TECH

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ENGINE BEARINGS FUNDAMETALS PART 7 "TRIMETALS'

Just about the time we had you convinced that the only way to obtain a stronger bearing was to give up surface properties, along come trimetals to make an apparent contradiction to that general rule. Don't lose heart, trimetals are not a contradiction, but rather a clever (and more complicated) way of allowing us to have some of the best of both worlds.

As we outlined briefly in part 5, trimetals are made up of three main layers. Actually, almost all trimetal bearings have at least 4 and sometimes even more layers. The additional layers are necessary for reasons which will become apparent as the plot unfolds. To start out, we have our basic steel back for strength, and also, to reduce cost (steel is cheaper than bearing metal). Next, we add a layer of some relatively strong (fatigue resistant) bearing lining; typically copper-lead or an aluminum based alloy. This is called the intermediate layer. For the purpose of making trimetal bearings we can rule out some of the weaker alloys used for bimetals; here the emphasis is on strength.

On top of the intermediate layer we add a thin overlay of babbitt. Remember, we said babbitt offers the best combination of surface properties. We also said we can make babbitt carry more load if we keep it thin. In trimetal bearings, we use a .001" thick layer of babbitt to provide the surface properties which our stronger intermediate layer lacks. By keeping the overlay thickness at .001" (less in high performance and some Heavy Duty applications) we produce a bearing capable of carrying much higher loads than any bimetal, with the surface properties of babbitt. Sounds too good to be true, doesn't it? Well actually, there are some trade-offs. Having a babbitt layer that is only .001" thick does limit embedability and conformity but the result is still the best overall combination of properties.

We said earlier that intermediate layers could be copper-lead or aluminum based alloys. Although hidden beneath the overlay where it can't be seen, the intermediate layer is a major factor in achieving long life in a trimetal bearing because the intermediate layer provides the strength.

ALUMINUMS - Two aluminum based alloy families have enjoyed popular use in trimetals. These are 6% tin-aluminum and silicon-cadmium-aluminum. The second of these is by far the strongest of the two, especially when heat treated. Tin-aluminum has declined in popularity as an intermediate layer due to its lower fatigue strength and is generally only used today for older engines where loads are moderate.

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Although aluminum based intermediate layers exhibit excellent corrosion resistance when exposed due to overlay wear, these materials have relatively poor surface properties.

COPPER-LEADS - There is basically just one family of copper based bearing alloys used for intermediate layers. All of these contain varying amounts of copper, lead and tin. Tin is a key player in these alloys because it can influence both corrosion resistance and fatigue strength. Varying the tin content from less than 1% to only about 3% can increase fatigue strength by as much as 20% and offer corrosion resistance which is adequate under all but the very worst conditions.

Another factor in copper-lead alloys is the method of manufacture. These alloys can be produced by either casting or sintering. Although sintering is the more common practice, casting results in greater fatigue strength. Cast copper-lead alloys are therefore commonly used in heavy duty diesel applications where extremely long life at continuous high levels of loading is required. Sintering generally results in more than adequate strength for passenger cars as well as light and medium duty truck applications.

The bearing surface properties of copper-leads make them superior to aluminums once the overlay layer has been worn away. With modern motor oils and the degree of corrosion resistance offered by the presence of tin in these alloys, corrosion is not a common problem.

<u>Common Intermediate Layer Materials</u>

Aluminums
F-146 91% alum, 6% tin, 1.5% silicon, 1% copper, .5% nickel
F-154 95% alum, 4% silicon, 1% cadmium

<u>Copper-leads</u> -
DA-49 75% copper, 24% lead, 1% tin
F-112 72% copper, 25% lead, 3% tin

Trimetals offer the best combination of strength and surface properties. They are therefore considered to be the premium class of bearing materials. They are the most popular with engine rebuilders because their babbitt overlay surface makes them more forgiving in the varying environment of a rebuilt engine.

Next: “Overlays and Bonding Layers’