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The Specific Selection and Application of Metal Materials in Mechanical Engineering Design

Ruijie Zhu

University of Southampton, Southampton, United Kingdom

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Abstract: At present, with the acceleration of the urbanization process, the mechanical design industry plays an important role in it gradually appears, which greatly promotes the national economic development, making the urban development more rapid and prosperous. However, in the process of mechanical design, the selection of metal materials is very critical. Because the quality of metal materials has a huge impact on the level of mechanical design, based on the realistic situation of mechanical design, choosing the most suitable and high-quality metal materials will promote the development of China's mechanical design industry. This paper focuses on the analysis and discussion of the selection of technical materials and specific use methods in mechanical design, to promote the efficiency of mechanical engineering and better implement the concept of sustainable development.

1. Introduction

With the development of social economy and the progress of science and technology, in the field of mechanical engineering, the application scope of metal materials is more and more extensive, among which, metal materials play an important role in mechanical engineering design. Therefore, the functional requirements of the parts must be taken into consideration when selecting the metal materials. For different mechanical parts, the functional requirements are also different. For example, as one of the most common mechanical parts, gear functional requirements are also diverse. Usually, the gear needs to bear a large load when working. To meet these requirements, the gear material shall have good strength, toughness and wear resistance.

2. The importance of material selection and application in mechanical design

With the rapid development of all walks of life, the demand for mechanical equipment continues to grow, at the same time, the people of machinery and equipment quality and performance requirement is more and more high, in the increasingly fierce competition, a series of scientific design for mechanical products, can greatly promote the development of the machinery industry, and metal materials, is the most important equipment and elements of mechanical design, the choice of metal materials must strictly follow the design specification, to adapt to the development of modern society, so as to promote the benign development of the industry. Before using metal materials, it must be closely tested to ensure that the use of materials contributes to the design of the

machine[1]. In addition, in the selection of materials, we also need to consider the practicality and environmental protection, in order to better promote the diversified development of the machinery industry. Especially under the national economic sustainable development strategy, in the selection of mechanical design materials, not only should pay attention to the quality of materials, but also to ensure its practicality. At present, a large number of new materials continue to emerge, not only has the mechanical design function, but also has the characteristics of environmental protection and energy saving, so as to achieve the purpose of green development of mechanical design, so as to promote the long-term development of the mechanical design industry.

3. Basic principles for selecting metal materials

3.1 Economic and environmental protection performance of materials

In the process of modern industry development, the selected materials must be based on green, in order to achieve the purpose of sustainable development. In addition, the selection of metal materials, should comprehensively consider the various influencing factors. For example, before a work, the required materials need to be estimated, based on this, waste can be effectively prevented in purchase and use. In addition, it is necessary to consider the difficulty and price of material processing, and try to choose materials with high cost-effective performance, which can not only reduce the cost, but also create greater economic and social benefits for enterprises[2].

3.2 Working environment of the parts

Mechanical design is a complex process, which composed of several seperated parts. The tiny mistakes during the installation would cause mechanical failure. Therefore, the quality of metal materials is very important, and its quality has important influence on the reliability of mechanical design. In addition, it is essential to consider the working environment and metal parts, because of metal material's thermal influences. If the work is under high temperature in a long period, material could expansion, making the extrusion between parts and finally causing negative effects on parts. Therefore, when using these parts, their quality needs to be strictly monitored to ensure that the mechanical design work can proceed smoothly.

3.3 Durability and economy of metal materials

Mechanical design should pay attention to two points: durability and economy. The service life of the machinery is directly determined by the durability of the parts. The use of metal materials with a long service life as raw materials for parts, and then used in mechanical design, can ensure that the machinery has a high durability, but also provide good conditions for the development prospect of mechanical design;

Economy is another factor to be considered in mechanical design. The economy of mechanical design refers to reducing the manufacturing cost of machinery as far as possible while ensuring the safety and functionality of the machinery. Based on this, the required metal materials can be compared with other metal materials to ensure that the final selected metal materials have the highest economic benefit.

