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Polymer material application in mechanical equipment

Na Wang, Xianyong Zhang

Guangdong Polytechnic Normal University,Guangzhou 510000, China

ABSTRACT. *With the continuous innovation and research and development of various emerging technologies in social development, non-metallic materials have gradually replaced steel materials and are widely used in social production and life. They have high strength, strong toughness and easy processing and applicability. . This article will start to analyze the polymer materials, mainly using polyurethane elastomer, nylon, ultra-high molecular weight polyethylene, polyoxymethylene materials in mechanical equipment to explore, and combined with the application to confirm that polymer materials are not only environmentally friendly and reduce cost guarantee product quality.*

KEY WORDS: *Mechanical equipment; Polymer materials; Structure*

1. Introduction

From the current development direction of electromechanical products, more and more non-metallic materials have replaced steel materials, which have the advantages of high strength, toughness, easy processing and application to oil-free or micro-oil. It is increasingly used by factories for research and application, especially in the electronics[1]. automotive, sewing, machine tool and office equipment industries. Due to the special mechanical properties of polymer materials, the absolute strength of some polymer materials is higher than that of metal materials, which not only helps to save energy, but also has wide applications in industries such as electromechanical, transportation, light industry and medicine. This article will focus on the application of polymer materials in mechanical equipment.

2. Polyurethane elastomer application machinery and equipment

2.1 Advantage application

Polyurethane elastomer is a rubber-based material that has excellent wear

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resistance, tear resistance, corrosion resistance, radiation resistance and fatigue resistance compared with ordinary rubber. At the same time, its mechanical properties range is wide, the hardness varies between 20-95 Shore, and the strength increases with increasing hardness.[2] Polyurethane elastomers are particularly resistant to abrasion, and in some organic solvents (such as kerosene) and mortar mixtures, they wear less than other materials. The polyurethane elastomer can be made into a flotation machine impeller and a cover plate, and is widely used in a flotation machine in which the working condition is abrasive wear. The anti-fatigue properties of polyurethane foam elastomers are unmatched by any material. The fatigue strength of reciprocating 107 is higher than that of any material. The successful use of coupling pins is the best proof.

2.2 Limitations

However, it is worth noting that when the polyurethane elastomer is used for the wheel of the guide wheel, if the installation force is always applied, the hydraulic oil will be directly discharged from the turbine to the exit position of the guide wheel[3]. As a result, the problem of "hydraulic topping" occurs, and the output torque of the torque converter of the guide wheel is greatly reduced, resulting in problems in loading maneuverability. Moreover, polyurethane elastomers are still rubber-based materials, and all polyurethane elastomers cannot be widely used in mechanical parts subjected to sliding friction. Polyurethane cartridges are also not suitable for use as a structure alone.

2.3 Molding method

There are many methods for forming polyurethane elastomers, such as manual casting, mechanical casting and injection molding. The variety of molding processes makes it easier to use and promote. The production of the sealing ring can be injection molding, and the single-piece and small-volume wear parts can be cast by hand, and the large-volume parts can be mechanically poured. The formulation of the polyurethane elastomer can be modified to change the curing mode. The spray molding process can be used to make the wear-resistant lining, which is convenient and reliable.

3. Nylon application machinery and equipment

3.1 Advantage application

Nylon material has good mechanical properties, and has the advantages of fatigue resistance, creep resistance, wear resistance, corrosion resistance and heat resistance. Although its specific rigidity is lower than that of metal materials,[4] its specific strength is superior to that of metal materials. Compressive strength is also

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comparable to metal and can be used as a substitute for metals. Nylon material has excellent friction resistance and low wear rate. The base coefficient of nylon oil-free lubrication is usually 0.1-0.3. It is about 1/3 of that of babbitt. The friction coefficient of nylon to steel is dry friction. 0.20-0.25, 0.08--0.12 under oil lubrication, the friction coefficient in water has a certain increase. If an additive such as molybdenum disulfide, graphite or polytetrafluoroethylene powder is added to the nylon, the friction coefficient thereof can be greatly reduced, thereby improving the wear resistance.

3.2 Limitations

However, the nylon material that needs attention should contain a large amount of guanamine groups and has strong water absorption. This property should be annotated in use. In particular, nylon materials are in water for a long time, and their wear resistance is rapidly degraded, which is not suitable for use as a wear-resistant material, and causes dimensional stability and insulation performance to be greatly reduced. Nylon materials are susceptible to corrosion by strong acids and strong oxidants. Generally, the long-term use temperature of nylon materials should be kept below 80 degrees Celsius. Since nylon has a linear expansion coefficient of 5 to 7 times that of metallic materials[5], this performance needs attention for mechanical equipment. The thermal conductivity of nylon materials is about one-hundredth of that of carbon steel, which is about one-fourth of that of brass. Note the use of nylon materials in mechanical equipment that pays attention to thermal conductivity.

