Influencing Factors and Control Strategies of Heat Treatment Deformation of Metal Materials

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[Abstract] In the thermal processing of metal materials, the performance of the material is more stable, and the heat-treated materials are processed into parts to make the performance more excellent and more in line with the performance requirements of mechanical parts. However, in thermal processing, metal materials are prone to problems, such as deformation, deformation of the appearance of metal materials, and fatal effects on the processing of mechanical parts. Therefore, this paper focuses on solving the causes of deformation in the thermal processing of metal materials, as well as solutions to improve the problems in the processing of metal materials.
[Keywords] Metal material; Heat treatment; Deformation factors; Control strategy

1. Introduction

In the processing of parts, in some cases, the metal material is subjected to hot working to improve the performance of the metal material. In the processing of metal materials in China, it is a manifestation of the development of the manufacturing industry. The demand for mechanical equipment is also increasing. Under such conditions, in order to ensure the quality of mechanical materials, it is necessary to heat-process the metal materials.[1]

2. Factors Affecting Heat Treatment Deformation of Metal Materials

In the hot processing of metal materials, due to the structural problems of the metal materials themselves, there is a possibility of deformation due to changes in the external environment, mainly due to uneven heat and heat in varying time. During the heat treatment of the metal, the temperature of the metal itself is subject to significant changes, and such temperature changes will affect the internal structure of the metal. When such an effect is intensified, the shape of the metal will change. The change is called internal stress shaping deformation. In the internal stress deformation, there are many changes to the external features of the metal, and such changes will change with the frequency of hot working on the metal material. In other words, the higher the number of hot works on the metal, the greater the possibility of deformation.

Under normal circumstances, the internal stress of the metal material is mainly layered, one is thermal stress and the other is tissue stress deformation. After the

equivalent thermal and cold effects on the metal material, thermal stress deformation can be obtained during such an operation. However, in the deformation of the tissue stress shape, the properties and shape of the metal itself, and the way in which the metal material is added and cooled are directly related. In the process of hot metal processing, we can understand that to improve the performance of metal materials, the process of this improvement is cumbersome and complicated, and the types of metal materials and operating specifications must be considered in the operation. Make reasonable adjustments while collecting parameter content. Due to the limitations of technical processing in China, it is difficult to effectively control the temperature during the processing and the accuracy of monitoring. In such an environment, the thermal processing is very easy to appear, which deforms the metal material.

3. Metal Material Heat Treatment to Reduce Deformation Should Follow the Principle

3.1 Compliance with Scientific Principles

In order to reduce the deformation of metal materials in the heat treatment processing environment, it is necessary to adopt a scientific management method to heat treatment of metal materials.[2] At work, our metalworking technologists must hold the spirit of science, guided by scientific means, and scientific concepts. In this way, in the case that the current technical equipment is not perfect, it is guaranteed that the hot processing of the technical materials will not be deformed, or it may occur, and it must be controlled within a reasonable range.

3.2 Follow the Principle of Practicality

Metal materials are a non-renewable resource for the earth's resources. In such resource utilization, we must consider the waste of resources and the sustainable development of resources. How to ensure the problem of resource waste in metal materials, we must reduce the problem of material deformation in metal thermal processing engineering, and make effective use of resources. At the same time, the effective use of resources is a kind of protection for the environment. When we protect the environment, we can develop, which is the core content of sustainable development.

Therefore, in the thermal processing of metal materials, it is necessary to adopt a scientific method to ensure that the processing is based on practicality and to ensure the effectiveness of the materials. Of course, while ensuring effective material savings, such a premise is to ensure the quality of metal materials in thermal processing. Only by ensuring good quality can we maximize the practicality.

4. Ways and Methods for Heat Treatment of Metal Materials to Reduce Deformation

4.1 Scientific Application of Heat Treatment and Quenching Process for Metal Materials

In the hot working process of metal materials, the quenching process is the core technology of hot processing of metal materials. In such a technology, a slight grasp of the metal hot working temperature is inaccurate, which causes internal stress deformation of the metal material. Therefore, in the processing, the quenching medium should be used well, and the medium can be used reasonably and effectively to ensure that there is no misalignment inside the metal, thus ensuring good metal deformation.[4] Therefore, in the use of quenching medium, we must adopt scientific and reasonable use methods, and we must constantly innovate in the work, and constantly improve the use of the medium. This is a process of accumulation of experience. In the work, the metal processing technologist is required to continuously discover the problem, then solve the problem, and create a new process method in solving the problem, thereby fundamentally solving the deformation problem of the metal material in the hot working.

The cooling process of metal is a key step in metal deformation. Therefore, the metal processing technologist should strictly follow the work flow, use the scientific cooling method, and grasp the speed in the cooling, so that the quality of the metal material can be effectively ensured, and the metal deformation can be increased. In the quenching process, the common medium for quenching is generally water and oil. When the speed of the filling is ensured, the temperature of the water is also ensured. The medium water temperature is generally required to be 55°C to 65°C. If oil is used as the quenching medium, the oil temperature is required to be maintained at 60 to 80 degrees. The key technology is to control the speed of the input. The quality and deformation depend on the cooling effect. The emphasis on the use of scientific methods here is to ensure good metal deformation problems and quality performance problems.

4.2 Scientific Selection of Cooling Methods for Metallic Materials in Thermal Processing

In the current stage of technical heat treatment in China, the methods of metal cooling mainly include two-liquid quenching method and single-liquid quenching method.[5] The so-called two-liquid quenching cooling method mainly refers to, in the addition of metal, the metal is first placed in a liquid medium, the metal temperature is rapidly reduced to 300 degrees, and then the technology is effectively cooled by placing the

technique in a lower temperature medium. Here, we must grasp the speed problem of putting in two times, and grasp the speed to grasp the quality of metal materials. In the single-liquid quenching process, it is necessary to improve the working efficiency in quenching, but it is difficult to control the scientific method in the control of the quenching speed. In the selection of these two quenching processes, the quality and level of metal quenching can be grasped according to actual needs.

4.3 Scientific Choice of Clamping Methods and Fixtures

In the process of heating and cooling the metal, the metal processing and clamping is used differently, and the current state of the processed metal material is different. Here, it is necessary to select the clamping tool according to the actual status of the metal. In a suitable clamping tool, the heating of the technical material can be ensured evenly, and at the same time, the material can be prevented from being deformed during the processing. Moreover, in the actual work, the clamping tool can be flexibly adopted according to the change of the shape of the processed metal.

5. Conclusion

After analyzing the hot working process of metal materials, understand the causes of metal deformation during the processing, and try to overcome the difficulties and find a solution in the work.

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