ENVIRONMENTAL ASPECTS OF SELECTED PRODUCTION OF PLASTIC MATERIALS USED IN AVIATION INDUSTRY

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This paper deals with the analysis of selected types of plastics used in the aerospace industry. In the introduction to selected plastics, which are most commonly used in the aerospace industry. Describes the composition, properties and use. The next part deals with the production of plastics and their positive and negative impacts on the environment. In conclusion, this work is a summary of the justification for the use of plastics in normal air traffic.

Keywords: engineering plastics, aerospace, plastics recycling

1 INTRODUCTION

The aerospace industry has used a wide range of materials ranging from metallic materials through plastics, ceramics to composites. During the construction of aircraft structures must be carefully select the optimum material properties. Each material must meet all not only functional, but also pricing and technological requirements.

In the introduction is designed analýza engineering plastics used in the aerospace industry, the impact of their production and subsequently end use in air traffic to their impact on the environment and a description of their recycling options.

At present air applications is asked a large number of requirements that are crucial for the choice of material for these applications. It is also an important economic aspect, therefore, the most favorable price. These materials include plastics, dissimilar in composition and hardness.

Functional properties of materials used in aircraft structures as much as possible. The materials are chosen in particular as low specific gravity, but also with a high specific strength. Strength characteristics of materials tend to be chosen with regard to safety and at the ceiling.

This means that the strength values of the materials should be sufficiently reliable. Fatigue strength properties are also not significantly reduced during long-term operation. This is connected with the total life of the aircraft. The use of plastics in the aerospace industry in ancient times was very limited. But these days, plastics are used for load-bearing structures, such as wings, hulls, and partitions ... [1] [34]

2 INTRODUCTION TO PLASTIC MATERIALS

The term means the heterogeneous plastic materials consisting of two or more phases, which are mutually vary considerably in their mechanical, physical and chemical properties. Plastics and aerospace industries were, are and will always be associated with the notion of strong dynamic growth in all research, development and production areas. Plastics in all forms done for the last period in the aviation industry in all categories of aircraft significant step in terms of the statein the Slovak Republic. Plastics dominated field structures as small aircraft and civil aircraft of the highest category, while the whole area of combat aircraft, including helicopter pilot and without resources. [5] [4]

Plastics used in aviation and aerospace applications

Using plastic makes the aircraft easier, safer and more economical. This is by no means the only reason interior, however, but also for sophisticated technical parts, structural components and propulsion components. Some time ago the importance of engineering plastics and plastic composites in aviation and aerospace applications has rapidly increased.

Nowadays we can observe rapid growth of manufacturing of plastics and their application in components, aerospace industry, which gives rise to a considerable number of test methods. Thanks to the unusual properties of plastic materials and relatively short experience with their use are many methods entirely new and specific to the plastic so u metal and other traditional materials are not used at all.

Analysis of some types of plastics and their distribution

Aerospace and aviation industry should nowadays not been without any plastic or plastic materials developed sophisticated. Taking into account that the Air Force itself is not just about the actual aircraft and attendants, but it is extensive ranging from machinery constructors then constructing the complete works.

One of the main parameters of thermoplastic materials is their temperature resistance.
By melting the plastics are divided into three groups:

- commodity plastics,
- engineering plastics,
- high-performance plastics.

3 PLASTICS PRODUCTION AND THEIR IMPACT ON THE ENVIRONMENT

A necessary requirement remains decrease demands on primary raw material resources, which is possible with the present volume of production to ensure only the gradual introduction of "smart" technologies as well as the consistent separation and recycling of useful raw

materials. Are lightweight and yet stable. Therefore, plastic components are increasingly replaced in all sorts of metal products. Thus there is not only to reduce the weight of such products, as well as to decrease cost. Material, without which today can not imagine daily life, not only in civil and industrial sphere, are ubiquitous plastic. Plastic materials due to its features, especially long life, a journey Their position in virtually all sectors of the economy in the form of refunds traditional materials, but especially metal.

