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METHODS FOR INCREASING THE HANGING STRENGTH AND FATIGUE OF LOAD-BEARING PARTS MADE OF REINFORCED COMPOSITE MATERIALS

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Annotation: This article analyzes the types of materials used for the manufacture of bearings. Each bearing material is sorted and selected according to the place and type of bearing use. The load-bearing part is made of several parts, for each part of which the appropriate material is selected. The advantages and disadvantages of each analyzed material are studied, and these advantages and disadvantages are of great importance in the selection of the carrier material.

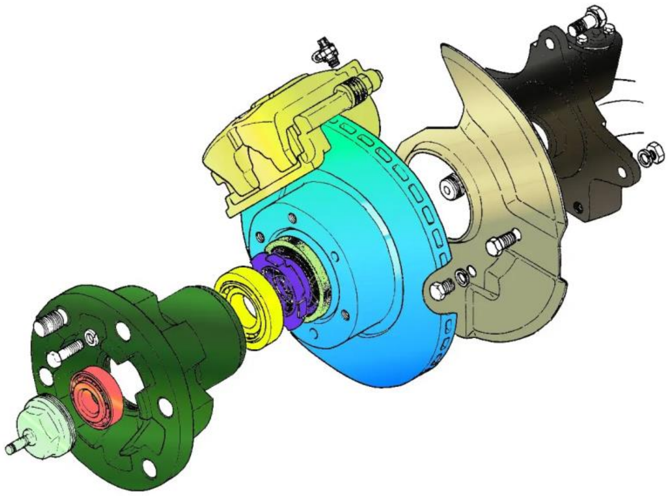
Keywords: Bearing rings, local materials, foreign materials, steel, bronze, ceramics, polymers, material comparison, technological innovations, environmental impact.

Intoduction. In order for a bearing to perform it according to the specified conditions, it is necessary that suitable materials are used for its manufacture. When we talk about bearing materials, we are referring to the chemical composition, mechanical and heat treatment, as well as other characteristics of this part – complete or partial.

Materials and Other Methods Media materials are flexible (< HB 50), soft (HB 50-100) and rigid (> HB 100). Plastics include babbitt, lead bronzes, aluminum alloys, silver; soft - canned, tin-lead, tin-lead-zinc bronze; hard - aluminum-iron, bronze and cast iron. For high-loaded, high-speed bearings designed for operation in liquid media. Lubricants, flexible alloys are used almost exclusively in the form of thin layers, which are laid on steel (less often bronze) bushings and primers. Soft and hard alloys are used to prepare boundary and semi-fluid lubricated bearings that operate at medium speeds.

Babbitts are alloys of soft metals (Sn, Pb, Cd, Sb, Zn) and are characterized by the presence of rigid structural components in a plastic matrix. Babbitt past ishqalanish koeffitsienti, egiluvchanligi, yaxshi kirish va aşınma qarshiligi bilan ajralib turadi. Babbittni normallashtirilgan yoki qattiqlashtirilgan po'latdan yasalgan vallar bilan birlashtirish mumkin (HRC 25-35), ammunition podshipnikning ishlash muddatini oshirish For shafts, it is > desirable to do heat treatment at a hardness of HRC 50. Elasticity guarantees an even distribution of the load over the laid surface: fine solids (metal dust, oxidation products of solid oil) are relatively safe to penetrate the bearing, they are pressed into the babbitt and neutralized. The disadvantage of babbitts is their low fatigue strength, especially at high temperatures.

The greatest antifriction qualities are found in babbitts, which have a high tin content, which are tin alloys with small copper additives (included in the composition to prevent delamination); Babbitt's structure is solid SnSb crystallites crossed in plastic eutics. The main brands of babbitt with a high tin content are B89, B83 (the numbers show the percentage of tin). Tin babbitt melting point: head 240-250°C, end 400-420°C. Babbitt was poured into preheated shells to 250° C. at 450–480° C. Centrifugation gives the best results.



Pic.1. Bearing details.

