GENERAL INSIGHT INTO COMPOSITE MATERIALS IN SCIENCE

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ANNOTATION

The article discusses the core ideas of origins of composite materials, new ways of obtaining them to use in mechanical engineering and physical treatments to broaden scope of their application in today's world. The results of this theoretical analysis, in particular, are intended to give main insight into composite materials for students, studying in material science and business people who are having desires to introduce composite materials at the minimum low cost by taking necessary treatments in the condition of laboratory in Uzbekistan.

Keywords: *traditional materials, manufacturing processes, fracture resistant, flexural strength, structural purposes, insulation properties, thermal shock.*

АННОТАЦИЯ

В статье рассматриваются основные идеи происхождения композиционных материалов, новые способы их получения для использования в машиностроении и физических обработках для расширения сферы их применения в современном мире. Результаты этого теоретического анализа, в частности, предназначены для того, чтобы дать основное представление о композиционных материалах студентам, обучающимся в области материаловедения и деловым людям, у которых есть желание внедрить композиционные материалы с минимальными затратами путем прохождения необходимых процедур в условиях лаборатория в Узбекистане

Ключевые слова: *традиционные материалы, технологические процессы, сопротивление разрушению, прочность на изгиб, конструкционное назначение, изоляционные свойства, термоудар.*

INTRODUCTION

The development of modern technologies creates new materials with high mechanical performance compared to traditional materials, demand for elasticity and other new features. Composite materials based on polymers, ceramics and metals are among the most interesting and promising products. Polymer, ceramic, metal matrix composite materials are used more in engineering, and they are used in the absence of new technology or other materials that respond to production. Nowadays, we encounter composite materials every day, not only in technology, but also in daily practice, so it is important to know the main properties of these materials and use them correctly. Composite materials are the main class of materials that meet strict, often contradictory requirements, for example, they are used for the production of products resistant to high temperatures, mechanical forces and aggressive chemical environments. Composites can effectively compete with construction materials such as aluminum, titanium, and steel. Industries that actively use composite materials include aviation, cosmonautics, marine transport, chemical engineering, medicine, sports, tourism, and mechanical engineering. Composites are used for the production of cars, railway vehicles, airplanes, space and sea ships, yachts, submarines, special containers for storing liquids, pipes, and sports equipment. Originally developed for military use, materials were first used in aeronautics and are now being used in many industries. As a rule, the high cost of composite materials can be noted, which is related to the complexity of the technological processes and the high cost of the components used. At the same time, it should be noted that there is an opportunity to save as a result of reducing the number of technological processes, the number of components, and reducing assembly work in the production of complex structures. The complexity of composite materials production technology can be reduced by 1.5-2 times compared to metal products. In the early 80s, in the development of modern composite materials.

Figure.1 the origin of composite materials

The history of the creation of composite materials goes back to the beginning of the development of civilization. The history of man's use of composite materials has a long history, for the first time people learned the idea of composite materials from nature. The first bricks and pottery, found before 5000 BC, were considered to be complex sun-dried products. But it was observed that their shrinkage during cooking causes the product to crack. In order to prevent this phenomenon, since ancient times, sand and organic additives (such as straw, river reeds) were added to the clay-soil and a composite material was obtained.

In the territory of Uzbekistan, composites containing sand and organic additives (such as straw, river reeds) were used in the construction of ancient structures. l came In particular, more than 50 monuments such as Uzunqir, Erkurgan, Afrosiyab, Lolazor, Khoja Boston, Sangirtepa, Chordara, Kurgancha, Koktepa have been preserved. The scale of production of industrial products with added value in our country is expanding day by day. As a result, as the domestic market is filled with import-substituting products, the export potential is increasing. Undoubtedly, the projects implemented on the basis of industrial cooperation on the localization of production of finished products, components and materials are an important factor in this regard. It should be noted that many such promising projects are being successfully implemented in the building materials industry, which is one of the leading sectors of our economy. As a result, the production of a new construction material that replaces the fittings - mirror fittings has been mastered. This product, manufactured under the trademark "Arm Composit", is the result of research carried out in the framework of the Localization Program at the limited liability company "Boston Textile" in our capital.

