Zinc-A10 Lapping Plates

ZINC-A10 ADVANTAGES for GMR/TMR HEADS

GMR/TMR thin film magnetic heads continue to provide the technology for increasing computer hard drive areal densities. Successful manufacturing implementation of these technologies requires production processes which address key manufacturing issues. Primary in successfully producing these magnetic heads is the lapping operation. The ZINC-A10 Lapping Plate offers the following advantages:

- ☐ Improved Pole Surface Finish
- ☐ More Consistent PTR
- ☐ Reduced Alumina Roll-off and Recession
- ☐ Less Pole/ Top Shield/ Base Shield Recession Differences (MR recession)
- ☐ Less Gap Smearing
- ☐ Corrosion Protection of GMR/TMR Materials during Lapping

PRODUCTION ADVANTAGES

ZINC-A10 has been a specifically engineered lapping/ polishing plate with a controlled metallurgical composition and controlled structure. The result is a rechargeable lapping surface which better wets and holds diamond.

- ☐ Rechargeable Fixed Abrasive Lapping and Polishing Process
- ☐ Increased Plate Life
- ☐ Less Metal Contamination from Lapping Plate
- ☐ Lower Diamond Consumption

"Improve performance and yields with ZINC-A10 Lapping"

Data Storage Lapping/Polishing

Why lap with ZINC-A10. ZINC-A10 is specifically designed for lapping GMR/TMR thin film magnetic heads. ZINC-A10 has several properties which makes it the best lapping/ polishing material for magnetic heads. These include its ability to take a diamond charge, retain the diamond during the lapping/ polishing operation, and its protective chemical and corrosion properties relative to the thin layers of the magnetic thin film head.

Lapping operations for producing magnetic thin film heads can be broken into rough lapping (strip height lapping) and finish lapping (polish or kiss lapping). The rough lapping process must provide a means to accurately lap to a very consistent strip height across

PACE Technologies 1802 W. Grant Rd. Bldg 102, Tucson, AZ 85745 Telephone 520-882-6598 FAX 520-882-6599

the entire lapping row bar. In most cases a diamond slurry is applied to the lapping plate during this operation. To optimize this lapping operation the lapping plate must hold a consistent profile and preferably take a fixed diamond charge. The ZINC-A10 lapping plates properties are such that the diamond slurry fixes rigidly into the lapping plate. In general, fixed abrasives cut more effectively. This is particularly true for lapping magnetic heads, where the alumina-TiC substrate is much harder than the lapping plate material. Rough lapping with the ZINC-A10 lapping plate results in a fixed diamond abrasive lapping process which produces increased cut rates, decreased plate wear, and therefore increased strip height control.

Finish lapping/polishing or kiss lapping operations are required to improve surface finish, pole-tip recession (PTR), and alumina recession (ALR). This final polishing operation requires a fixed abrasive. The ZINC-A10 lapping/polishing plate is the ideal finish lapping plate because it accepts and holds diamond more effectively than other polishing materials such as diamond lapping films and other lapping plate materials.

ZINC A-10 LAPPING TECHNOLOGY

ZINC - A10 is an engineered lapping plate 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. The following Table lists the recrystallization temperatures for various metals used for magnetic head lapping.

Material	Recrystallization Temperature
Lead	-25°C
Tin	-25°C
ZINC-A10	Room Temperature
Copper	200°C
Aluminum	194°C

The only lapping plate material which has a recrystallization temperature close to room temperature is the ZINC-A10 material. The following describes the charging process for the ZINC-A10 lapping plate:

- As a force is applied to the diamond, the pressure at the ZINC-A10 interface increases the interface temperature
- Once this temperature increases above the ZINC-A10's recrystallization temperature, the diamond embeds into the plate
- As the diamond embeds the surface area contact of the ZINC-A10 plate increases around the diamond particle. As this area increases the force on the embedding diamond particle gets distributed over a larger area thus reducing the overall pressure on the plate

As the pressure decreases so does the point contact temperature at the diamond/ ZINC-A10 interface. As this temperature decreases below the recrystallization temperature the area around the diamond particle is work hardened, thereby rigidly fixing the diamond into the lapping plate. The result is a fixed diamond lapping / polishing abrasive.

Note that the two most commonly used lapping materials since the middle ages have been tin and lead. This was because of the ease at which an abrasive could be embedded into its surface. Subsequently, because of their low recrystallization temperatures they do not hold diamond very well. Thus the diamond is only semi-fixed and will subsequently smear across the lapping surface resulting in lapping damage to the magnetic poles (higher PTR, increased alumina roll-off, smeared and deformed magnetic layers). A semi-fixed diamond will also result in wear on these lapping plate materials (plate profile and plate life).

"ZINC-A10 is a Fixed Diamond Lapping Process"

IMPORTANCE OF FIXED ABRASIVES

Fixed 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 Include:

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

TMR/GMR CORROSION

Corrosion and corrosion control of the GMR/TMR elements is an extremely important issue. As the composition and number of layers increases with MR, Spin-Value, GMR and TMR head designs, so does its susceptibility to galvanic corrosion. ZINC-A10 is anodic to the other elements used in the manufacturing of today's heads, thus a degree of galvanic protection is built into the lapping process.

Element	Corrosion Potential (mV)
Zinc	-763
Iron	-409
Cobalt	-280
Nickel	-230
Tin	-136
Copper	340

Conversely, tin and copper lapping can result in the galvanic corrosion of the iron, cobalt, and nickel. As these layers become thinner and increase in numbers, corrosion issues will certainly be more difficult to control and monitor with these traditional lapping plates.

In addition, with a lapping lubricant such as glycol, ZINC-A10 provides added insurance that the GMR/TMR layers are protected from lapping corrosion, especially the cobalt layers.

RECOMMENDED APPLICATION

The following is a list of recommendations to maximize the potential of lapping with the ZINC-A10 lapping platens.

- ☐ Optimize lapping surface roughness to match diamond size and type
- ☐ Use a lapping plate texturizing abrasive which will not remain embedded in the lapping plate such as:
- ☐ **PACE LAPTEX™ Water Soluble Lapping Plate Conditioning Abrasive**
- ☐ Charge initial diamond (recommend a high friability diamond) at higher pressure than the lapping process
- ☐ Use a glycol lubricant such as the ULTRALUBE™ which also provides a cleaning action to the lapping plate to increase plate life.
- ☐ Pre-charge and apply diamond abrasives to lapping plate for course lapping and pre-charge only for polishing operations
- ☐ When storing or not using the ZINC-A10 lapping plate store with a thin film of glycol on the surface.

ADDITIONAL LAPPING PRODUCTS by PACE TECHNOLOGIES

- ☐ Tin-antimony and Tin-bismuth Lapping Plates
- ☐ Lapping Plate Texturizing Abrasives
- ☐ Cutting Lubricants
- ☐ Polycrystalline Friable Diamond Abrasives
- ☐ Cleaning Solutions

PACE TECHNOLOGIES 1802 W. Grant Rd. Bldg 102, Tucson, AZ 85745 Telephone 520-882-6598 FAX 520-882-6599