TECHNOLOGY FOR PRODUCING BEARINGS USING SECONDARY METAL WASTE

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Abstract:

This paper presents the technological process of producing bearing rings using secondary metal waste. A comprehensive analysis was carried out on the types of metal waste, melting methods, and refining processes. The microstructure and mechanical properties of the regenerated materials were evaluated and compared to standard bearing alloys. The study confirms that bearing rings made from recycled metals can meet industrial standards when proper modification and processing techniques are applied.

Keywords: secondary metals, recycling, bearing rings, melting technology, microstructure, mechanical properties.

1. Introduction

The increasing volume of industrial metal waste has raised concerns regarding environmental pollution and resource depletion. In the field of mechanical engineering, bearings are vital components that require high precision and strength. Utilizing secondary metal waste for bearing production is a promising solution to reduce costs and environmental impact. This study aims to develop and evaluate a technology for producing high-quality bearing rings from recycled metal scrap[1].

2. Materials and Methods

2.1. Selection of Secondary Metal Waste

Various types of ferrous and non-ferrous scrap metals were collected, including steel shavings, worn-out bearings, and casting residues[2].

2.2. Melting and Modification Process

The metal waste was melted in an induction furnace. Modifiers such as ferro-silicon and rare earth elements were introduced to enhance the quality of the molten metal and reduce impurity levels[3].

2.3. Casting and Forming

The refined molten metal was cast into ring-shaped molds. After solidification, the blanks were machined to meet the standard bearing dimensions.

2.4. Heat Treatment

A two-stage heat treatment process (normalizing and quenching) was performed to enhance the hardness and wear resistance of the bearing rings[4-5].

3. Results

The resulting bearing rings demonstrated a hardness of 58–62 HRC, comparable to those made from virgin alloys. Microstructural analysis revealed uniform distribution of carbides and a refined grain structure.

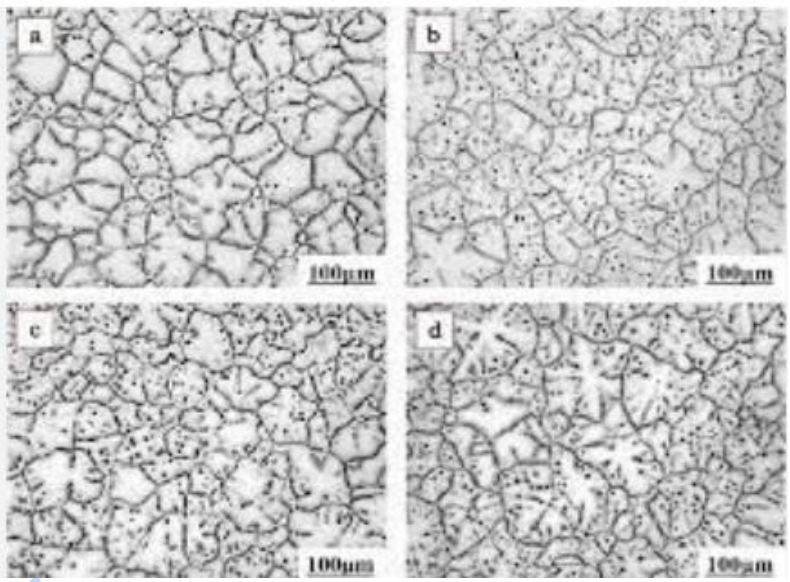

Figure 1. Microstructure of bearing ring made from secondary metal (500×)

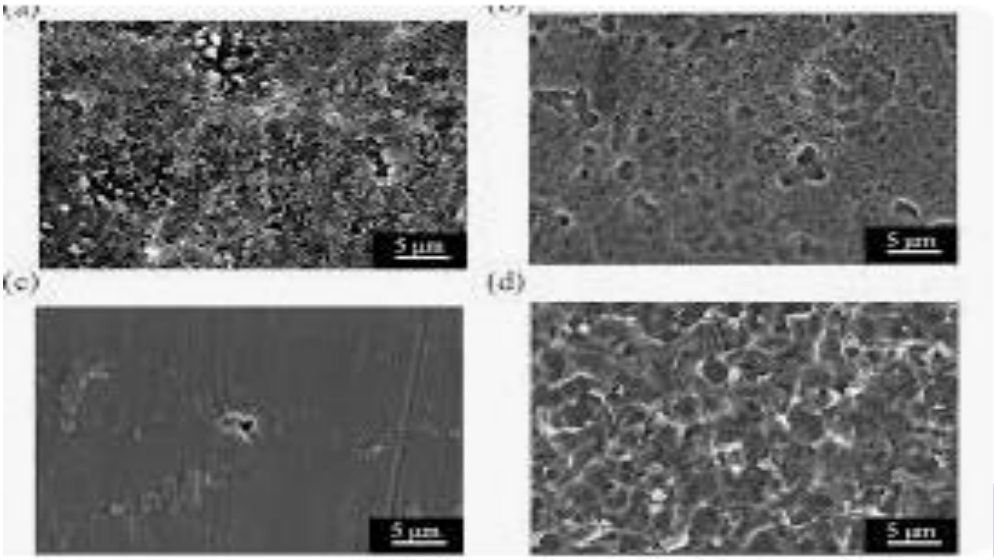

Figure 2. Hardness comparison chart between recycled and standard bearings

4. Discussion

The study confirms that with appropriate refining and alloying, secondary metals can serve as a reliable source for bearing production. The key factors influencing final properties are melting temperature, modifier composition, and heat treatment parameters. Additionally, cost analysis showed a 30–40% reduction compared to traditional manufacturing routes[6-7].

5. Conclusion

The use of secondary metal waste for bearing production is both technically and economically feasible. With optimized technological parameters, the resulting products meet industrial performance standards, contributing to sustainable manufacturing.

6. References

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