In 1989 he started using Polyetherimide (PEI). Advantage of the excellent mechanical properties and flame resistance, but the downside is lower chemical resistance. Another of thermoplastics, which came into use in 1997 was polyphenylene sulfide (PPS) is characterized by good processability.

The newest material used since 2003 is Polyeterketonketon (PEKK). He brings excellent thermomechanical characteristics with good processability.

Quality thermoplastics are divided into amorphous and semi-crystalline. Their behavior in raising the temperature is very different. Semi-crystalline thermoplastics (eg PPS) has the lowest energy state, where the semi-crystalline state. This state is always a mixture of crystalline and amorphous phases. If the initial state of amorphous PPS and softening by heating it at about 90 ° C, but at 120 ° C is starting crystallization, which raises a very mechanically stable condition which is maintained until the melting point, which starts from 250 ° C. . At 300 ° C has been completely melted plastic. On subsequent cooling of the material gradually solidified with random structure, which is then a certain temperature begins to organize into crystals. It depends on the cooling rate. at high speed crystallization is not enough to develop a material remains amorphous. When construction is of course suitable semi-crystalline state. Between different binders are other than temperature differences. They influence the choice of the type for a particular application. Depending on whether it will be a part of the interior or the dragon, or will be in the lineup, which nituje, glued or welded shall elect a suitable material. [3] [4] [6]

The recycling of engineering plastics

Recycled plastic is not easy, whether it is technologically or economically feasible.

In my work I describe specifically the four options, namely:

-PEI - PEI Thermoplastic offers high performance processing. Chemical structure providing two or more flexible bindings, which may result in the polymers that are melt processable dobre. The correct choice of these flexible connections may allow preservation and long-term heat resistance.

Thermoplastics have high strength and dimensional stability, as well as resistant to samovznietivosti, have good electrical properties, are transparent. PEI are recyclable. New modifications of plastic are still in development. [5]

-PI - Manufacture of polyimide has specific technology requirements, because the condensation reaction. Inappropriate treatment carries a slight risk of inhomogeneities, such as bubbling, or adverse reactions, including chain termination, may lead to a lack of strength characteristics. Typical polymerization of polyimide is poly condensation. Is a typical method for the synthesis of a polyimide, to be the tetracarboxylic aromatic acids and aromatic diamines as monomers [17].

-PAI - At present there are two popular ways to synthesize commercial polyamide-imides. One of which is hydrochloric acid, and the other is isocyanate. Synthesis method used will determine or restrict to a certain extent and the applications that use the resulting polymer. Polyamide-imides, due to their relatively high costs compared with conventional engineering plastics such as nylon and polycarbonate, are used in service conditions, which require the benefits of these materials and other plastics which would have failed. They have a relatively high strength to weight ratio, and therefore are often used as substitutes for metals.

Environmental resistance: Polyamide-imides have very good water resistance, UV-light and radiation. [8]

-PVC - Polyvinyl chloride is one of the most problematic type of plastic that contains substances seriously threatening the environment and human health. Use of PVC recycling is very limited, and therefore mostly to landfills or incineration plants. Especially in the plant source of PVC is hazardous chemical chlorine-containing compounds, which are the most dangerous dioxins. The world is growing pressure to ban PVC. Why is PVC and thus more dangerous than other types of plastic? Greatest drawbacks are associated with chlorine, which in the production of PVC used the most.

