

# Tin Alloy Lapping Plates

## Tin and Tin Alloys for Precision Lapping

**T**in is one of a few metals which has a recrystallization temperature below room temperature. In this respect, tin does not work harden, which has been the primary reason why it has found a particular niche in the field of lapping and polishing. Because of its low recrystallization temperature, tin is very easy to charge with an abrasive such as diamond. However, due to the low recrystallization temperature the embedded abrasive also does not become permanently fixed into the lapping plate.

The degree at which the diamond abrasive becomes fixed is a function of the tin or tin alloy grain size and also the intergranular microstructure. For pure tin, the grain size is actually quite large and the embedded diamond has a tendency to "float" within the grains. By adding small amounts of alloying ingredients, the size of the grains can be dramatically reduced and the hardness of the tin alloy can be significantly increased. The result is that the embedded diamond becomes more rigidly fixed at the grain boundaries.

**"Improve performance and yields with Tin alloy Lapping Plates"**

## PRODUCTION ADVANTAGES

**T**in-copper and TAC alloys have been specifically engineered for lapping and polishing. These plates have a controlled metallurgical composition and microstructure which results in a rechargeable lapping surface which better wets and holds diamond. Several production advantages include:

- Rechargeable Fixed Abrasive Lapping
- Increased Plate Life
- Less Metal Contamination from Lapping Plate
- Lower Diamond Consumption

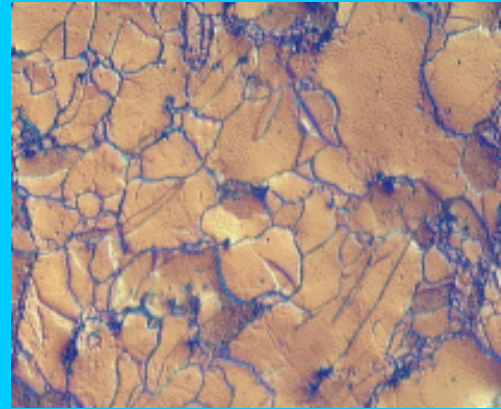
## IMPORTANCE OF FIXED ABRASIVES

**F**ixed abrasives have lower cutting profiles, are more efficient cutters (energy is applied to cutting vs. rolling), produce less wear on the lapping plates, and cut vs. smear soft magnetic materials. The result is a polished surface. The benefits of fixed abrasive lapping processes for lapping magnetic heads include:

- Lower PTR
- Lower Alumina Recession
- Less Alumina Roll-off
- Less Smearing Across the GMR Gaps
- Reduced Embedded Diamond in the Slider
- Increased Plate Life
- More Consistent Lapping Plate Profiles
- Polished Surfaces

## TIN LAPPING TECHNOLOGY

TAC-3000 and tin-copper alloys are engineered lapping plates designed to easily take a diamond charge during the embedding or charging process and then to hold the diamond effectively once it has been embedded. In order for the diamond to be effectively embedded into the lapping surface the lapping surface must not work harden during charging. Thus the lapping plate must have a recrystallization temperature below room temperature. For pure tin the recrystallization temperature is  $-25^{\circ}\text{C}$ . Because of this low recrystallization temperature pure tin has a very large grain size. By adding elements such as antimony, copper or bismuth, the grain size and the subsequent microstructure can be controlled to provide better abrasive embedding into the lapping plate. The following table lists the most commonly used tin alloys found in lapping.

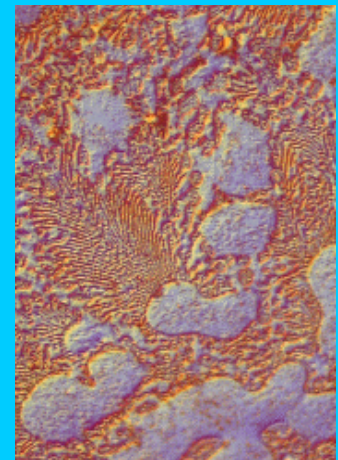


Pure tin consists of large grains



Bismuth-Tin-structure

Tin Alloy	Properties
Tin-copper	Structure has tin-rich dendritic grains in a eutectic matrix. This provides localized areas for the diamond particles to become embedded.
Bismuth-tin	Structure is a very fine grain structure. Has been commonly used for lapping magnetic hard drive heads. The main drawback to this lapping plate material is that the plate life is very short with conventional lapping lubricants. This situation can be avoided with the PACE POLYLUBE H9 or DIALUBE 9G lapping lubes.
Tin-antimony	Structure has coarse cored dendrites with the microstructure being dependent upon cooling rate after casting. Common alloy for tin lapping, however grain structure very dependent upon cooling rates and therefore it has a relatively high production variability
TAC-3000	Also known as tin Babbitt, this structure contains fine cored dendrites with the harder grain boundaries produced by small $\text{Cu}_6\text{Sn}_2$ particles.



TAC-3000-copper alloy showing dendritic grains