MATERIALS AND METHODS

Composite materials are complex systems made up of components with different properties, which consist of a mixture of elastic and hard phases that provide integrity and strength. In this case, each separate component cannot fully meet all the characteristics of the composite material. It is possible to create a composite material that meets the specified requirements by collecting components that meet the optimal conditions.

This is one of the strengths of composite materials: it is possible to choose different components to provide the desired properties, creating a special material with maximum efficiency for each operating condition (for aerospace structures, boats, automobiles or electric motors). there is a possibility. In recent years, a series of artificial composites reinforced (reinforced) with inorganic fibers, fibrous crystals, and inorganic particles with high strength and hardness have been created on the basis of metals and nonmetals.

Threaded forms of various crystals, SiO2, SC, Al2O3, or thin quartz fibers formed by the methods of deposition from a veil to a thin wire are used as fibers.
Depending on the type of filler, composite materials are divided into dispersion-reinforced, fiber and layered composites.

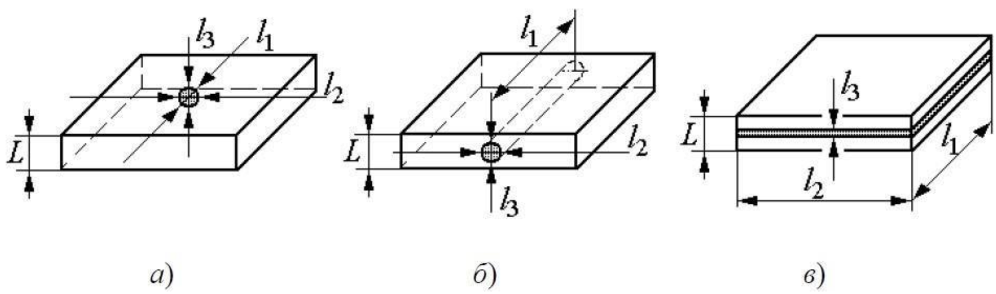

Figure 2. Reinforcement fillers: a- zero size, b - one size; v- two-dimensional, l1, l2, l3 - filler sizes; L is matrix thickness

Reinforcement fillers are zero-dimensional in terms of size (the sizes of the filler have a uniform small value in the three-way direction: powder, dispersed substances, nanopowders); one-dimensional (the dimensions of the filler have a uniform small value in both directions, a large indicator in one direction: continuous and short fibers, grease, needle-like crystals); two dimensional (the dimensions of the filler have a large value in two directions and a small value in one direction: layer, sheet, layers)

How is the mechanical advantage of composite measured?

For example, the axial deflection, ***u***, of a prismatic rod under an axial load, ***P,*** is given by

$$u = \frac{PL}{AE} , \quad (1.1)$$

where

L = length of the rod
E = Young's modulus of elasticity of the material of the rod

Because the mass, M, of the rod is given by

$$M = \rho AL , \quad (1.2)$$

where ρ = density of the material of the rod, we have

$$M = \frac{PL^2}{4} \frac{1}{E/\rho} . \quad (1.3)$$

This implies that the lightest beam for specified deflection under a specified load is one with the highest ***(E/ρ)*** value. Thus, to measure the mechanical advantage, the ***(E/ρ)*** ratio is calculated and is called the *specific modulus* **(**ratio between the Young's modulus ***(E)*** and the density ***(ρ)*** of the material**)**. The other parameter is called the specific strength and is defined as the ratio between the strength ***(σult)*** and the density of the material ***(ρ)***, that is

$$\text{Specific modulus} = \frac{E}{\rho},$$

$$\text{Specific strength} = \frac{\sigma_{ult}}{\rho}.$$

The two ratios are high in composite materials. For example, the strength of a graphite/epoxy unidirectional composite could be the same as steel, but the specific strength is three times that of steel. *What does this mean to a designer?* Take the simple case of a rod designed to take a fixed axial load. The rod cross section of graphite/epoxy would be same as that of the steel, but the mass of graphite/epoxy rod would be one third of the steel rod. This reduction in mass translates to reduced material and energy costs. *Figure 1.1* shows how composites and fibers rate with other traditional materials in terms of specific strength. 3 Note that the unit of specific strength is inches in *Figure 1.1* because specific strength and specific modulus are also defined in some texts as

$$\text{Specific modulus} = \frac{E}{\rho g},$$

$$\text{Specific strength} = \frac{\sigma_{ult}}{\rho g}.$$

where g is the acceleration due to gravity (32.2 ft/s^2 or 9.81 m/s^2).

