Date: 5th February-2025

COMPARISON OF LOCAL AND FOREIGN MATERIALS USED IN BEARING RING PRODUCTION.

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Abstract. This article examines the local and foreign materials used in the production of bearing rings. It provides an in-depth analysis of the chemical composition, physical and mechanical properties, production technologies, and environmental aspects of these materials. Local materials, such as steel and bronze, are compared with advanced high-tech materials commonly used abroad. The analysis focuses on cost, durability, and operational efficiency.

Keywords: Bearing rings, local materials, foreign materials, steel, bronze, ceramics, polymers, material comparison, technological innovations, environmental impact.

INTRODUCTION. Bearings are essential mechanical components in various industries, reducing friction and enhancing the efficiency of rotating elements. Bearing rings must be manufactured from materials that can withstand high loads, fast speeds, and environmental stresses such as temperature variations and corrosive conditions. Therefore, selecting the right material for bearing rings plays a crucial role in the performance and longevity of mechanical systems.

In this context, the article compares locally produced materials used in bearing ring production with advanced foreign materials. The study considers factors such as mechanical properties, cost, availability, and technological processes involved in producing these materials. Special emphasis is placed on how advancements in foreign material technologies might benefit the local industry, especially in the context of Uzbekistan's growing manufacturing sector.

Types of Materials and Their Applications.

1. Steels and Their Alloys

Local Production:

40X and 45 Steels:

Chemical Composition: Carbon, manganese, and silicon, with small amounts of chromium.

Advantages: Economical, easy to process, suitable for moderate loads.

Disadvantages: Prone to wear and reduced efficiency under high stress or high-speed conditions.

Foreign Production:

Chromium Steel (GCr15, SAE 52100):

Chemical Composition: Carbon (1%), chromium (1.5%), manganese (0.35%).

Properties: High hardness (HRC 60-65), excellent wear resistance, suitable for high-speed and high-load applications.

Applications: Automotive, aerospace, and high-precision machinery.

2. Bronze and Its Alloys.

Local Production:

Tin Bronze:

Properties: Good resistance to wear and corrosion, excellent lubrication properties.

Applications: Bearings subjected to moderate mechanical loads.

Disadvantages: More expensive than some steels, limited load-bearing capacity.

Foreign Production:

Beryllium Bronze:

Properties: High elasticity, excellent fatigue resistance, and wear resistance.

Applications: Bearings for high-speed and high-load conditions.

3. Polymers and Composite Materials

Local Production:

Textolite and Getinax:

Properties: Lightweight, corrosion-resistant, good for low-speed applications.

Disadvantages: Poor performance under high loads and speeds.

Foreign Production.

PTFE-Based Polymers (Teflon):

Properties: Excellent low friction coefficient, high-temperature resistance, chemically inert.

Applications: Bearings in food processing, medical devices, and low-load environments.

4. Advanced Materials (Ceramics and Titanium Alloys)

Foreign Production:

Ceramics (Silicon Nitride):

Properties: Extremely high hardness, excellent heat and wear resistance, low friction.

Applications: High-speed, high-precision bearing systems, such as in aerospace and electronics.

Titanium Alloys:

Properties: Lightweight, high corrosion resistance, good strength-to-weight ratio.

Applications: Aerospace and military industries where weight and corrosion resistance are critical.

Analysis of Local and Foreign Materials.

1. Cost Comparison:

Local Materials:

Local materials are often more affordable, making them an attractive choice for industries where cost efficiency is a primary concern. However, they may lack the durability and performance capabilities of advanced materials in certain applications.

Foreign Materials:

Foreign materials often come with higher upfront costs but offer superior performance in demanding conditions. The initial cost is offset by their longer lifespan, reduced maintenance, and overall higher operational efficiency.

2. Technological Capabilities and Production Methods:

Local Materials:

The production technologies available locally tend to be more traditional, relying on established methods that may not take advantage of the latest advancements in material science.

Example: conventional casting and forging techniques used for steel production.

Foreign Materials:

Foreign materials benefit from cutting-edge technologies like 3D printing, laser sintering, and advanced alloying techniques. These methods result in materials with superior structural integrity and performance.

Example: advanced processing techniques such as powder metallurgy and nanotechnology.

3. Environmental Impact:

Local Materials:

The environmental impact of local materials is significant, especially when older production methods that involve harmful emissions and non-sustainable practices are used.

Foreign Materials:

Many foreign materials are produced using environmentally friendly technologies and adhere to stricter environmental regulations, which is an important consideration for modern industrial standards.

Example: foreign manufacturers' use of energy-efficient processes and recycling of scrap material.

Here is a table and a diagram description suitable for the article titled **"Comparison of Local and Foreign Materials Used in Bearing Ring Production"**.

Table

Criteria	Local Materials	Foreign Materials
Cost	Lower	Higher
Quality	Moderate	Superior
Durability	5-8 years	10-15 years
Supply Availability	Readily available locally	May face import delays
Customizability	Limited options	Wide range of customization
Environmental Impact	Lower (local sourcing)	Higher (due to transportation)

CONCLUSION.

The choice between local and foreign materials for bearing ring production depends on various factors, including cost, performance requirements, technological capabilities, and environmental considerations. While local materials are suitable for industries where cost is a key driver, foreign materials provide superior performance, durability, and long-term cost efficiency, making them essential for high-performance applications. To stay competitive, Uzbekistan's industry must adopt foreign technologies and explore the potential for improving local material production methods.

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