

MAIN PROPERTIES AND APPLICATIONS OF POLYMERIC COMPOSITE MATERIALS

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ANNOTATION:

This article shows various groups of modern polymer composite materials, their composition and applications. Their general classification is determined by the reactivity of binders and fillers, applicable to dispersed, fibrous or laminated materials. The classification is based on the most common thermosetting matrix materials and the most common fillers.

Keywords: polymer composite material, matrix, binder, filler, filled polymer, glass fiber, textolite, getinax.

INTRODUCTION:

Composite materials (compositions) are multicomponent materials, usually consisting of a plastic base (matrix) reinforced with a filler with high strength, rigidity, etc. The combination of dissimilar substances leads to the creation of new materials, the properties of which differ from the properties of each of its components in terms of quantity and quality. By changing the composition of the matrix and fillers, their proportions, the direction of filling, a wide range of materials with the desired set of properties is obtained. Many compositions have superior mechanical properties compared to traditional materials and alloys, but are also lighter. The use of composites usually reduces the weight of the structure and maintains or improves its mechanical properties.

In terms of strength, fiberglass polymers (1000 ... 6000 MPa) are stronger than ordinary glass (100 MPa). This property is due to the uniqueness of its manufacturing technology.

Among fiberglass PCMs, quartz fibers with magnesium aluminosilicate have the highest technical strength.

The properties of glass wool are the same as those of hard glass, and these properties are determined by the chemical composition of the glass. The fact that the density and specific heat capacity of glass wool is much lower than that of hard glass can be explained by the flat and porous structure formed by the rapid cooling of water glass during elongation.

Silica fibers soften at high temperatures. The softening point of high molecular weight silicon fibers of the Vikor type is 1773 K, and refrasil fibers (98-99% SiO₂) does not liquefy or evaporate until 1923 K. All types of silica fibers have good thermophysical and electrical insulating properties, which practically do not change with increasing temperature. Aluminum-silicon fibers have a higher softening point (1973 K) than silicon fibers. Aluminosilicate (kaolin, kaowul, fiberfrax) fibers with relatively high liquefaction (1973-2063 K) and softening (1723-1773 K) temperatures have good electrical and sound insulation properties and low density (80-100 kg / m³). Aluminosilicate and aluminochromosilicate fibers can be used for a long time at temperatures of 1473-1723K.

The chemical stability of glass wool depends on the composition, nature, concentration, temperature and time of exposure to the reagent and is characterized by a loss of weight and strength as a result of exposure to an aggressive environment. The size of the work surface relative to solid glass

makes it more susceptible to external influences.

Quartz, silica, kaolin and alkaline aluminoborosilicate fibers have high chemical resistance to water and high pressure vapors. However, in some cases, the strength and stability are reduced due to the long duration of exposure.

Quartz, silica and alkaline aluminosilicate (except for hydrogen fluoride) fibers (no anhydride) are resistant to organic and mineral acids. The addition of some oxides (titanium, zirconium, cerium, etc.) to aluminosilicate glass fibers dramatically increases the acid resistance of the fibers.

Not all glass fibers are alkali resistant. Only quartz and silica fibers absorb more slowly than regular glass. Oxides are added to glass wool fibers to increase their resistance to alkalis, thereby densifying their structure.

These oxides include oxides of elements such as zirconium, aluminum, iron, zinc, tin, and lanthanum. The inclusion of inorganic fillers in the binder is based on the regulation of the properties of PCM in the desired direction (increase in viscosity, electrical conductivity, etc.), which reduces the cost of the product. Usually, fillers simultaneously perform a number of functions: they improve technological properties, reduce internal stresses, volumetric subsidence and flammability, increase water resistance, and resistance to aggressive media. Fillers improve the thermal properties of the binder when heated and hardened. The quality of the fillers is determined by the particle size and specific surface area, moisture content, chemical composition and special requirements. The cheapest aggregates are sand, gypsum, kaolin, feldspar, chalk, talc, soil and carbonates. Aerosil and white sediment as fillers for the production of fiberglass, to increase the chemical resistance - colloidal graphite of the C-1 grade, to increase the viscosity and electrical conductivity of the

binder, as well as for blackening the binder from gaseous DG-100, aluminum powder for painting with silver, inert filler - kaolin grade P-1-S, enriched enamel grade MMO to increase viscosity and reduce sedimentation, increase viscosity and reduce flammability emulsion polyvinyl chloride grade E-62 is used for

In some cases, flame retardants are added to the resin to provide the required fire resistance. These substances are retained by the resin through physical or mechanical stress or chemical reaction. By adding flame retardants, the color, elongation strength, electrical properties and forming properties of the PKM resin can be altered.

