# OBTAINING BEARING RINGS FROM METAL WASTE: TECHNOLOGICAL AND MATERIAL CONSIDERATIONS

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**Abstract**

The increasing need for sustainable production practices has led to growing interest in recycling metal waste. This study investigates the feasibility of manufacturing bearing rings from remelted secondary metals. The research outlines the recycling process, analyzes the microstructure and mechanical properties of the resulting material, and evaluates its performance against standard bearing materials. The findings demonstrate the potential of metal waste as a viable resource for bearing ring production, contributing to resource efficiency and circular economy goals.

**Keywords:** bearing rings, metal waste, recycling, remelting, microstructure, hardness, mechanical properties

## Introduction

Bearings are critical components in mechanical systems, ensuring smooth rotation and load distribution. Conventionally, bearing rings are produced using high-quality alloyed steels such as 100Cr6. However, the cost and environmental impact of sourcing primary raw materials remain challenges. This research explores the possibility of producing bearing rings from recycled metal waste, focusing on cost-effectiveness and environmental sustainability.

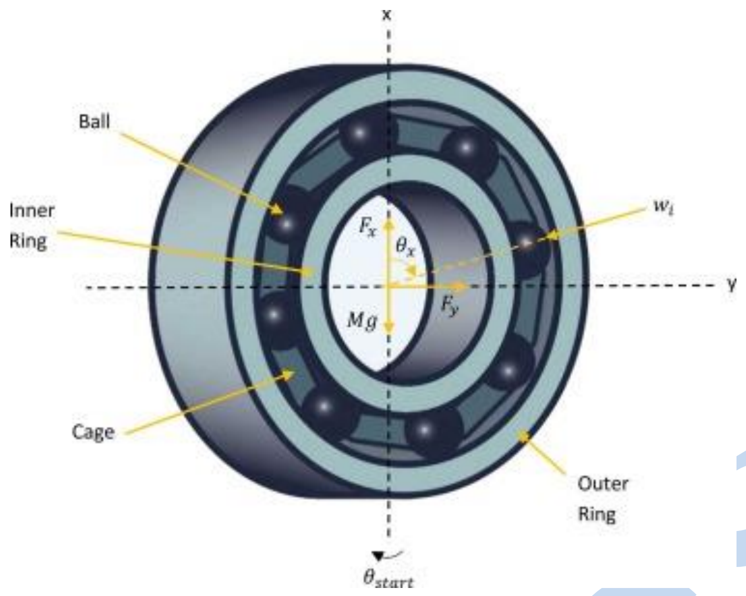


**Figure 1. Bearing ring (schematic view)**

## Methods

**Materials:** Metal waste containing high-carbon steel and chromium-based alloy residues were collected from mechanical workshops. The scrap was sorted, cleaned, and subjected to remelting.

### Recycling and Casting Process

- Melting was conducted in an induction furnace at 1550°C.
- Degassing and deoxidation were performed using Ca-Si additives.
- The molten metal was cast into ring-shaped molds (Figure 2).
- Subsequent heat treatment included quenching at 840°C and tempering at 180°C for 2 hours.

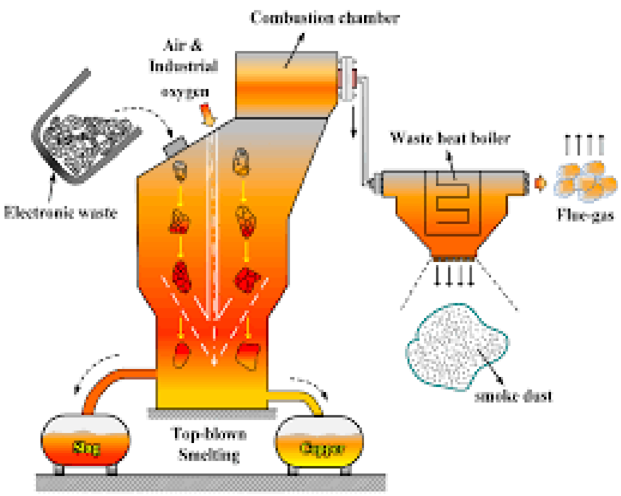


**Figure 2. Process flow for recycling metal waste into bearing rings**

## Testing and Analysis

Chemical composition was verified via spectrometry.

Microstructure was observed using a metallographic microscope.

Hardness was measured using Rockwell and Vickers methods.

Tensile strength and wear resistance were evaluated through standard mechanical tests.

## Results

- The recycled alloy showed a composition comparable to standard bearing steel with 0.95–1.05% C and 1.3–1.5% Cr.
- Microstructural analysis revealed fine martensitic structure with evenly distributed carbides.
- Rockwell hardness averaged HRC 59–61, suitable for bearing applications.
- Wear resistance was within 90% of commercial bearing rings, as shown in Figure 3.

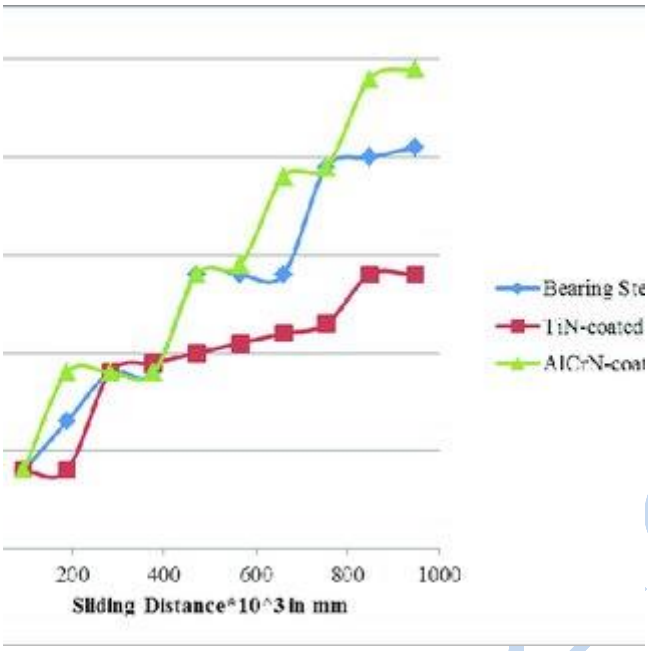


**Figure 3. Comparison of wear resistance (recycled vs. standard)**

## Discussion

The use of secondary metals for bearing ring production presents multiple advantages:

- Significant cost reduction (up to 30%) due to raw material reuse.
- Decrease in environmental footprint through waste valorization.
- Mechanical properties of the recycled material meet industrial standards.
- Challenges include:
- Ensuring chemical uniformity of scrap materials.
- Maintaining strict control over remelting and heat treatment parameters.

## Conclusion

The research confirms that bearing rings manufactured from remelted metal waste can achieve the structural integrity and performance required in industrial applications. With proper process control, this approach offers a sustainable alternative to traditional bearing production.

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