3.4 Renewable and recyclable materials

When choosing metal materials, it is necessary to choose some recycling as far as possible to achieve the purpose of secondary circulation and reuse, so as to reduce the production cost of

products, and at the same time can have a positive impact on the ecological environment, to avoid "white" pollution. In addition, both before and during the use of metal materials, various materials need to be classified to improve the production efficiency and quality. In addition, after classification, convenient reuse of recyclable materials, and the concept of sustainable development are thoroughly implemented. At the same time, in terms of manufacturing process, we should also adopt a scientific and standardized way to reduce the discharge of sewage and tail gas, scientific disposal of industrial waste, try to reduce resource consumption, and prevent the pollution caused to the environment[3].

3.5 Material is harmless

In some metal raw materials, there will be lead, mercury and other harmful substances. Therefore, in the manufacture of such spare parts containing dangerous materials, if improper disposal, it will bring great danger to the surrounding environment. Mechanical production and manufacturing aims to promote social and economic development and seek the welfare of all mankind. However, when the metal materials with pollutants are used in the mechanical design, it will cause adverse effects on the human body, and affect the coordinated development of the natural environment and social stability. Therefore, in the machinery manufacturing enterprises to choose metal materials, it is necessary to fully consider their materials, as far as possible to choose harmless metal materials, as far as possible to avoid those metal materials with harmful effect, and consider its substitutes. If there is no suitable substitute, the mechanical design and manufacturing enterprises should consider limiting the use and use of such substances, so as to maintain their environmental impact within a controllable range and avoid negative impact on the external environment.

3.6 Part dimensions

Part scale control is a very important part in the design of parts, especially some high-precision parts, often require the parts to have the manufacturing accuracy of nanoscale. At the same time, the mechanical design is theoretically the size of mechanical parts calculation and analysis. In the actual work, the processing site often processing parts cannot cooperate with various problems such as nesting. Therefore, designing of metal parts size must fit to the actual process conditions and working environment, accurately calculate the mechanical parts size, and not only analyze in theory. In the selection of materials, to ensure that their mechanical properties are consistent, and easy to process as far as possible to ensure its accuracy[4].

4. The concrete manifestation of the new material application in the mechanical design

4.1 Application of practical materials

In the manufacturing process of mechanical equipment, it is necessary to carry out a series of processing, such as cutting treatment, heat treatment, forging treatment, etc., to ensure that the materials produced by the equipment have good performance, it is necessary to choose suitable materials according to the actual performance requirements of the equipment. Only those materials that show obvious advantages in practical application can keep their characteristics from changing with the application of production technology in the machine design and production, and even after they are made into various parts, they can still maintain their original use, so as to ensure the smooth operation and safe operation of the machinery and equipment (as shown in Figure 1).

