-aluminum oxide system. Very small (thickness 0.1-0.2 μm) aluminum flakes (flakes) are formed on the surface of very finely ground aluminum oxide and disperse into the aluminum matrix. The name of this material is sintered aluminum powder (abbreviation SA' - sintered aluminum powder).

From the point of view of modern technology, composite materials consisting of dispersed phase fibers are the most important. The purpose of using fibers for reinforcement is to

reduce weight by increasing strength or stiffness. A quantitative measure of this effect is the amount of relative strength and relative modulus of elasticity. Composite materials are also found in nature. For example, wood is made up of strong and tough cellulose fibers that are held together by a soft medium called lignin. Bones are also compositing of strong but almost soft collagen and hard brittle mineral matter.

Fiber-reinforced metals are composite materials with reinforcement in the form of fibers with a metal matrix. Boron, carbon fibers, fibrous crystals of hard-to-liquefy compounds, tungsten or steel wires perform the sealing service. The matrix material is selected taking into account the function of the composite material (corrosion resistance, oxidation resistance). As a matrix, light and plastic metals (aluminum, magnesium) and their alloys are used. The number of reinforcements by volume is 3-50%. Metals reinforced with fibers are used in aviation and rocket technology.

Fiber reinforced composites and their use. Wires are the cheapest universal testing material. It is used for details obtained from steel and beryllium. Wires made of tungsten and molybdenum at medium and high temperatures.

Carbon fiber. These are derived from polyacrylonitrile hydrocellulose fiber or petroleum resin-based fibers. The technology of obtaining carbon fibers is based on the decomposition of organic primary fibers under the influence of heat. Heating is carried out in a controlled atmosphere.

The production of carbon fibers consists of the following operations:

1. Oxidation;
2. Carbonization;
3. Graphitization.

Fibers are carried out at 200-3000C. Carbonization takes place above 9000C in a hydrogen atmosphere. It is given the property of stability to the grass, above 25000C, carbon fiber is formed.

Obtaining composite materials with metal-based fibers. The choice of the method of obtaining composites with different matrix materials and different fibers depends on the following factors:

1. Dimensions, profile and nature of raw materials of matrices and refiners;
2. The ability to form a strong bond at the matrix-cleaner boundary;
3. Getting the fibers evenly distributed in the matrix;
4. Carrying out the processes of obtaining composite material and making details from it at the same time.
5. Economic efficiency of the process.

Conclusion. Taking all the data based on composite materials into account, it can be concluded that, composite materials consisting of dispersed phase fibers are the most important. The purpose of using fibers for reinforcement is to reduce weight by increasing strength or stiffness. A quantitative measure of this effect is the amount of relative strength and relative modulus of elasticity. Boron, carbon fibers, fibrous crystals of hard-to-liquefy compounds, tungsten or steel wires perform the sealing service. The matrix material is selected taking into account the function of the composite material (corrosion resistance, oxidation resistance). As a matrix, light and plastic metals (aluminum, magnesium) and their alloys are used. The number of reinforcements by volume is 3-50%. Metals reinforced with fibers are used in aviation and rocket technology.

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