PVC main downside is that it is used for the production of sodium chloride (NaCl), of which the chemical industry produces chlorine gas. Contributes to the formation of highly toxic dioxins affecting the immuneand hormonal system. [18]

Environmental devastation

The main cause of environmental devastation is reckless human activity leading to global climate change. Our activity tends to increase in carbon dioxide in the atmosphere and thereby increasing so. "greenhouse effect". Has far-reaching consequences of ozone depletion in the stratosphere for climate radiation in the ultraviolet radiation. Increase in the intensity of ultraviolet (UV) radiation, increases the incidence of cancer, there is damage to vegetation (especially sensitive to seaweed). Human activity has on the Earth in a reduction of forest cover to 20% of the total area of the globe. Serious consequences are also linked to the consumption of carbon dioxide in the destruction of rainforests. We do not take into account neither the function of forests as a source of water vapor. The atmosphere is also payable on

toxic substances, mostly industrial: carbon dioxide - is generated by the combustion process, nitrogen oxides - the incineration, transport, resulting in the inverse situation in industrial areas, carbon monoxide - during incomplete combustion of fossil fuels. [18]

Hydrocarbons, heavy metal compounds - from manufacturing, waste incineration plants. Toxic to the body. Dust fallout - plants, domestic heating. Threatens the food chain, humans and animals in content heavy metal compounds. Hydrosphere pollution: pollution of continental waters and marine-industrial organic substances.

Consequently, there is a mortality of organisms, which is sad. The risk of contamination of marine oil pollution, toxic waste. Phytoplankton are reduced and thus there is a decrease of oxygen in sea water, for its production is largely dependent on the atmosphere.

Water of the river is loaded with toxic substances, such as salts of heavy metals, phosphate from agriculture. Fertilized soil affects groundwater and surface water in the final stage. The land is burdened by oil substances and heavy metal salts to dioxin and chemical warfare agents (chlorine, anthrax, mustard gas - which was first tried in the First World War in France, etc.).

Another threat to the devastation of our planet is dangerous and irresponsible sale of the natural environment. Ruban forests, phasing out the rainforests expires genetic potential. Burning of forests in Brazil and other areas of rainforest are destroying the Earth's richest living space and provides users with these countries only very short-lasting benefit. After several years, the Emerging step can be used as pasture land and then destroyed by erosion. Burning forests is increasing as. carbon dioxide in the air and promotes the greenhouse effect. Two essential living areas are particularly vulnerable to human activities: wet grasslands habitats (bogs, marshes, swamps seaside) and forests. It is certain that the most harmful one planet, which is very sad.

Recycling feedstock

The introduction of environmental requirements for the production and hence with those of lawful content of the element is designed to prevent the emission of elements that threaten human health and the environment, waste (quantity, ecological destruction), look for the recycling of end of life product directly in the design, located solutions for ecological disposal of all waste associated with the production (machinery oil, chemical cleaning agents, waste materials, paints, thinners, etc.).

It is based on the decomposition of polymers through heat, chemicals and katalyzátoryk creating variations of products ranging from initial monomers to mixtures of compounds, mainly hydrocarbons, with possible applications as a source of chemicals or fuels. Products vary, and plastic decomposition shown similar characteristics and quality of the plastic material being prepared by conventional methods. The wide variations of procedures and arrangements were examined for recycling starting produktuplastových and rubber waste.

The methods are classified into the following categories:

• Chemical depolymerization is reacting with certain elements to obtain the initial monomers.
• Gasification oxygen or steam to produce syngas.
• Thermal decomposition of polymers heated in a protective environment.
• Catalytic breaking and reshaping. Polymer chains are smashing effects of catalysts that promote the cleavage reaction.
• Hydrogenation. Polymer is reduced procedure associated heat treating catalyst in many cases.

At present, the recycling feedstock limited economic process rather than technical reasons. [18] [19]

In this paper I addressed the issue also features various mixtures, threats, use and advantages and disadvantages of recycled materials.

4 PLASTICS VERSUS METALS

It is preferable to use plastic instead of metal in the manufacture of parts? If we answer this question, we must first consider the process for the manufacture of metal products and the start of production of raw materials.

Mining ore processing for use in production - it is a very costly process that requires the use of special machines, cutting machines and complete processing plants. The manufacturing process is also for economic reasons rather difficult, and moreover is worth a reminder that the entire machinery of the organization.

Plastic is durable material. It is also very functional and can be used for almost anything that may come to mind. The third factor is the price. Indeed, the cost of production and the organization of production products, plastic is much cheaper than if we use metal.

