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| Research Article

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Application of Composite Materials in Designs Unmanned Aerial Vehicles

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Annotation
This article presents information about the composition, structure, basic features of composite materials used in the production of UAVs, as well as on the specifics of their production.

Keywords: composite materials, component, matrix, reinforcing, non -metallic, metal.

Today, military operations in different parts of the world show that UAVs bring excellent results on the battlefields. As a result, countries are paying great attention to the further development of drones. New types of innovative approaches and new types of composition are widely used in the production of drones.

Unmanned aerial vehicles (UAVs) are manufactured using various materials that provide lightness, strength and aerodynamic characteristics. Here are some of the basic materials that can be used to create a UAV

This is one of the most common types of materials used to create UAVs. Composites consist of a matrix (usually polymer) and reinforcing fibers such as carbon fiber, fiberglass or aramid fiber. These materials provide lightness, rigidity and structural strength.

Multicomponent materials or composites include several types of materials of different composition. The need for creation is the formation of a fundamentally new type of material, which will include the chemical and physical properties of its constituent components, distributed in different proportions, in a more profitable way for the emergence of new mechanical properties[1].

A composite is a material consisting of two or more components that, in combination with each other, create a new material or improve the characteristics of one of them. Thus, all composite materials in their composition have a matrix and a rigid reinforcing filler. As a rule, carbon or glass fibers play the role of filler, and the matrix is a polymer material. This design allows you to create lightweight, but very durable parts. Therefore, it is in the aircraft industry that composites have become especially popular – they increase the strength of aircraft parts, reduce their weight and increase corrosion resistance.

Composite materials are compounds that are unique in their structure and have the following list of features:

- the composition includes several components, necessarily more than two, the chemical composition of which is different and separated by a clearly defined boundary;
- it has fundamentally new properties that differ from the properties of the components that make up these materials;
- it has uniformity on the macroscale and heterogeneity on the microscale;
- each component is characterized by distinctive properties, the presence of which in the material is necessary in large quantities and in close connection with the whole, i.e. more than some critical value.

Composite materials, commonly referred to as "composites", have significantly changed many industries, becoming a modern solution in high-tech products, their advantages are low weight and high mechanical strength. [2].

Aircraft designers began using composite materials around the 1960s. Since that time, the use of composites in aviation has been steadily increasing. For example, exactly half of the weight of the Boeing 787 Dreamliner is made up of composite materials, 20% is aluminum, about 15% is titanium, and 10% is steel.

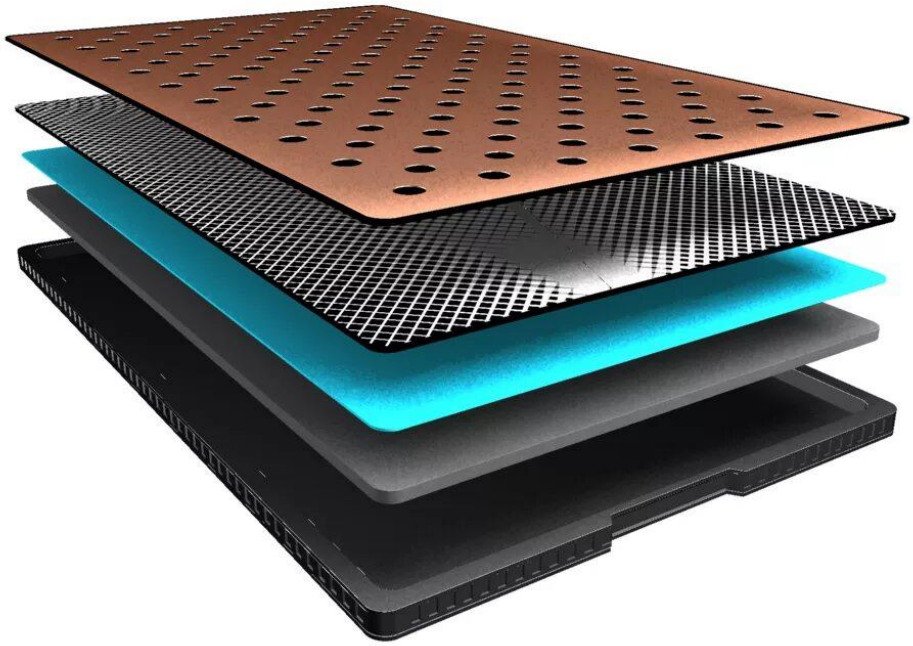
The economic benefits expected from the innovative projects studied in this article are modern developments in the field of defense industry and aerospace technology. First of all, they are associated with composite materials, because their advantages are lightness and resistance to external exposure to high temperatures. It is such substances that make it possible to lighten the weight of the finished product, therefore reducing costs during operation and the cost of fuels and lubricants.

Composites have incredible lightness and therefore are increasingly used in systems of internal connections (connectors), for which low structural weight is a determining factor. In most such applications, the typical weight reduction when using composite materials compared to aluminum is approximately 40%. When compared with brass and stainless steel parts, an indicator of 80% is observed [1; 3].

