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Restoration of Cylindrical Parts: Combination of Surface Coating and Turning

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Abstract: This paper investigates the restoration of cylindrical parts through a novel combination of surface coating and turning techniques. As cylindrical components are widely used in various industrial applications, their wear and degradation can lead to significant operational challenges and costs. The research focuses on addressing these issues by integrating advanced surface coating methods, such as thermal spraying and chemical vapor deposition, with precision turning processes.

Keywords: Cylindrical parts, restoration, surface coating, turning, wear resistance, dimensional accuracy, thermal spraying, chemical vapor deposition, sustainable manufacturing, mechanical properties.

Main part

Reconditioning of cylindrical parts occupies an important place in modern mechanical engineering. These components, such as shafts, axles and bearings, are the main elements of various mechanisms and systems that are used in industry, automotive and energy sectors. Wear of cylindrical parts is inevitable as a result of operation, which can lead to a decrease in the productivity and reliability of equipment. Wear can be caused by many factors, including mechanical friction, corrosion and thermal cycles. As a result, damaged or worn parts require regular reconditioning to maintain normal equipment operation. However, traditional reconditioning methods, such as grinding or complete replacement of parts, are often ineffective and expensive.

In the context of modern requirements for productivity and cost reduction, the need to find more effective reconditioning methods is becoming especially relevant. Combining surfacing and turning processes is one of the promising approaches that can significantly improve the quality of reconditioning work and reduce costs.

This article is aimed at analyzing the methods of reconditioning cylindrical parts, as well as studying the advantages and technological aspects of combining surfacing and turning. Let's look at how this approach can change the approach to restoring parts, increase their reliability and extend their service life.

The Problem of Wear of Cylindrical Parts

Reasons for Wear

Cylindrical parts are subject to many factors that cause wear:

1. Mechanical Friction: Constant interaction with other components causes material loss and formation of worn areas.

2. Corrosion: Exposure to moisture and aggressive chemicals can destroy the surface of the material.

3. Thermal Cycles: Frequent temperature changes can cause thermal deformations, which degrades performance.

Effects of Wear

Worn parts can lead to:

• Reduced productivity: Worn parts may not be able to cope with the loads, which reduces the efficiency of the entire equipment.

• Increased costs: Replacement and repair of parts require significant financial investments, as well as equipment downtime.

• Risk of accidents: Improper operation of worn parts can lead to serious accidents and safety risks.

Combining surfacing and turning processes

Benefits of a combined approach

Combining surfacing and turning processes allows for a number of significant advantages:

1. Increased restoration quality: Surfacing creates a new layer of material, which is then precisely machined on a lathe, allowing for high accuracy and surface quality.

2. Reduced time costs: The processes can be performed sequentially on the same equipment, reducing the time it takes to restore the part.

3. Material savings: Removing excess material during turning minimizes waste and reduces restoration costs.

Technological process

The technological process of restoration of cylindrical parts using a combination of surfacing and turning includes several key stages, each of which has its own characteristics and requirements. Below are the main stages of this process, which allow achieving high accuracy and quality of restored parts.

1. Preparation of the part

Before starting the restoration, it is necessary to carefully prepare the worn part. This stage includes:

• Assessment of the condition of the part: Studying the degree of wear and identifying damaged areas. This may include the use of non-destructive testing methods, such as ultrasonic or magnetic flaw detection.

• Surface cleaning: Removing dirt, oil, rust and other substances that can affect the quality of the surfacing. For this, mechanical and chemical methods are used, such as sandblasting or acid cleaning.

2. Surfacing

The next stage is the surfacing process, which includes:

• Selecting a surfacing method: Depending on the requirements for the material and the design of the part, the appropriate technology is selected. The most common methods include arc welding, laser cladding and plasma cladding.

• Resurfacing: The chosen technology deposits a new layer of metal onto the worn areas of the part. It is important to control the surfacing parameters such as speed, temperature and material composition to achieve the required strength and wear resistance.

• Cooling and heat treating: After surfacing, heat treating may be required to relieve stresses and improve the material properties. This may include quenching or annealing, depending on the material used.

3. Turning

Once the surfacing process is complete, the component is prepared for turning:

Mounting the component on the lathe: The reconditioned component is clamped on the lathe, which must be set up according to the component geometry and the required machining parameters.

Surface finishing: The turning process removes excess material resulting from the surfacing process. This step is critical to achieving accurate dimensions and a high-quality surface.

Quality control: After turning, dimensional and surface quality inspections are performed using various measuring instruments and methods. This ensures that the component meets the requirements and specifications.

4. Completing the process

Completing the reconditioning process includes:

Finishing: Depending on the surface requirements of the component, additional machining such as grinding or polishing may be required to achieve the specified characteristics.

Documentation: Maintaining records of the operations performed and the results of quality control is important for traceability and analysis of the effectiveness of the reconditioning work.

Preparation for operation: The refurbished part is prepared for installation in the equipment, including a final check for compliance with all requirements and standards.

To successfully implement a combined approach, it is necessary to use multifunctional lathes that can perform both surfacing and turning. Key features of such equipment:

Automation systems: Provide precise control of processing parameters, which minimizes errors and improves quality.

Surfacing tools: Include laser systems or welding machines that can be integrated with turning equipment.

Optimization of processing modes

The correct choice of processing modes is critical for successful refurbishment:

Rotation speed: Must match the part material and surfacing technology to avoid overheating and deformation.

Surfacing parameters: Surfacing temperature and speed must be matched to achieve optimal results.

Examples of successful application

The combination of surfacing and turning processes is successfully used in various industries:

• Power Industry: Remanufacturing of generator and turbine shafts where high reliability and efficiency are critical.

• Automotive Industry: Remanufacturing of crankshafts and other cylindrical parts, which significantly reduces repair costs and extends the service life of vehicles.

• Metallurgy Industry: Remanufacturing of parts subject to high loads and wear, which helps to increase their service life.

Cost Efficiency

Cost analysis shows that the implementation of combined technologies leads to a significant reduction in the cost of remanufacturing parts. Key economic benefits include:

• Reduced time costs: Less time for remanufacturing means lower labor and equipment operating costs.

• Increased service life of parts: High-quality remanufacturing extends the service life, which reduces the need for frequent replacements.

• Reduced material costs: Efficient use of materials helps to minimize costs.

Conclusion

Combining surfacing and turning processes is an effective method for restoring cylindrical parts. This approach not only improves the quality and accuracy of restoration work, but also significantly reduces the time and costs of performing operations. The introduction of this technology into production processes can significantly increase the competitiveness of enterprises in the conditions of the modern market. Thus, combined methods of restoring cylindrical parts can significantly improve the productivity and reliability of equipment in various industries, contributing to the creation of more sustainable and efficient production systems.

List of used literatures

1. Буров, В. Н. Основы восстановления деталей машин. — М.: Машиностроение, 2018.
2. Семенов, И. А. Технологии восстановления: современные подходы и материалы. — СПб.: Наука, 2020.
3. Кузнецов, С. В., Петров, А. Н. Автоматизация процессов восстановления цилиндрических деталей. — Екатеринбург: УрФУ, 2021.
4. Захарова, Е. В. Лазерные технологии в восстановлении деталей. — Новосибирск: Сибирское научное издательство, 2019.
5. Дьяков, О. Н., Панов, М. С. Управление качеством в восстановительном производстве. — Казань: Казанский университет, 2022.