Casting. Pour into molds and apply also under the press. In order to save scarce tin, low-tin babbitts were developed and put into production. This industry is a more or less high-quality replacement for the high-grade tin content in Babbitt. Lead-tin babbits consist of 60-75% lead, 5-20% Sn, 10-20% Sb, 10-20% Sb with small amounts of Cu, Cd, Ni, Fe added to B16, B6, BN, BT. As modifiers, 0.3-1% are adjusted. Antifriction properties of lead babbitt under conditions of semi-liquid lubrication: lower than that of babbitt with a high tin content. The stiffness and mechanical properties are similar to tin babbitt. Significantly less corrosion resistance. In lubricated conditions, the difference between a can of lead and babbitt is much smaller. In the absence of tin, Babbitt BK1, BK2 consists almost entirely of lead with the addition of ~1% Ca and Na. The antifriction properties and corrosion resistance of lead babbitt have been improved. by introducing small numbers of adults, Ba, Li, Te. Cadmium babbits contain 90–97% Cd, to which Cu, Ni, Ag and other metals are added. On the basis of plastic, cadmium forms rigid structural elements.

Cadmium hardness is Babbitt HB 30-40. Antifriction properties are high. The disadvantage of cadmium babbitts is their low corrosion resistance. For bimetallic thin-walled primers, aluminum-tin alloys with a CH content of up to 20% are used. The most common are alloys of the AO20-1 type (20%Sn; 1% copper; the remainder is Al), as well as AO6-1 alloy (6%Sn, 1% Cu, 0.5-1% Ni, 1-). 1.5% Si, the rest AI). Hardness of antifriction materials of aluminum alloys HB 35-45; Aluminum alloys have high fatigue forces and can withstand special loads up to 50 MPa. Trends in mile traffic. Increased oil pumps as well as the use of hardened shafts (> IF 50). For non-critical bearings, inexpensive zinc-aluminum alloys such as CAM 10-5 (10%Al; 5%Cu, the rest Zn) and SAM 9-1.5 (9%Al; 1.5%Cu) are suitable. Their qattiqligi HB 60-80; Aluminum Sink Kotishmalarining Ishkalanishga Karshi Sifatlari O'RTACHA. Qattiqligi HRC 50 It is necessary to use shafts that are higher than the shafts. Non-standard high-aluminum-zinc alloys (30-40% Al; 5-10% copper; the rest Zn) have the best quality. Their hardness is HB 50-60. Lead bronzes are alloys of Cu (40-70%) and Pb (30-60%) with a small amount of Sn, Zn, Ni, Ag. B - The most common bronzes are BrS30 (30% Pb, the rest Cu) and BrO5C25 (5% Sn, 25% Pb, the rest Cu). High-lead-nickel bronze BrS60N2.5 (60% Pb; 2.5 Ni) was also used. Lead is virtually insoluble in copper and exists as round additives in alloys, more or less evenly distributed in the copper matrix. Lead bronzes are stronger and more durable than babbitt (HB 40-60). Unlike babbitt, their hardness and strength remain almost constant at a temperature of about 200°C. The disadvantage of lead bronzes is their corrosion resistance (due to the presence of free lead). Additionally, give the reasons for the acceleration of fatty acid acidity during surgery. The anti-slip and anti-friction properties of lead bronze are worse than those of Babbitt. Bearings filled with bronze lead especially require low friction surface roughness, elimination of misalignment, increased rigidity of the shaft bearing system, improved pump and oil filtration, and increased shaft surface rigidity (>HRC 50). On bearings filled with lead bronze, the cavities are on average 30-50% larger than on bearings filled with Babbitt. The working surfaces for the bearings are filled with lead bronze. It is machined by precision drilling with diamond or carbide milling cutters with low feed and high shear rate (10-13 m/s). Lead is poured into bronze graphite molds at a temperature of 1050°C on a low-carbon steel insert with a thickness of 0.5-0.8 mm. Improved lead bronze compositions have been developed with Ni (up to 5%), Sn (up to 25%), 30% Pb with the addition of S and Ca. The addition of nickel increases corrosion resistance, C and Ca are introduced to prevent separation from lead. In addition to bronzes with a high lead content, curved (HB 60-80) bronzes containing 5-7% Pb, 5% P. and 5% zinc are used for bearing casting. Silver. For the bases of heavy trucks produced in small series, bearing