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INCREASING THE SURVIVAL EFFICIENCY OF MODERN AIRCRAFT USING VARIOUS COMPOSITE MATERIALS

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Annotation: The article discusses the use of various composite materials in aviation to improve the survivability of modern aircraft, the main types of composite materials and their areas of application. And also getting acquainted with the advantages of producing composite materials that meet the requirements of a new era. It contains practical recommendations on their role in industry, durability and various properties, as well as on the production of components for all types of modern aircraft.

Keywords: Composite materials, carbon fiber reinforced plastic, fiberglass, aramid, polymer, corrosion, ceramics, glass-fiber reinforced plastic, metal composites, aluminum, silicon carbon nitride, thermal, silicon carbide, titanium composites.

The aviation industry is one of the most technologically advanced industries, and its development requires innovative materials that ensure passenger safety and flight efficiency. In recent decades, more and more attention has been paid to the use of composite materials in aviation.

Composite materials are materials that consist of two or more components that together create properties that are not available individually. In aviation, such materials are used to create some parts of aircraft, such as fuselages, wings, tail fins, landing gear, etc. [1]

The advantages of using composite materials in aviation are obvious. Firstly, they have high strength with low weight. This allows you to reduce the weight of aircraft and, as a result, reduce fuel consumption. Secondly, composite materials have good resistance to corrosion and aggressive environments. They are not subject to rust and do not require regular maintenance and repair.

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Composite materials are also very resistant to vibration, noise, and shock. This ensures comfort for pilots and passengers, as well as flight safety.

The main composite materials used in aviation are carbon fiber reinforced plastic and fiberglass reinforced plastic. Carbon fiber is very strong and lightweight, and is used in parts of highly stressed aircraft. Fiberglass is inexpensive and has good electrical insulation, making it an ideal choice for covering the interior of aircraft.

In general, the use of composite materials in aviation allows for the creation of more reliable, safe, and efficient aircraft. This allows for reduced maintenance costs, reduced environmental impact, and increased flight comfort. [1]

Types of composite materials in aviation

The aviation industry actively uses composite materials due to their lightness, strength, and ability to withstand heavy loads. Various types of composites are used in aviation, including:

Carbon fiber is a composite material consisting of carbon fibers impregnated with a polymer. It is widely used in aviation due to its unique properties.

Properties of carbon fiber:

High strength. Carbon fiber has high strength to withstand damage, which allows it to be used in aircraft structures that must withstand heavy loads. Carbon fiber is a very light material, which allows you to reduce the weight of aircraft and, as a result, reduce fuel consumption.

Excellent corrosion resistance. Unlike metal materials, carbon fiber is not subject to corrosion, which significantly extends the service life of aircraft. Carbon fiber is easily formed into any aerodynamic shape, which allows you to create optimal aircraft structures to reduce air resistance.

High temperature resistance. Carbon fiber has high thermal stability, which allows it to be used in high-temperature environments, for example, in aircraft engines.

Advantages of using carbon fiber in aviation:

Weight reduction. The use of carbon fiber allows you to reduce the weight of the aircraft and, accordingly, the liquefied load, which reduces fuel costs and allows you

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to increase the flight range. Increased strength. Carbon fiber has high fracture toughness, which increases flight safety.

Corrosion resistance. Carbon fiber is not susceptible to corrosion and does not require special rust protection, which saves resources and maintenance time.

Improved durability. Due to its corrosion resistance and high temperature resistance, carbon fiber has high strength and low degradation.

Carbon fiber is one of the most effective and promising materials for the aviation industry, bringing significant benefits in terms of reliability and efficiency in the production of aircraft. [2]

Carbon fiber is one of the most common composite materials in aviation. It consists of carbon fiber impregnated with a polymer. Carbon fiber has high strength and lightness, which helps reduce the weight of aircraft and, as a result, allows for fuel economy. [2]

Fiberglass is a composite material made from glass fibers and polymers. Fiberglass has good strength and corrosion resistance, but is less durable and stiff than carbon fiber. In aviation, fiberglass composites are often used for fuselage upper skins and lower wing underbody skins.