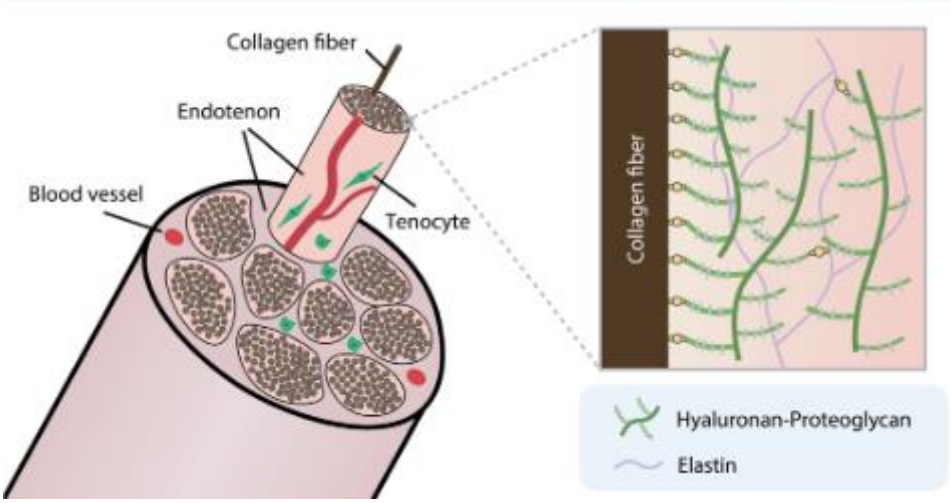

Figure 1: Application of practical materials

4.2 Application of loading-type materials

In mechanical design and production, some material damage often occurs. The reason for this is largely the limitation of the carrying capacity of the material. Therefore, in the design, it is necessary to use loaded materials, according to its characteristics of a comprehensive understanding, scientific selection, to ensure the safety of the material. In addition, the load requirements of the loading materials should be considered to ensure that the mechanical equipment meets the relevant use standards in the later application. The selection and application of qualified load materials can minimize the material failure phenomenon and ensure the consistency of mechanical product design and practical application.

4.3 Application of alloy materials

In the mechanical design, attention should be paid to the selection and use of alloy materials and carbon steel materials. This kind of material has low cost, convenient production, strong applicability, but the application of carbon steel material in mechanical design, it needs to consider its toughness and strength have some limitations, should be combined with the performance requirements of specific mechanical equipment to comprehensive selection. But the alloy material can well make up for the shortcomings of carbon steel, in the mechanical design, the alloy wear resistance advantages can be played to the extreme, to ensure that the product design to achieve the best use results.

4.4 Application of non-toxic materials

In mechanical design, suitable materials are often harmful. For example, the use of some chemicals can cause harm to humans and the natural environment. In the mechanical design, attention should be paid to the application of non-toxic materials, so as to achieve both environmental protection and reduce human damage. In addition, designer should integrate the concept of green environmental protection from material selection to ensure reduction of toxic materials, the use of chemical materials, and radioactive materials. In order to reduce the adverse reactions of human beings in the machine manufacturing process of machine manufacturing, the violation of rules and other nonstandard phenomena should be prevented from the source. Therefore, enterprises need to provide professional training for front-line operators to ensure that they have a

sufficient understanding of operational skills and related professional knowledge. For example, under the premise of using ultra precision machining technology, the spindle running state judgment method, the spindle end beat and the maximum allowable deviation value, end surface support surface parallel difference, surface roughness substandard and ring against common quality problems such as factors and treatment methods, ultra precision machining process steps. In addition, the effect of professional training of employees should be regularly evaluated regularly, and the next training plan should be determined according to the evaluation results. It is strictly prohibited to arrange unqualified employees to specific positions, and the relevant qualification of the production personnel should be examined[5].

4.5 Application of processing technology

In the structural design of mechanical engineering, the cutting technology is also a main basis for the selection and use. The right treatment allows the material to fit perfectly into the machine. Therefore, in the machine design, it is necessary to identify all kinds of machine manufacturing technology, and develop a complete set of manufacturing plan. For example, in the steel manufacturing, the steel must be heat treatment, and heat treatment also has different treatment methods, such as quenching, annealing, nitriding, etc. For the parts with high hardness and adverse effects on cutting and processing, in order to ensure the smooth cutting process, the parts must be heat-treated to reduce their surface hardness to a certain degree. In order to show different characteristics on the surface of the mechanical structures, or to enhance some of its properties, such as corrosion resistance, heat resistance, hardness, etc., it can be nitride.

5. Conclusion

To sum up, the machinery industry needs to improve its own competitiveness while adapting to the development of The Times. Mechanical design is a very tedious work, its types, the use of materials are also different, its has, the characteristics are also different, so we must have a keen insight, according to the determined specifications to choose the materials used. In the process of use, we should ensure that the materials used are economical and environmentally friendly, so as to better meet the needs of modern design. Only in this way can we ensure the further development of mechanical design technology.

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