Polymers, due to their structure, are less susceptible to mechanical resonance, therefore, parts with threaded connections are nowadays made of similar materials, and are less likely to weaken and unscrew under various mechanical influences, such as shocks or strong vibration (for example, when transporting troops by rail or marching off-road [1; 3]).

There are composites that do not have electrical conductivity. This aspect is significant due to the fact that composites are often necessary in structures where resistance to external influences and high electrical insulation properties are needed [1; 3].

Composite materials are able to weaken magnetic fields, reduce the influence of oscillatory systems on corrosion and drown out the so-called "acoustic signature", that is, acoustic radiation characteristic of any device, which is a significant property in the development of products for which the important characteristics are to achieve the lowest probability of their detection



Pichture -1. Composite materials

As a rule, this is a combination of reinforcing fibers and a binder (polymer matrix).

Carbon, glass, and boron fibers are often used as reinforcing elements.

The matrix is usually polymer (epoxy, polyester, etc.).

Composites have high strength and rigidity with low weight.

They are widely used in aviation, astronautics, automotive and shipbuilding, and sports equipment.

Advantages - high specific strength, corrosion resistance, durability.

Thus, composite materials are lightweight and durable materials for high-tech industries.

Как правило, это комбинация армирующих волокон и связующего материала (полимерной матрицы).

В качестве армирующих элементов часто используются углеродные, стеклянные, борные волокна.

Матрица обычно полимерная (эпоксидная, полиэфирная и др.).

Композиты обладают высокой прочностью и жёсткостью при малом весе.

Широко применяются в авиации, космонавтике, авто- и судостроении, спортивном инвентаре.

Преимущества - высокая удельная прочность, коррозионная стойкость, долговечность.

Таким образом, композитные материалы - это лёгкие и прочные материалы для высокотехнологичных отраслей.

Aramids are synthetic polymer fibers with high strength.

They are known under the trademarks Kevlar, Tvaron, Technora, SVM.

They are characterized by very high tensile strength, rigidity, and heat resistance.

They are chemically inert, do not burn, and resistant to abrasion.

They are used for the production of body armor, helmets, sports equipment, cords, ropes.

They are used in aviation and cosmonautics.

They are actively used as a reinforcing component in composite materials.

They give composites high strength and rigidity with low weight.

Thus, aramid fibers are a unique polymer material that provides composites with record strength.

Aluminum:Aluminum is a lightweight and durable metal that is widely used in the aviation industry. It has good corrosion resistance and can be easily processed and molded.

Titanium:Titanium alloys are also used in the creation of UAVs.Titanium is a lightweight metal with high strength and excellent corrosion resistance.

Composite elements:

UAVs can also have a skin made of composite panels consisting of layers of aluminum and plastic. This allows you to combine the advantages of both materials, providing strength and lightness.

Composite materials are used in unmanned aerial vehicles (UAVs), or drones, due to their unique properties such as high strength, lightness and shape stability. Here are some of the most common composite materials used in UAV construction:

Carbon Fiber: This is the most common composite material used in the construction of UAVs. Carbon fiber has high strength and rigidity at very low weight, which makes it an ideal material for building drone bodies and frames, especially for those designed for racing and professional applications.

Fiberglass: Another common composite material, fiberglass has good strength and rigidity, although not as high as carbon fiber

Polymer composites: There are various polymer composites that can be used in the construction of UAVs. Some of these polymers can be reinforced with fibers (for example, carbon or glass) to increase their strength and rigidity. The choice of composite material for UAVs depends on many factors, including weight, strength, stiffness, impact resistance, cost and specific application requirements.

Other materials:

Depending on the specific requirements and purpose of the UAV, other materials such as glass, carbonates, Kevlar and other composites can be used. It is important to note that the materials used to create a UAV depend on its size, type (multirotor, fixed wing, etc.), purpose and other factors, so the specific choice of materials may vary for each specific UAV.

The experience of using polymer composite materials in aerospace engineering structures has shown that their use instead of metal alloys has reduced the weight of structures to 30-50%, increased the service life by 2-5 times, reduced the complexity of manufacturing by 20-40% and material consumption by up to 50%.

New heat-resistant metal-polymer layered composites based on a layered combination of thin sheets of titanium alloys with carbon fiber plastics are being developed for aircraft structures operated at temperatures of 150-350 °C.

The disadvantages of composites include:

- most composite materials have a higher cost compared to classical metal alloys;
- the strength of polymer composites relative to the compression process is quite low, which makes it difficult to dock and fix products made of them with fasteners.

Advantages of composite parts over parts made of metal alloys:

Weight qualities - a composite part can be up to 80% lighter than a metal one. High strength. Corrosion resistance. High fatigue characteristics.

Wear resistance. Environmental properties. Almost the entire range of composite materials is used in the aircraft industry:

Aramid fabrics are used primarily in the production of the lower fuselage and aircraft engine pylons.

Carbon fabrics are used for the manufacture of steering surfaces, doors, the hood of aircraft engines and many other elements.

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