PREVENTION AND ELIMINATION METHODS OF DEFECTS ARISING DURING THE HEAT TREATMENT PROCESS OF BEARING RINGS

A.R. Baymirzayev,
PhD, Associate Professor, Andijan State Technical Institute
Z.A. Azimjonova,
1st-year Master's Student
Andijan State Technical Institute

Annotation: This article analyzes the main defects that occur during the heat treatment process of bearing rings, their causes, and methods of prevention. The research examines the technological characteristics of heat treatment processes and quality control measures. Effective methods for eliminating defects are proposed. This article contributes to improving quality in bearing manufacturing processes.

Keywords: Bearing, ring, heat treatment, defect, prevention, elimination, alloy, stress, internal stress, surface quality, carburizing, quenching, normalizing, annealing, microstructure, deformation, hardness, cracks, metallurgy.

1.Introduction

Bearings are one of the main elements of mechanical transmissions, ensuring the frictionless movement of rotating parts. The service life and reliability of bearings depend on the quality of their rings. The heat treatment process is a key technological stage that determines the mechanical and physical properties of bearing rings. However, various defects may arise during this process. The main defects include surface cracks, deformations, internal stresses, and structural changes. These defects reduce bearing quality and shorten their service life. This article highlights the types of defects occurring during the heat treatment process of bearing rings, analyzes their causes, and explores effective elimination methods. The aim of the study is to improve the quality of bearing rings and reduce defects in the production process[2-3].

2.Research and Methods

During the study, metallographic analysis, hardness testing, and ultrasonic inspection were conducted to identify defects occurring during the heat treatment process of bearing rings. In the experimental research, rings made from 100Cr6 bearing steel were used. The rings underwent surface hardening, quenching, and low-temperature sorbitization processes. The main defects arising during heat treatment included alloy structure disturbances, surface cracks, and uneven hardness distribution[4].

To prevent these defects, optimal temperature and cooling regimes were selected during the heat treatment process. Additionally, a pressure tempering method was applied to reduce internal stresses caused by heat exposure. Furthermore, structural analysis using a metallographic microscope and hardness testing using the Rockwell method were carried out for early defect detection. These methods strengthened quality control in the production process[5].

Figure-1. Bearing rings.

3.Results and Discussion

Research results indicate that the main defects occurring during the heat treatment process of bearing rings are surface cracks, uneven hardness distribution, and structural disturbances. When optimal heat treatment regimes and pressure tempering were applied, defects significantly decreased [9]. Metallographic analysis showed that the properly selected cooling rate and sorbitization regime ensured structural uniformity of the rings. Hardness measurements confirmed that after heat treatment, the hardness values of the rings ranged between 62-64 HRC, which fully met the standard requirements. Discussions emphasized the importance of strengthening quality control in the production process and following strict standards in heat treatment technology to prevent defects. The research findings suggest that implementing these methods in industrial production can increase the service life and reliability of bearings[5-8].

Ring Type	Description	Material	Application
Inner Ring	Mounted on the shaft, main support of the bearing	Steel, ceramic	Engines, gearboxes
Outer Ring	Placed in the housing, external part of the bearing	Steel, alloys	Automotive wheels, industrial equipment
Intermediate Ring	Used in some special types of bearings	Steel, bronze	Aerospace equipment, high-precision mechanisms
Protective Ring	Protects against dust and contamination	Plastic, metal	Automotive and agricultural machinery

4.Conclusion

The defects occurring during the heat treatment process of bearing rings, their causes, and prevention methods were studied. Research findings indicate that

properly selected heat treatment regimes, pressure tempering, and quality control are the main factors in reducing defects. By applying optimal technological regimes, structural integrity of the rings was ensured, and the required hardness level was maintained. Continuous metallographic analysis and hardness control during the production process allow early defect detection and elimination. When applied in industrial practice, the research results can significantly improve the quality and service life of bearings. This article serves as a practical guide for engineers and technologists working in bearing manufacturing.

References

1. Umidbek Turg‘unboy o‘g, X., Islombek Turg‘unboy o‘g, X., & Muxammadamin o‘g‘li, M. A. (2024). PROSPECTS IN THE USE OF THERMOELECTRIC GENERATORS FOR VEHICLES. Ta'limning zamonaviy transformatsiyasi, 6(1), 62-66.
2. Umidbek Turg‘unboy o‘g, X. (2023). TECHNOLOGICAL EVALUATION OF GRAPHITE AND ITS PROPERTIES. Journal of new century innovations, 27(6), 68-73.
3. Tursunali o‘g‘li, Y. F., & Umidbek Turg‘unboy o‘g, X. (2024, April). ASSESSMENT OF TECHNOLOGICAL PROPERTIES OF MILLING TOOLS. In Proceedings of International Conference on Educational Discoveries and Humanities (Vol. 3, No. 5, pp. 281-285).
4. Adaxamjonovich, O. Z. A., & Jaksilikovna, O. G. (2024). THE IMPORTANCE OF CALCIUM OXIDE IN THE PRODUCTION OF PORTLAND CEMENT CLINKER AND THE STEPS OF THE PRODUCTION PROCESSES. Ethiopian International Journal of Multidisciplinary Research, 11(03), 292-295.
5. Араббаева, Ф. (2024). НЕОБХОДИМОСТЬ ПРАВИЛЬНОГО ПОДБОРА ЦВЕТА СПЕЦИАЛЬНОЙ ОДЕЖДЫ РАБОТНИКОВ МАШИНОСТРОИТЕЛЬНОЙ ОТРАСЛИ. Научно-технический журнал «Машиностроение», (2), 15-19.

6. Uchkunovna, A. F. (2024). THE NEED FOR THE CORRECT SELECTION OF THE COLOR OF HOSPITAL CLOTHING FOR PATIENTS WITH SKIN DISEASES. Spectrum Journal of Innovation, Reforms and Development, 27, 1-5.
7. Baymirzaev, A. (2024). New Methods of Obtaining Bearing Material from Steel. Web of Semantics: Journal of Interdisciplinary Science, 2(4), 25-28.
8. Rustamjan o'g'li, A. B., & Adhamjon o'g'li, A. A. (2025). STUDY OF ITS CHEMICAL PROPERTIESIN OBTAINING ШХ15 MATERIAL FROM SECONDARY MATERIALS. Science, education, innovation: modern tasks and prospects, 2(2), 92-95.
9. Tursunali o'g'li, Y. F. (2025). KUKUN METALLURGIYASI TOMONIDAN ISHLAB CHIQARILGAN ALYUMINIY ASOSIDAGI METALL MATRITSALI KOMPOZITSIYALAR BO 'YICHA TADQIQOTLAR. INNOVATION IN THE MODERN EDUCATION SYSTEM, 5(48), 44-47.
10. Koraboyevna, A. S. (2025). TIRE MANUFACTURING TECHNOLOGY. Science, education, innovation: modern tasks and prospects, 2(2), 15-18.
11. Koraboyevna, A. S. (2025). APPLICATION OF 110G13L STEEL FOR EXCAVATOR BUCKETS IN THE MINING INDUSTRY. Science, education, innovation: modern tasks and prospects, 2(2), 1-4.
12. Ibragimovich, K. R. (2025). CUTTING TOOL COATING WITH ELECTRICAL SPARK PLASMA ASSISTED TECHNOLOGY USING WC-CO ALLOYS AND THEIR COMPOSITIONS. Science, education, innovation: modern tasks and prospects, 2(2), 53-55.