It is widely used in the production of low-density fiberglass plastics (0.3 ... 0.7 g / cm³) with hollow spherical dispersed (powder) fillers made of glass material. This material has high compressive strength, high dielectric and electrical insulating properties, high noise, vibration and thermal insulation properties. Polymer composite materials filled with glass powder are widely used in the production of materials with high electrical insulating properties.

Dispersed particles are often called powder particles, and their size should not exceed 40 microns in order for them to be suitable for PCM. Usually they are 1-15 microns. When smaller particles are added to the polymer, they can agglomerate without mixing with the polymer, which can lead to sedimentation, and the larger particles to sedimentation. Powder fillers come in a variety of colors and results. The amount of powder fillers is usually 25-50 parts by weight per 1 part of polymer and up to 200-300 parts by weight at high levels. 1 or 2 screw extruders are used when it is necessary to improve the mixing quality and make all the components into one whole before transferring and processing PCM. Let's get acquainted with their composition on the topic of processing polymer materials by

extrusion. Alumina, asbestos, bentonite, nifelin, pumice are used as natural and inexpensive fillers, which mix well with polymers and are recommended for polyethylene, polypropylene, PVC, polyamide, polyurethane, epoxy and phenolic resins.

Lead and cadmium filled materials protect against high energy ionizing radiation. Reinforced plastic is used in the manufacture of bearings, bushings and many other abrasive products. These are very convenient and inexpensive materials for the manufacture of magnetic tapes, thermostat heaters, static electricity transmitters, conductive elements, capacitors and connecting wires in radio circuits. Fillers such as black moth are used to fill rubbers. In this process, a suspension of the structure in water or hydrocarbon is mixed with a latex or rubber solution. The uniform distribution of the structure in the rubber gives the resulting material the desired high-tech properties. Such tires are easy to process and are used for the manufacture of car tires, rubber products, rubber shoes.

For filling paint and varnish materials, highly dispersed inorganic substances and materials are used, which not only improve the technical properties of the paint, but also help save pigments. The most common fillers are white. These are chalk CaCO_3 , bentonite $\text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot 2\text{H}_2\text{O}$, chrysolite asbestos $3\text{MgO} \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ gypsum $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ talc $3\text{MgO} \cdot 4\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ white matter $\text{SiO}_2 \cdot \text{H}_2\text{O}$ alumina Al_2O_3 and others. Their whiteness is 90% of that of MgO , the white standard.

Dispersed fillers are not always as powdery as those listed above. They can also be granular. Donor fillers include hollow spheres (microbubbles), glass coins, and granular polymers. The main function of such fillers is to make the material resistant to corrosion, improve the coefficient of friction and change the optical properties.

If there is a filler microbead, the density of the plastic decreases and the heat transfer increases. But the use of granular litters is increasing every day.

As you know, modern research in the field of tribology is based on the study of microscopic processes that occur as a result of very small microscopic laws. This led to the further development of the theory of energy associated with energy and structural changes in friction layers that obey the fundamental laws of thermodynamics. In this paper, the results of the study of tribotechnical and structural changes in composite polymer materials and thalamic (cotton) friction pairs are analyzed from the point of view of the laws of irreversible thermodynamic processes. From the point of view of the laws of irreversible processes of thermodynamics of a friction pair, polymer and cotton represent an open equilibrium thermodynamic system, since friction leads to equilibrium processes of diffusion and heat transfer due to thermodynamic forces, which differ in quantity. Analysis of the results of experimental studies shows that rapid changes in energy and structural parameters in friction pairs coincide with the initial period of friction, i.e. a period of unbalanced education. If we analyze these changes from the point of view of the laws of irreversible thermodynamic processes, it becomes clear that friction changes the basic thermodynamic parameters of the system (temperature in the friction region, triboelectric charge, friction force and friction velocity). However, the temperature on the friction surface and the density of the tribocharge are characterized by stabilization and relatively moderate changes in the friction force and wear rate. Under such conditions of friction, the distribution of thermal energy is also characterized by an average value, which ensures the constancy of the average number of energy parameters when the system reaches a stable equilibrium state 43. The onset of initial

interactions between the structural and energy parameters of polymer materials under unbalanced friction leads to the formation of thermodynamic anisotropic structures under thermodynamic effects this friction.