3.3 Molding method

The molding of nylon products is diverse, generally adopts injection molding, and mold-cast nylon is appeared as needed, which is suitable for producing large-sized nylon products and small-volume nylon products, so that the forming process is perfected.

4. Ultra high molecular weight polyethylene

Ultra high molecular weight polyethylene is a very good wear resistant material. Compared to other wear resistant materials, the friction coefficient of ultra high molecular weight polyethylene for steel is very low, while the wear of ultra high molecular weight polyethylene is the smallest. Because UHMWPE is a very wearable material with very high performance. Moreover, the ultra-high molecular weight polyethylene is a non-polar material, and the ultra-high molecular weight polyethylene does not adsorb any material, especially the ultra-high molecular weight polyethylene as a coal-based tank, which does not adsorb the coal seam, thereby effectively solving the steel hopper adsorption. The problem of coal seams[6]. In summary, UHMWPE will be used in hoppers, silos, chutes, bulldozer

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bulldozers, automatic loading and unloading carts, etc. for coal, cement, salt, sugar, etc., and will have good applicability. . In addition to the above applications, ultra high molecular weight polyethylene is also used in mechanical equipment such as star wheels, guide wheels, gears and worms in food machinery. However, it is also necessary to pay attention to the mechanical strength of ultra-high materials compared to nylon, which only achieves a compressive strength of 25 MPa and is less prone to sticking.

5. Polyoxymethylene material application

Among all plastics, polyoxymethylene has a specific strength and specificity similar to that of metal materials, and can replace metal materials such as steel, iron, aluminum and copper in many fields. The outstanding advantages are high modulus of elasticity, high toughness and hardness, high impact strength and fatigue resistance. Under normal circumstances, the specific strength of polyoxymethylene can reach 50.5 MPa, the specific rigidity can reach 2 650 MPa, the heat resistance of polyoxymethylene is also very high, and it can be used for a long time at 100 ° C. The paraformaldehyde is continuously used at 82 ° C for more than one year. There was no significant change in tensile strength and impact strength after continuous use at 121 ° C for 3 months. Good electrical properties, almost independent of temperature, humidity, water resistance.

POM has outstanding wear resistance. The wear resistance of metal is smaller than that of nylon. It is modified with PTFE, engine oil, aluminum disulfide, chemical lubrication, etc., and its friction coefficient and wear amount are smaller. The limit PV value can be Up to 39×105Pa·m/s, due to its good mechanical properties and wear resistance, POM is widely used in the manufacture of various structural parts such as gears, bearings, cams, nuts, various pump bodies and guide rails. A large number of non-ferrous metals such as zinc, copper and aluminum have been replaced in the automotive industry, which can replace cast iron and steel stampings.

However, POM has high resistance to oils and fats, organic solvents, etc., and it can ensure its safe use even at high temperatures. In the case of strong acid, stress cracking may occur, such as sulfuric acid, nitric acid, sulfurous acid, and the like. In addition, the weather resistance of polyoxymethylene is poor. When it is used outdoors, ultraviolet sorbents and antioxidants should be applied to improve the weather resistance. Polyoxymethylene is usually injection molded and extruded into a molding method.

6. Conclusion

In summary, it can be seen that all kinds of polymer materials have their own advantages and limitations, carefully verify the specific performance data of each material, compare the advantages and disadvantages and then consider the amount of demand, select the appropriate molding method, develop and use high Molecular

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materials, examples are as follows:

(1) For wear parts that are rotated, stirred or scoured in mud and mortar, and similar to the above-mentioned wear forms, wear-resistant rubber with hysteresis resistance, polyurethane elastomer and wear-resistant type should be used. Molecular weight polyethylene and the like. The wear resistance of wear-resistant rubber in this environment is not as good as polyurethane urethane elastomer and ultra-high molecular weight polyethylene, but the price of the latter two is higher than the former, the service life is higher than the former, and the production efficiency, maintenance and actual use can be considered. Production and many other factors, choose to use.

(2) The selection of sliding friction parts is generally nylon, ultra high molecular weight polyethylene, polyoxymethylene and the like. Ultra-high materials, whether self-lubricating, water-lubricated or oil-lubricated, have lower friction coefficient and wear than other materials, and are corrosion-resistant and can work in any harsh environment of acids, alkalis, salts, oxidants and organic solvents, but their strength low. Nylon series materials and polyacetal are resistant to abrasion, abrasion and high strength, but nylon is easy to absorb water. It can not be used after working for a period of time in water. It can not be used in strong acid and salt. Polyformaldehyde is not resistant to strong acid and weather.

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