Research on Modern Precision Machining Technology

Baxian Liu

Sichuan University of Arts and Science, Dazhou 635000, China.

Abstract

Precision machining technology is one of the key technologies for manufacturing high performance equipment and the key parts of products. Based on modern machinery manufacturing technology, and tanking precision machining technology as the breakthrough point, this article studies the characteristics, classification, key contents and applications of precision machining technology, and provides possible solutions for problems faced by high-performance parts manufacturing combined with examples.

Keywords

Precision machining technology; high performance; modern manufacturing; characteristics.

1. Introduction

Precision machining technology is one of the important signs of a country's manufacturing level. It plays a very important role in many fields, for example, in the design of biological tissue, functional material parts and so on. There are a large number of macro and even micro geometric features in those designs, which has higher requirements for manufacturing technology. In addition, the high-end applications of optical engineering, laser communication, infrared detection, laser nuclear fusion and other engineering fields have more performance requirements for high performance devices.

The level of manufacturing technology can largely reflect the level of mechanization of a country, as well as the embodiment of a country's comprehensive strength. Nowadays, the mechanical manufacturing market is becoming more and more competitive, which is mainly reflected in the quality competition, that is, the technology competition. Therefore, the machinery manufacturing industry is required to develop new technologies to improve the precision of the processing of parts. By making full use of the advantages of precision machining technology, we can lay a good foundation for the development of modern machinery manufacturing industry in China and achieve the goal of surpassing the leader in this field. It can be seen that the study of modern precision machining technology has important practical significance and value.

2. Features of Modern Precision Machining Technology

Precision machining refers to the processing technology of machining tolerance of 10.0~0.1 m and surface roughness of Ra0.30~0.03 m. Compared with traditional precision machining technology, modern precision machining technology presents some new characteristics, mainly in the following aspects. First, complexity. With the continuous development of intelligent manufacturing technology, precision processing technology is increasingly involved in the comprehensive application of a variety of technologies, including computer technology, automatic production technology and so on. Only by using these technologies comprehensively, the automation and precision control of machining can be realized. Second, internationalization. With the further intensification of global competition, the competition of science and technology has become the core of a country's competition. While

continuing technological innovation, countries should cooperate with each other to promote the steady development of manufacturing technology and precision machining technology [1].

3. Classification of Precision Machining Technology

3.1 Precision Cutting Technology

Precision cutting is one of the most commonly used direct cutting methods. In the actual manufacturing process, in order to get high precision products, the machine tools, cutters, workpieces must be strictly checked and operators carefully selected. Therefore, high stiffness, small deformation and other advanced technologies are chosen, mainly to improve the spindle speed of processing equipment [2].

3.2 Mould Forming Technology

At present, more than 1/3 parts are processed by mold, and mold forming technology will occupy an important position in the future parts processing. In order to get a high precision mold forming product, the mold itself must be highly precise. At present, the most advanced ECM process can reach the micron level of mold machining precision, and it has been used in the processing of complex parts [3].

3.3 Precision Grinding Technology

As a traditional processing method, the grinding technology introduces some new techniques to the application of the silicon chip to control the precision of the silicon wafer at the micron level. With the development of computer technology, the precision grinding technology can be manipulated directly by the computer. The operator only needs to input the grinding instructions into the control system. It can automatically stop and avoid accidents after the instruction has been completed. It can achieve ultra precision on the basis of precision and improve the accuracy of parts [4].

4. Manufacturing Difficulties and Solutions of Modern Precision Machining Technology

4.1 Precise Complex Curved Surface Parts Of Complex Structure

Complex curved surface parts with complex structure constraints mainly refer to the difficulties in designing and processing parts. There are many problems in the actual manufacturing of such parts. For example, the machining deformation and interference in the machining process lead to the difficulty of ensuring the accuracy of parts. Zhejiang University, Nanjing University of Aeronautics & Astronautics, Beijing University of Aeronautics and Astronautics, etc. have carried out a great deal of fruitful work in the precision and high efficiency machining of high performance complex surface. The relevant precision processing equipment has been developed and applied in China, thus breaking the technical blockade abroad and filling the domestic blank [5].

4.2 Ultra High Precision Parts

Ultra high precision microelectronics / optoelectronic substrates and optical lenses and length standard metering devices are called ultra high precision parts. Because of the high requirements for precision, the machining of such parts should ensure that the nanoscale processing can be achieved at the same time, and the micro crack damage can be avoided. With chemical and physical methods, the subnanometer material is removed, and the non damage and nanoscale smooth surface can be obtained.

4.3 High Performance Parts' Requirements For Hard-To-Cut Materials

The high performance parts of hard-to-cut materials mainly refer to parts with high performance guaranteed by special difficult machining materials and high geometric accuracy. The main processing difficulties are: the characteristics are extreme, showing super hard, super brittle or super soft, and the mechanism of material removal is unknown. The key technology can be started from three aspects:

material removal, processing technology and high performance cutting tools. At present, some advanced composite materials have been widely used in the manufacture of high performance components in the fields of defense and aerospace because of their advantages of high strength, high stiffness, high impact resistance and good electromagnetic properties. While the machining process is uneasy to control, the processing efficiency is low, and the defect is uneasy to detect, which makes it difficult to guarantee the performance of parts. The main problem at present is how to realize high quality production of large composite parts. Further research can be done in the way of material removal, damage mechanism, while improving the processing technology and processing equipment.

5. Conclusion

Precision machining is the basis and the key of advanced manufacturing technology. It is also an important embodiment of a country's manufacturing level, especially in the processing of high performance parts, which is related to the national security. With the further deepening and implementation of the strategy of rejuvenating the country by science and education, our science and technology have been constantly innovating and developing, which requires us to master the characteristics of precision machining technology, and introduce some new technologies to the precision machining technology, such as nanotechnology, and undertake specific analysis of the difficulties encountered in the precision machining.

With the rapid development of technology, in the future machinery manufacturing industry, the further introduction of computer technology can make the manufacturing process more intelligent. At the same time, it is necessary to absorb the world's advanced technology, continue to innovate, and accelerate the development of China's machinery manufacturing.

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