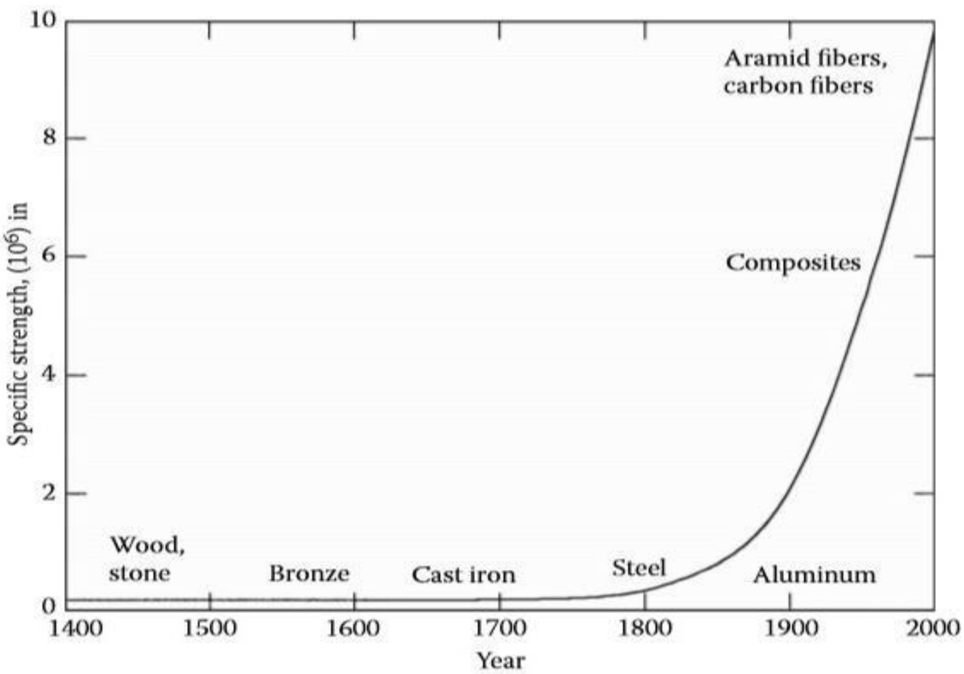

Figure.3 shows how composites and fibers rate with other traditional materials in terms of specific strength

DISCUSSION

The Well-Known, composites have distinct advantages over metals. Are there any drawbacks or limitations in using them?

Drawbacks and limitations in use of composites include:

- High cost of fabrication of composites is a critical issue. For example, a part made of graphite/epoxy composite may cost up to 10 to 15 times the material costs. A finished graphite/epoxy composite part may cost as much as $300 to $400 per pound ($650 to $900 per kilogram). Improvements in processing and manufacturing techniques will lower these costs in the future. Already, manufacturing techniques such as SMC (sheet molding compound) and SRIM (structural reinforcement injection molding) are lowering the cost and production time in manufacturing automobile parts.
- Mechanical characterization of a composite structure is more complex than that of a metal structure. Unlike metals, composite materials are not isotropic, that is, their properties are not the same in all directions. Therefore, they require more material parameters. For example, a single layer of a graphite/epoxy composite requires nine stiffness and strength constants for conducting mechanical analysis. In the case of a monolithic material such as steel, one requires only four stiffness and strength constants. Such complexity makes structural analysis computationally and experimentally more complicated and intensive. In addition, evaluation and measurement techniques of some composite properties, such as compressive strengths, are still being debated.
- Repair of composites is not a simple process compared to that for metals. Sometimes critical flaws and cracks in composite structures may go undetected.

CONCLUSION

The science of modern composite materials has undergone dynamic development in the last decade, mainly due to the use of composites in aerospace engineering. An example of this is the need to solve problems related to the implementation of the project on the development of aerospace vehicles for trans atmospheric flights in the United States of America. It is assumed that the flying device called "Orient Express" can land on the usual runways of modern airfields. A flight from the west coast of the USA to Asian countries takes less than two hours. During the flight, some components of the aircraft can heat up to a temperature of 1800 °C, so it is not advisable to use metal materials for the production of such materials. An effective solution can be achieved only by using composite materials with high mechanical strength, hardness, heat resistance and light weight.

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