Aramid is a composite material that contains aramid fibers (such as Kevlar fibers) and a polymer. Aramid has high tensile strength and good impact resistance. It is widely used in aviation for the production of armor panels and protective elements.

In addition to the above materials, other composite materials are also used in the aviation industry, including aluminum composites, titanium composites, etc.

It should be noted that composite materials in aviation are used not only to create the body and skin of aircraft, but also to manufacture wings, tail fins and other components and parts. The advantages of composite materials, such as lightness, strength and corrosion resistance, allow reducing the weight of aircraft, increasing speed and maneuverability, and increasing flight efficiency and productivity. [2]

Aramid composite

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Aramid is a polymer material used as a composite material in aviation. Aramid composites have a number of properties and advantages that make them a popular choice in the aviation industry. One of the main properties of aramid composites is their high resistance to damage. This material is very resistant to mechanical stress and can withstand large amounts of force without damage. Due to this property, aramid composites are widely used to create structural parts such as skins, wings, and other elements in aircraft.

Another advantage of aramid composites is their lightness. Aramid materials have a very low density, which reduces the overall weight of aircraft. This is important for aviation, as lighter aircraft require less fuel to fly, which saves money and reduces environmental impact.

In addition to strength and lightness, aramid composites have another important property - fire resistance. This material is difficult to ignite and does not sustain combustion, which makes it suitable for use in aviation from a safety point of view. In the event of a fire in aircraft, aramid composites help prevent the spread of fire and significantly reduce the risk of fire. In conclusion, aramid composites are one of the important materials used in aviation. Their high strength, lightness and fire resistance make them an ideal choice for structural parts of aircraft. Thanks to the use of aramid composites, aviation becomes more efficient, safer and more environmentally friendly. [4,5]

Glyco-glass fiber plastic (GSP) is a composite material actively used in aviation due to its excellent mechanical and physical properties. It consists of fiberglass impregnated with epoxy resin. Such a coating has a number of advantages that significantly improve the performance and performance of the aircraft.

The main advantages of Glycoglass plastic:

Glycoglass plastic is a very light material, which allows you to reduce the weight of aircraft. At the same time, it has high strength and excellent corrosion resistance. This significantly increases flight safety and extends the service life of aircraft.

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GSP has a flat surface, which reduces air resistance and allows the ship to reach high speeds with less fuel consumption.

Resistant to extreme conditions. Glycoglass plastic is not affected by moisture, engine oils and other aggressive substances. It retains its properties at high and low temperatures, as well as pressure changes. Easy to process. Glycoglass plastic is easily machined, welded and can be given precise shapes. This simplifies the manufacturing process of parts and structures.

Glycoglass plastic is widely used in the manufacture of covers, wings, tail fins and other elements of aircraft. This allows for improved quality and safety of aircraft structures, as well as reduced maintenance costs by reducing aircraft weight and improving aerodynamic properties. [3,5]

Metal composites

Advantages of using titanium composite in aviation:

The use of titanium composite helps to reduce the overall weight of the aircraft, which increases flight efficiency and fuel economy. Due to its low density and high strength, titanium composite allows you to create more efficient and durable structures, which in turn increases the service life of aircraft.

Titanium composite, unlike traditional metals, does not corrode, which increases the service life of aircraft and reduces the need for maintenance.

Thus, titanium composite is an innovative and promising material for use in aviation. It has unique properties that reduce the weight and increase the strength of aircraft, as well as improve their performance characteristics. [3]

A ceramic composite is a material consisting of a ceramic matrix with the inclusion of fibers or particles of other materials. It is widely used in aviation due to its unique properties and advantages.

Properties of ceramic composites:

High strength and hardness;

Low density;

High temperature resistance;

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Corrosion resistance;

High corrosion resistance;

Low coefficient of thermal expansion.

Advantages of using ceramic composites in aviation:

Reducing the weight of aircraft structures, which allows to increase their load-bearing capacity and flight range.