A output? We get a solid inexpensive product. Furthermore, this material is very durable.

Manufacture of plastic products is organized using forms. Today, modern technology make any molds, these devices are so functional that can be used to make products of plastics, which can be cheaply mass produced in different shapes and sizes. Therefore, today plastic is rapidly replacing metals in the production of various kinds of many products. It has long been a traditional industry. Cheap plastic substitutes in many products made of metal, wood and glass, which have become commonplace in our lives. [26]

Landfills are full of plastic waste, and scientists are working on obtaining biodegradable forms of plastic to use these products to nepřeroste polluting the problem. Scientists at the University of Tel Aviv (Israel) offered diametrically opposite solution. The team of specialists led by Prof. Moshe Kol developed a method of producing a much stiffer and more durable polypropylene. This type of plastic is widely used around the world, and can

replace steel and other materials in various industries. Plastics are composed of long molecules - polymers that combine in a single chain of small building blocks - monomers. The polymer is exerted by the catalyst. For the production of durable plastic requires less energy and resources than the manufacture of metal alloys. In addition, the plane with plastic parts weigh less, which means that less fuel is consumed. Moreover, plastics are korózibilné or release toxic substances in water. [27]

The traditional field of application include metal toothed wheels, where the emphasis is on torque load. Comparing, for example, transfers wheels of steel and plastic, wire transfers where, when the need for continuous lubrication for plastic and no transfers. Reducing weight is another advantage of the exchange of metal components for plastic. A plastics in some applications is to reduce noise and increase recycling options considered more effective use of these materials in practice.

One method for assessing the pros and cons of exchange is the primary rights to assess performance.

Here are a few critical parameters that must be defined:

• System and the operating temperature range.

• Maximum load crease and conditions.

• Fatigue.

• Use restrictions (tribology) and types of materials.

• Impact on traffic load.

• Effect of chemical agents in use.

• Resistance to UV or other weather conditions.

• Anticipate possible responses.

Another important parameter is the stress. Designers must determine the nature and extent of the stress components. Also important is the temperature at which the individual components subject to load. Engineering plastics can withstand a considerable amount of stress. This feature is evident in plastics used as thrust washers, EPS sprockets, chains and tensioners. [26]

5 CONCLUSION

In order to compete in today's highly competitive environment, manufacturers must ensure a strong emphasis on product differentiation while maintaining good margins and low costs. This distinction is made according to the design, appearance or development of new functions requiring more sophisticated and miniaturized systems. Part of the rationalization is another important trend in industries such as aerospace. For these reasons, the use of plastic versus replacement of metal and other traditional materials which is becoming a key strategy in many markets.

This trend is rapidly expanding due to the numerous advantages compared to the metal with plastics. All of them lead to significant improvements in productivity and product differentiation. Plastics compared with metals, still have some advantages, such as: increased strength and rigidity, internal thermal and electrical conductivity and self-tolerance.

The situation in the area of engineering plastics is difficult. It is a combination of many factors and intervening institutions. Treatment methods in this area are extensive technology progressing in leaps and bounds, therefore it can be concluded that most of the material from which airplanes are manufactured, can be recycled nowadays quite easily. Very important is the use of secondary raw materials. energy Saving and raw materials through recycling, are crucial for the protection of the environment. Major shortcomings are seen by experts including the legislation, compared with Western Europe are lagging behind in terms of material utilization.

Ecological processing of engineering plastics used is an activity that is not economically profitable too. The processing of these materials are relatively expensive and the prices obtained parts, recycled metal and plastic are not high. Seamless material recycling in our country is rather a pipedream.

There is a huge potential for metallic compensation in the aerospace industry. Plastic construction materials are in themselves undeniably high development potential. However, the effectiveness of their use should always be carefully considered. Empirical development of plastic construction materials, production technologies and the design of primary structures is obvious that the right direction is still looking.

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