

Selection and Application of Materials in Chemical Machinery Design

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Abstract. Materials used in the design of chemical machinery are an indispensable part of industrial production, and chemical machinery materials are also the main basis of chemical production. Chemical mechanical properties can directly determine the quality of products in chemical production, and their materials also determine the quality of chemical mechanical properties. Selecting corresponding materials has become the core of chemical mechanical design. Therefore, in the design of chemical machinery, there is a special value for the selection of materials used in manufacturing.

1. INTRODUCTION

With the continuous growth of national economy, the production of chemical industry has entered a new development period. New methods and technologies overlap one another, resulting in large-scale development and production of chemical industry, which adds many material wealth to the development and life of national society and accelerates the pace of social development. In the design of chemical machinery, it is very important to select suitable materials. Improving such chemical industry can not only improve the comprehensive economic effect and promote the continuous development of society, but also effectively promote the development of chemical production and improve the working efficiency of equipment.

2. Main Functions of Material Selection and Operation in Chemical Machinery Equipment

With the rapid development of national market economy, construction in various fields is at the peak of continuous development, and the demand for chemical products is also increasing gradually. Therefore, chemical machinery and equipment are greatly developed. However, due to the increasing demand for materials in various fields, the supply of materials used in chemical machinery design is in short supply, and the shortage of mechanical materials becomes more and more serious. Based on the new era, the selection of suitable mechanical materials can not only ensure the mechanical quality and performance, but also make the operation of equipment more humanized and safe, such as excellent materials can effectively reduce noise and reduce hazards to human body [1]. In addition, we should not only consider the quality of mechanical materials in front of us, but also select the mechanical materials

with environmental protection, energy saving, sustainable development and economy, and reasonably use the limited resources to expand the chemical field. This is the only way for the sustainable development of chemical industry and also the only feasible way.

3. Accounting internal control strategy based on financial management of enterprises

3.1. Selection of common steel materials

Based on the background of chemical mechanical design, steel is one of the most commonly used mechanical materials. Common steel materials are usually of two types: alloy steel and carbon steel. Carbon steel is chemically processed and its mechanical parts are relatively stable. Most of them are used in the processing of some parts. In addition, due to the current steel price restriction, the price of carbon steel in China is relatively low. Using carbon steel as processing material can effectively reduce company costs. However, due to the high carbon content in carbon steel, the toughness is relatively reduced under high strength conditions. For some relatively large parts, the actual force is quite large. Poor flexibility will cause damage to the parts, so it does not conform to the parts with large processing volume. Alloy steel is a new type of steel based on the combination of carbon steel and other metals. Alloy steel can not only retain the advantage of high strength of carbon steel, but also provide better toughness for newly added metals [2]. Therefore, the appearance of alloy steel provides a new material selection for the field of machining.

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3.2. Material recycling

According to the national vigorously advocating to build a resource-saving society, in view of the progress in the field of technology and under the annual limit of products, obsolete equipment should be eliminated for waste recycling and reuse, which attracts much attention. Metal is usually used as comprehensive material for chemical machinery design. However, there are more than 100 kinds of metal materials available for material processing industry in today's society. If the selection of metal types for chemical equipment is too tedious, it will bring a certain strength to the classification of metal materials when recycling and reusing. Therefore, it is strongly required to follow the single principle as far as possible in the selection of materials in the design of chemical machinery, to select a single alloy as possible, and to facilitate the implementation of recycling, classification and integration, and to implement the recycling and utilization of old equipment.

3.3. Selection of suitable materials according to production process

In the design of chemical machinery, first of all, consideration should be given to the different manufacturing processes of parts when they are manufactured. When material processing is carried out for the designed chemical mechanical equipment, the main manufacturing processes are welding, casting, cutting, etc. The requirements for materials used vary according to the manufacturing process. For example, when cutting a material, one should think about whether the material used is good for cutting, whether the material used is easy to cast, and whether the material used has excessive compressive resistance when welding. Therefore, the materials used should be selected appropriately according to the production process and material characteristics.

3.4. Bearing material

In the production of chemical machinery, chemical equipment will generally face two situations: first, when the equipment is running, some parts of the equipment will be under a lot of force. The stress condition will cause parts to wear to varying degrees until deformation, resulting in shorter service life of the equipment. Therefore, the toughness and wear resistance of materials should be considered for the parts which are heavily stressed in actual production. It is expected that such parts should be processed by infiltrating carbon into low carbon steel using materials with high toughness and strength. Secondly, for some equipments with equal force, the force generated in the specific production will be applied to such parts on average. Whether stretching or extrusion, parts can maintain force balance, so it is impossible for a part to wear at a faster speed [3]. For example, all parts of automobile structure are balanced in material and stress structure, and the materials used also have good bearing capacity, as shown in Figure 1.