bearings with friction surfaces made of silver (with less Sn and Pb) are used. Silver coatings are characterized by ductility, softness (HB 25-35 in the annealed state), good antifriction properties, and high fatigue strength. The melting point is 960°C. Silver coatings are poured on the surface in a layer of 0.1–0.3 mm or electrolytically applied to a porous bronze or copper-nickel substrate with a thickness of 20–50 μm. In some cases, silver is poured into fine-grained shavings to improve contact with the undercoat. Mesh steel base. Protruding parts of the steel die increase the bearing bearing capacity. For reconstruction, a 10-30 μm thick lead-sliding spleen is applied to the surface of the silver coating, which is coated with a layer of indium several micrometers thick to prevent corrosion. High hardness rolls (> HR 50) are required. Multi-layer coating. In multi-layer pouring, a thin layer of tin babbitt is applied to the surface. The substrate is made of an anti-friction alloy with a thickness of 0.2-0.5 mm. Using the valuable qualities of tin babbitt, this method can drastically reduce tin consumption and at the same time increase its fatigue strength and the impact resistance of cast iron. Lead bronze, aluminum alloys, and bronze are used as substrates. The best results are obtained with substrates made of sintered Cu-Al and Cu-Ni alloys (60% Cu, 40% Ni), which form a strong bond between the babbitt and the additive. There are two ways to use Babbitt. When pouring, Babbitt is applied in a layer of 0.3-0.4 mm. The thickness of the babbitt layer after treatment is 0.15-0.2 mm. Electrolytic deposition of babbitt with a thickness of 15–20 μm on the surface of the substrate to be processed is technologically advanced. With this method, when impregnating with babbitt, it is necessary to use a porous substrate to form an anti-friction substrate on the surface of the babbitt layer, which ensures the correct operation of the bearing during local wear or in general. Sometimes babbitt is used as the surface layer of lead. To prevent corrosion, they are lined with an electrolytic sheet several micrometers thick, followed by heating for 2-3 hours at 150°C. Aluminum alloys have high mechanical, anti-corrosion and technological properties. - Instead of nickel, iron bronze is alloyed with cheaper manganese (BrAJMn10-3-1.5). Antifriction cast irons. For bronze, anti-friction cast iron is used as a cheap substitute. Used: Laminated Graphite Grey ASF, High Power Knotted Graphite ASF, Slotted Graphite Flexible ASF and Copper FM. Cast iron bearings are used with shafts with high surface stiffness (> HRC 55). Soft anti-friction cast irons (AChS-3, ACV-2, ACK-2) can be used in tandem with standardized or improved steel (HRC 25-35) under light loads. The disadvantages of anti-friction cast irons are brittleness and high hardness (HB 160-250), which excludes the possibility of independent starting. Cast iron bearings are prone to misalignment, resulting in high pressure on the edge. light alloys. Of the light alloys, aluminum is often used as an anti-friction material. Non-critical Al-Si bearings (Al3; Al4; Al5), AlMg (Al8) is made from casting alloys. Al-Cu (Al10V; Al18V), preferably by metal casting (HB 65-70). It is desirable to make bearing accessories by stamping from forged alloys, such as AK4, AK4-1 (HB 80-90). Heat Treated, Non-Heat Treated (HB 40-60)Alloys AM8 (8% Cu) Wide; AMC2 (8% Cu; 2% Cu); AG6 (6% Fe); AN-2.5 (2.5% Ni), ACC6-5 (6% Sb, 5% Pb). In bimetallic tape coatings, plastic alloys AK5M and An-2.5 (HB 35-45) are used. Tin-aluminum alloys (up to 20% Sn content) have the highest antifriction properties. One of the best alloys of this type is that it must be composed, combining flexibility and high strength; 6% tin; 1,5% Ni; 0,5-1% Sb; 0,5% Si; 0.5-1% manganese; Hardness of antifriction aluminum alloys for rest Al. HB 40-80; Aluminum alloys are resistant to corrosion and also do not cause oil oxidation. Rollers with higher lubricating pressure and stiffness (> IF 55) are required. Their disadvantages are reduced running, as well as a tendency to overcome a mile. The elastic modulus of aluminum alloy is low, so during normal operation, it is necessary to