REQUIREMENTS TO ENGINE BEARING MATERIALS

Engine bearing materials compromise between high mechanical strength (Fatigue strength, hardness) and anti-friction properties (seizure resistance,conformability, embedability), which are characteristic for soft materials.
In order to meet such contradictory demands the bearing materials are designed to have composite structure:
- Particulate composite having a relatively hard matrix (copper, aluminum) with particles of a soft phase (tin, bismuth, lead, Graphite).
- Laminate composite composed of several layers. The upper layer (overlay) is commonly softer than lower layers (intermediate layer, back layer).

The properties required for engine bearing materials:

- ⊡ **Fatigue strength (load capacity)**
- ⊡ **Seizure resistance (compatibility)**
- ⊡ **Wear resistance**
- ⊡ **Conformability**
- ⊡ **Embedability**
- ⊡ **Corrosion resistance**
- ⊡ **Cavitation resistance**

Fatigue strength (load capacity)

Fatigue strength (load capacity) is the maximum value of cycling stress that the bearing can withstand after an infinite number of cycles.
Cycling stresses applied to the bearings are the result of the combustion and inertia forces developed in the internal combustion engines.
If the bearing loading excesses its fatigue strength fatigue cracks form in bearing material (Engine bearing failure), spread to the back bearing layer and may result in flaking out of the material.
Fatigue strength of Engine bearing materials is evaluated in fatigue test rigs.

Seizure resistance (compatibility)

Seizure resistance (compatibility) is the ability of the bearing material to resist physical joining (friction welding) with the journal material when the direct metal-to-metal contact between the bearing and journal surfaces occurs.
High seizure resistance is important when the bearing works in the mixed regime of lubrication (low speed, cold start, oil starvation, excessive clearance, high roughness of the bearing or shaft surfaces).

Wear resistance

Wear resistance is the ability of the bearing material to maintain its dimensional stability (oil clearance) despite the presence of abrasive foreign particles in theengine oil and under the conditions of intermittent direct contact between the bearing and journal materials.

The Mechanisms of wear:

- ⊡ **Abrasive wear**
- ⊡ **Adhesive wear**
- ⊡ **Fatigue wear**
- ⊡ **Corrosive wear**
- ⊡ **Erosive wear**

Conformability

Conformability is the ability of the bearing material to accommodate geometry misalignments of the bearing, its housing or journal.
Shape irregularities of a bearing with poor conformability may cause localized decrease of the oil fil thickness to zero, where the bearing material experiences excessive wear and high specific loading.

Embedability

Embedability is the ability of the bearing material to entrap and sink beneath the surface small foreign particles (dirt, debris, dust, abrasive residuals) circulating in the lubricating oil.
Poor embedability of a bearing material causes accelerated wear and produces scratches on the journal and bearing surfaces, which may lead to seizure.

Corrosion resistance

Corrosion resistance is the ability of the bearing materials to resist chemical attack of oxidized and impure lubricant.

Cavitation resistance

Cavitation resistance is the ability of the bearing material to withstand impact stresses caused by collapsing cavitation bubbles, which form as a result of sharp and localized drops of pressure in the flowing lubricant.

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