That is, the system is characterized by a spatial transition, the spatial transition of the system from an initial unstable equilibrium state to a metastable equilibrium state is based on the results obtained when the free energy of the system changes due to a decrease in entropy. for every small volume. This stage is characterized by the rapid disintegration of the initial equilibrium structures and the formation of new tribostructures with high antifriction properties. In the process of unbalanced friction, new dissipative stable structures are formed by a certain amount of entropy of the external energy flow. However, these structures are stable due to the presence of free radicals or food. Thus, the system passes into a new steady state with energetically stable dissipative tribostructures. According to the Glenedorf-Prigazhin structural theory, the formation of dissipative tribostructures can be considered as a result of the instability of the tribosystem in the process of spatial transition, the exchange of energy and matter with the external environment. In this case, the formation of excess entropy is a criterion for measuring the rate of formation of dissipative tribostructures. In this case, the formation of equilibrium tribostructures forces the system to pass into a stationary state with relatively constant thermodynamic forces (temperature in the friction zone and tribo charge). The use of the entropy of the system as a measure of the change in the state of the tribosystem makes it possible to theoretically take into account the effect of all physicochemical processes on friction on PM wear and to determine the energy consumption for friction. Thus, according to the results of the study and their analysis, it can be concluded that in the friction pairs of polymer

and cotton, dynamic tribostructures providing a stable and minimal friction force are formed as a result of the formation of an equilibrium period of friction. After the end of the period of unbalanced friction, the destruction of these tribostructures is compensated by the presence of information feedback channels, which are channels through which energy signals are transmitted. Schematic representation of polymetholamome tribotism. RVT Below is a graphical diagram of thermodynamic processes of polymetholamome tribotism: Dependence of the impact strength of epoxy polymer materials on the adaptation time. The roughness of epoxy resin materials depends on the adaptation time. Dependence of the coefficient of friction of epoxy polymer materials on the adaptation time. So the bottom line is that we are really looking forward to it. Prospects for the use of plastics in the automotive industry. We know that in the manufacture of automobiles [1-3], automobile parts are produced as a result of the production of various parts and products from structural materials. The body and chassis of the car are mainly made of iron, steel and copper, while the inner and outer bumpers are made of plastic. Plastic comes from Greek and Latin and means flexible, rounded. In terms of shape, plastics are divided into thermoplastics and rheoctoplastics. Thermoplastics change shape when exposed to heat and can be recycled, while rheoctoplastics cannot be recycled. Plastics in the manufacturing process are highly elastic or liquid. When used, it is either a solid crystal or a liquid. Plastics are composed of a mixture of several components. Plastics can be single-phase or multi-phase. Single-phase plastics are made up of only one component, while multi-phase plastics are made up of several components. In the manufacture of plastic parts, a car is obtained mainly in the following ways; injection molding, extrusion, blow molding or vacuum forming, hot pressing, stamping. The use of plastics in automotive parts has the

following advantages: - Improves appearance; - the weight of the car decreases; - reduced noise when driving; - improved shape of parts; - increased service life; - reduced fuel consumption; - vehicle speed increases; - Increases the comfort of the car; - Reduced the cost of cooking them. According to American scientists, each kilogram of plastic reduces the weight of a car 50 by 1-2 kg, and a decrease in weight by 10% allows to save up to 20% of fuel in time.

Types of plastics used in the automotive industry and their areas of application: 1. Polyethylene fuel tanks and sealants were manufactured. 2. The cooling pipes are polypropylene, the doors are made of parts of the inner panels. 3. Parts of door locks are made of various types of polyamide bearings. 4. Polyvinyl chloride (PVC) is mainly used for the manufacture of automotive hoses, electrical insulation, various knobs and buttons. 5. Polyurethane foam is used to make car seats, dashboards, interior door panels, camshaft belts, steering wheel bearings. 6. Polymethylmetacnlat - parts of lighting devices, protective covers for lighting devices are manufactured. 7. The electrical insulation of the phenolic plastic combustion system has been prepared. 8. ABS plastic is mainly used for cooling grills, wheel covers and seats. Table 1 shows the chemical and mechanical properties of plastics commonly used in the automotive industry. This table shows the physical and mechanical properties of plastic car parts.

CONCLUSION:

When considering groups of composite materials, their general characteristics, main advantages and disadvantages are given, the main directions of application and products based on them are indicated. If there are varieties of composites for the classification groups in question, they are referred to as part of the group or are issued separately, indicating

that they belong to a specific group of compositions. The data presented show that at present, polymer composite materials are the most widespread composite materials in terms of composition and properties, which are effectively used in many fields. The use of these materials is limited by their low thermal stability due to compositions based on ceramic and metal matrices, as well as flammability, toxicity of combustion products and the aging phenomenon of polymer binders.

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