Fig. 1. Structural performance diagram of parts used in automobile mechanical equipment

4. Specific Analysis of Material Application in Chemical Machinery Design

The application of materials in chemical mechanical design is an extension and presentation of high and low quality of material selection and plays a crucial role in comprehensive mechanical design. In the design of chemical machinery, the scientific nature of material selection is particularly important. At the same time, the energy-saving, environmental protection and economy of material application are also particularly worthy of close attention of chemical machinery workers. In other words, how to effectively handle the unity of operability, energy saving, environmental protection and economy in material application on the basis of quality of material selection has already become the core topic of mechanical design work, and also the sudden trend of sustainable development in processing field and mechanical production field.

4.1. Ensure energy-saving and environmental protection in the application of mechanical design materials

Material selection and application in chemical machinery design need to be combined with energy saving and environmental protection. At the same time, it should be given a new requirement in the field of mechanical design as a long-term development concept in the construction and development of Eco-economy and society, which should arouse great concern of relevant workers. In the development of social market economy, the consumption and requirements of various non-renewable materials will definitely leave hidden dangers for the application and selection of chemical machinery design materials. Therefore, the integration of environmental protection and energy saving in material application has become the core of current machining work. For example, in the work of mechanical design castings, taking material application as an example, the cost of 4.5% in the process of casting design determines about 75% of the production cost of castings [4]. This reminds us to attach importance to energy-saving

g and environmental protection in the application of materials in mechanical design, which can not only reduce unnecessary energy consumption costs, but also save costs and raw materials effectively. In addition, the broad space for innovation can also meet the environmental requirements in the application process of materials in mechanical design.

4.2. Ensure that mechanical material parts are guided by manufacturing process

In chemical machining and production, cutting, welding, casting and heat treatment require different application of mechanical design materials in processing technology [5]. Careful analysis shows that the cutting process needs to be in accordance with the advantages of cutting operation in the application of mechanical design materials; the casting process strives to develop in the direction of high fluidity and high shrinkage in the application of mechanical design materials. The welding process should consider comprehensively the cold pier property and stamping property of the material in its material transportation and application. The heat treatment process should conform to the main properties of oxidation decarbonization, hardenability and superheat sensitivity in the application of mechanical design material.

4.3. The application of mechanical design materials should be controlled economically

In the design of chemical machinery, great attention should be paid to the market economy at that time in the application of materials. The analysis shows that in the application of chemical machinery design materials, the performance of parts and materials system should be guaranteed to meet the foundation, and the process cost of materials and parts should be scientifically controlled. Therefore, it is necessary to organically integrate chemical units with existing production conditions of mechanical production and to reasonably control the processing technology and casting-forming route of mechanical parts.

5. Measures to Improve Material Selection and Operation in Chemical Machinery Equipment Design

5.1. Improving corrosion protection design

In the design of chemical machinery, mechanical equipment usually processes some corrosive products, such as chlorine, fertilizer, alcohol and so on. At this time, the corrosion resistance of chemical machinery equipment is particularly important. In order to effectively prevent chemical machinery from being corroded, we need to use corrosion-resistant materials [6] at the beginning of the design. But in addition, adequate protective measures should be taken in the specific application process to centralize corrosive articles in one place so as to avoid close contact with mechanical equipment and thus cause different degrees of harm to mechanical equipment.

5.2. Perfect Selection of Alloy Steel and Carbon Steel for Chemical Equipment

Before making the material selection for chemical equipment, it is necessary to know the working environment and performance of chemical equipment and choose the appropriate material to meet the requirements of effective production. During the design, not only the practicability, safety and non-toxicity of materials must be guaranteed, but also the chemical and physical properties of materials must be considered comprehensively. For example, alloyed steels can be made by injecting trace alloying elements into carbon steels, which have a particularly high performance and are easy to obtain, and are also suitable for use in places with high wear, high temperature and strong corrosiveness. Alloy steel has many special properties, but it can not completely replace carbon steel, because carbon steel has its own unique advantages and characteristics [8]. Therefore, in the selection, it must be selected according to the actual requirements of chemical machinery and equipment. Only in this way can the use efficiency of materials be maximized.

5.3. Material selection shall be based on the manufacturing process of mechanical parts

Chemical mechanical equipment is also from mechanical processing, so the selection of material for chemical mechanical equipment must have Machinable characteristics. In view of the different requirements of materials for various processes, in the process of chemical machinery equipment design, the selection of materials for machinery must be carried out according to the requirements of different parts processing processes, not only focusing on the feasibility of specific processing, but also on the scientificity of design. After ensuring the economic use of materials, we should also consider the pass rate of finished products of machine materials in the process of processing. Some materials need to be processed several times before they can be produced as a good product, which undoubtedly increases the production cost and wastes a lot of time [9]. Commonality and standard parts should be used as much as possible in the design of chemical machinery to simplify the design process and thus effectively reduce costs and input standards.

6. Conclusion

In the field of chemical machinery design, material selection has always been one of the topics of great concern in the field of chemical production. At the same time, in order to make the production work in chemical industry more stable and internationalized, scientific researchers in chemical production field are gradually deepening the research and development of chemical machinery and equipment. Only by properly selecting chemical machinery materials can chemical groups produce chemical products with high efficiency and durability, and improve the basic work of chemical production, can chemical groups ensure that the products produced by chemical production not only have high efficiency but also have better quality,

thus promoting domestic technology in chemical production to all parts of the world.

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