Increasing the rigidity and strength of the structure, which increases its resistance to deformation and flight safety.

Improved thermal properties, which allow the use of such materials at high temperatures.

Resistant to corrosion and corrosion, which extends the service life of aircraft components and reduces the cost of replacement and maintenance.

Examples of applications of ceramic composite materials in aviation:

Turbine blades. Increasing engine efficiency by reducing weight and increasing thermal stability. Linings and landing gear. Reducing weight and increasing the rigidity of the chassis structure, which improves landing stability. Heating system pipes. Improved thermal performance and reduced weight of the heating system.

Ceramic composites are an important class of materials with unique properties used in aviation to create lightweight, strong, and heat-resistant components. This increases the efficiency and safety of aircraft and reduces operating costs. [2,5]

A metal composite is a material consisting of a metal matrix in which particles of various materials are embedded. Due to its properties and advantages, it is widely used in aviation.

The main advantages of a metal composite are:

Lightness and strength - metal composites have low density and high strength, which reduces the weight of the aircraft structure and increases its reliability.

Corrosion resistance - metal composites do not affect the environment and are able to maintain their performance for a long time.

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High temperature resistance - the metal matrix provides high temperature resistance, which allows metal composites to be used in environments with high loads and extremely high temperatures.

Metal composites are widely used in aviation. They are used to create fuselages, wings, landing gear, as well as engine parts. Metal composites allow to reduce the weight of aircraft, improve their aerodynamic properties and increase operational characteristics.

Thus, metal composites are one of the main materials in aviation, providing lightness, strength and reliability of aircraft structures. [3,5]

Silicon carbon nitride is a composite material consisting of silicon carbide (SiC) and silicon nitride (SiN). It has a number of unique properties that allow it to be used in aviation.

The main advantages of silicon carbon nitride in aviation:

Silicon carbon nitride has high mechanical strength, which allows it to be used for the manufacture of lightweight and durable aircraft parts, such as wings, landing gear, etc. The material retains its mechanical properties even at high temperatures, which allows it to be used in conditions of high thermal loads, for example, when operating engines.

Excellent thermal stability. Silicon carbon nitride is not subject to thermal oxidation, which allows it to be used to create protective coatings and thermal insulation materials for aircraft structures.

The material is not affected by corrosion and aggressive chemicals, which ensures the durability and reliability of its operation. Silicon carbon nitride has a low density, which allows it to be used in the creation of lightweight and efficient aircraft structures, which helps to reduce the weight of aircraft and save fuel.

The use of silicon carbon nitride in aviation allows to increase the safety, efficiency and productivity of aviation technologies, as well as reduce their operating costs. [4]

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Titanium composite is a unique material widely used in aviation. It consists of titanium fibers coated with a matrix of polymers or metals.

Properties of titanium composite:

Titanium composite has a much lower density than traditional metal materials such as aluminum or steel, but still maintains high strength. Titanium composite is not prone to rust and can withstand aggressive environments such as acids, alkalis and salts. Titanium composite can withstand high temperatures without losing its properties, which makes it ideal for use in aircraft engines and high-temperature environments.

Conclusion

In conclusion, I would like to emphasize that in the process of studying composite materials, I became convinced that even in pre-Era times, humanity was conducting research, and continuing this research, I witnessed the results of a number of research works carried out to create and find new forms of high-quality composite materials adapted to the requirements of the present day. Nowadays, there is no industry where composite materials have not entered. Composite materials, with their low cost, lightness, as well as strength and durability, stand out in the world market and are rapidly entering our industry.

We can see that modern aircraft using various composite materials have already proven themselves in the field in which I work, in order to increase the survivability of aircraft. At the same time, composite materials are widely used in the production of components of many aircraft. I would like to emphasize that this leads to the lightness of aircraft in terms of weight, low cost, and also reduces fuel consumption. As a result of the study and analysis of the above data, it is advisable to invent new types of composite materials, improve them, and also apply them to areas where they have not yet penetrated.

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