increase the stiffness of the bearing (thicken the walls, make the beads harder, increase the stiffness of the bearing). When designing bearings made of aluminum alloys, it is necessary to take into account their high coefficient of linear expansion. When heated, the clearance on the bearing increases, due to which the "cold" clearance is minimal, and in the initial periods corresponds to the condition of reliable operation of the bearing. In addition, as the noise heats up in the seats, the support surface increases. Aluminum alloy bearings are preferred in housings made of the same alloy. As an anti-friction material, magnesium alloys are distinguished by the fact that they have an elastic modulus close to, but even lower than, aluminum. For the production of bearings, cast alloys MLZ, ML4 and wrought MA1, MA2 are suitable. The hardness of magnesium alloys is HB 30-40. When designing magnesium alloy bearings, the same rules should be followed. was observed for aluminum alloys. Despite these drawbacks, babbitt is widely used in many fields of engineering. Their positive features are complex engineering and technical problems. Currently, the most commonly used polymer materials for conventional bearings are fluoroplastics, for example, polytetrafluoroethylene (aka PTFE, Teflon, PTFE-4). These plastics have a low friction coefficient, are characterized by high strength, resistance to chemicals, and high temperatures. However, their rigidity is low, so they are often used in the form of a thin-walled sliding sleeve or in the working layer of rubbing surfaces in a body made of a more durable material. Various technologies are used in the production of bearings, such as casting, stamping, rolling, extrusion and powder metallurgy. IV. Results List of defects in materials intended for bearings No material Name Defects 1 Babbitt Low fatigue strength, especially at high temperatures. 2 Lead - Tin Babbitt The anti-friction properties of lead babbitt under semi-liquid lubrication conditions are lower than that of babbitt with a high tin content. The stiffness and mechanical properties are identical to tin babbitt. Significantly less corrosion resistance. Under liquid lubrication conditions, the differences between lead and babbitt are slightly noticeable. 3 Cadmium Babbitt Low corrosion resistance. 4 Lead bronzes Reduced corrosion resistance (due to the presence of free lead). In addition, lead leads to accelerated oxidation of oil. during surgery. Lead bronzes, which work in their good anti-friction properties, are even worse than those of babbitts. 5 Aluminum – Iron Bronzes Iron aluminum has a variable effect on the structure of bronze, reducing the tendency to brittleness. 6 Aluminum alloys Reduced performance as well as a tendency to rotate around the shaft. 7 Anti-friction blankets are brittle and of high hardness (HB 160-250), except for the possibility of spontaneous mobility. Cast iron bearings are prone to misalignment, resulting in high pressure on the edge. 8 Grey pearl cast small weight, low friction unit impact velocity, brittle due to internal stresses; 9 Aluminum-zinc alloys cause an increase in the weak tension of the steel shaft. 10 Copper powder - graphite due to its small overall size, low load, short processing time, and the possibility of destruction when abrasive particles enter the friction zone. 11 Bimetallic bushings welded with babbitt – Insufficient thermal conductivity leads to deterioration of mechanical properties at high temperatures, destruction of the layer filled with babbitt. The elimination of the anti-friction layer on the bimetallic bushings will lead to dynamic friction and emergency failure.

Conclusion

As a result of the analysis of the studied materials, the following conclusions can be drawn: 1. Recently, a number of scientists have developed new types and compositions of bearing materials. 2. As a result of the analysis, it is advisable for media manufacturers to select the material for the carrier in accordance with its application in the carrier. 3. It is desirable to choose the material for the types of ordinary bearings, bearings, bending bearings, couplings, etc.

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