Discussion on the Technology and Application of Mold NC Machining

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Abstract: With the continuous development of science and technology in China, new breakthroughs have been made in manufacturing technology. Among them, NC machining and manufacturing technology of mechanical die is the most widely used. In the process of manufacturing, the NC machining technology of die and mould has stricter requirements on the complexity of structure, which means that the NC machining technology of mechanical die and mould plays a decisive role in the working process. In this paper, the characteristics and application of NC machining technology are introduced to analyze the actual situation of using machinery in die manufacturing process, and discuss the future development of data processing technology for mechanical die manufacturing.

1. Introduction
In the process of machine tool manufacturing, the manufacturing process and the mould need to coordinate with each other. Die is an important basis for manufacturing process equipment. To ensure the quality of mass production of mechanical equipment, we must pay attention to the quality of die. In the process of mould manufacturing in our country, there are some characteristics. Because of the fierce market competition, it is often necessary to produce a large number of moulds in a short time, so that the production cycle is more frequent, and at the same time the production requirements are also very high. In this case, the processing technology of machinery needs to be more rigorous and advanced. Traditional mechanical die production can not well meet the needs of social productivity at this stage. The production efficiency can be effectively improved by NC machining and manufacturing technology of mechanical die.

2. Definition and Characteristics of NC Machining and Manufacturing Technology for Machine Moulds
Simply put, NC Machining Technology is a new control technology developed from traditional processing technology. The biggest feature is to ensure automation and precision, which is also widely used in real life. The use of numerical control technology mainly depends on digital information, so it has certain characteristics of digitalization and automation. It also has a good effect in the control of machinery and facilities, and has a wide range of uses in all aspects. With the further development of China's economy, people's living standards have also been greatly improved, which is reflected in the higher requirements for the quality and beauty of products. Therefore, production enterprises also need
to innovate on this basis to improve the fit between products and users. Change the traditional thinking mode of mechanical production, adopt the innovative technology of NC die processing, and regard speed as an important aspect of development. As a product of the information age, NC machining technology is a new revolution of social production. It breaks the limitations of traditional technology. It is mainly manifested in two aspects, namely, NC machine tool technology and NC program system. The two can be effectively linked through technological interlinkages and give full play to their existing roles. Among them, CNC machine tool technology is an important foundation of CNC processing, which has double standards of accuracy and efficiency. It also plays an important role in parts processing. The whole technology can improve production efficiency and production convenience under the condition of guaranteeing product quality[1].

3. Application of Machining and Manufacturing Technology of Machinery Mould

3.1 NC Turning and Milling Technology
Manufacturing industry needs CNC turning technology, which is usually combined with die manufacturing. This technology is used in many parts of the actual manufacturing process. For example, the processing of rod parts, bearing forging and disk parts, etc. Because these processes themselves need to undergo extremely careful calculation and precise research, there are often some limitations in the manufacturing process. This limitation leads to the limitation of CNC lathe, so that it can only exist in the processing of parts with the die. The following figure is the working procedure diagram[2].

![Pre-process diagram for NC turning of coupling shaft](image)

Figure 1 - Pre-process diagram for NC turning of coupling shaft
But if the milling technology is used in the machining of mechanical die, the expected effect will be better. Milling is to fix the blank effectively in advance and to process the shape of the revolving body in an all-round way on the basis of fixing, so that it can meet the needs of production. Then the high-speed milling cutter is used to cut the blank, so that the blank can generate the desired shape features, as shown in Figure 2.
Figure 2 - Technical illustration of milling

Traditional milling technology usually only processes the shape of milling and simple groove parts, while NC milling technology can process more complex shape features according to the actual proportion of parts and the need. As far as the present NC milling technology is concerned, it can be allowed to process three or more axes. It can not only be applied to die, but also to complex thin-walled surfaces and artificial prostheses. Because most of the moulds are made up of curved surfaces, but the external structure of the moulds still belongs to the plane structure. The use of milling technology can greatly improve the quality of the moulds and save more time on the basis of traditional processing[3].

3.2 CNC WEDM and CNC EDM Technology

CNC EDM technology strictly belongs to the category of special processing. Its principle is to use high density and high energy EDM to process on CNC WEDM machine tool. It usually processes materials that can conduct electricity. In the process of making dies, numerical control EDM technology has been more and more widely used. Fig. 3 is the principle of numerical control EDM.

Figure 3 - WEDM Principle

Compared with other processing methods, the main advantage of CNC EDM technology lies in its control of EDM, which can ensure the accuracy of the model to the greatest extent, and also ensure high efficiency in the process of programming, especially for some more complex and subtle processing, and some plastic assembly processing, CNC. Wire cutting technology is more widely used. When the CNC spark works in practice, one of the poles of the pulse power supply is connected to the basic tool electrodes, and the other is connected with the workpiece electrodes. Both ends of the
electrodes are immersed in a liquid medium with a certain insulating property, which is usually ionic water containing kerosene or mineral oil. The electrode of the tool is controlled separately by an automatic adjusting device. During the effective time, the tool and the workpiece can maintain a proper discharge gap between 0.01 mm and 0.05 mm when they are working normally. When the pulse voltage is gradually applied between the two poles of the workpiece, the breakdown effect of the nearest liquid medium can be formed under working conditions, and the corresponding discharge channel can be formed, as shown in Fig. 4\(^3\).

![Figure 4 - Drawing of numerical control WEDM Technology](image)

In this channel, the cross-sectional area is small, which also leads to a very short discharge time, and all the energy can be concentrated together, which can reach between 10 and 107 W/mm\(^4\). The high temperature generated in the instantaneous region of discharge also causes the material to melt or evaporate instantaneously, forming a small pit at the evaporation place of the material. After the end of the first pulse, after a short period of time, the second pulse will break down and discharge in another electrode. Through such high frequency cyclic discharge, the tool electrodes are constantly strengthening the corresponding supply of the workpiece, making its shape and the shape of the workpiece adapt to each other, and eventually forming the required surface for production. At the same time, part of the total energy will also be transferred to the corresponding tool electrodes during the pulse process, which causes tool loss to a certain extent. The numerical control EDM technology should adopt appropriate pulse power supply and automatic adjusting device to keep a small gap between tool electrode and workpiece electrode. At the same time, the spark discharge must be carried out in the liquid with a certain insulation strength, which ranges from 10 to 107 Ω \(\cdot\) m\(^5\).

4. Summary
As a new manufacturing technology, CNC processing technology of mould has more advantages than traditional processing technology, and can effectively reduce the labor intensity of relevant staff, laying a solid foundation for the future development of mould manufacturing industry. In this paper, the definition and characteristics of NC manufacturing technology for dies and moulds are analyzed, and the specific application fields of NC machining for dies and moulds are analyzed, so as to make the future development direction of manufacturing technology for mechanical dies and moulds clearer, hoping to provide some suggestions and contributions for the future development of manufacturing technology for mechanical dies and moulds and the future theoretical development of enterprises.

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