Lapping Tool Surface Control （仕上研磨工具表面の制御）

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Research Background

Lapping is a crucial machining method used in a variety of industries, including metal, electrical, and optical component manufacture. The most common process in machining flat surface planes is called fixed-abrasive lapping, which is frequently utilized when working with ceramics (as seen in **Figure 1**).

Tin alloys which usually contains a small amount of additive number of elements such as 1% of bismuth or antimony, etc., are currently employed as lapping plate material in the magnetic slider manufacturing process of Hard Disk Drives fields.

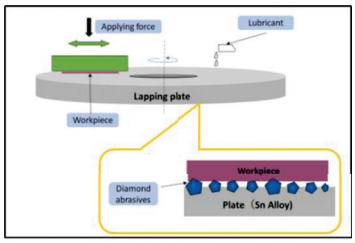


Figure 1 Fixed Abrasive Lapping Process

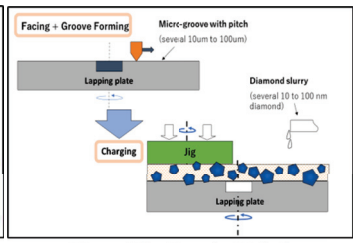


Figure 2 Plate Preparing Method

To prepare such a lapping plate, there always consists of three steps as shown in **Figure 2**, namely facing, groove forming and charging with diamond abrasives(several 10 to 100 nm).

Research Objective

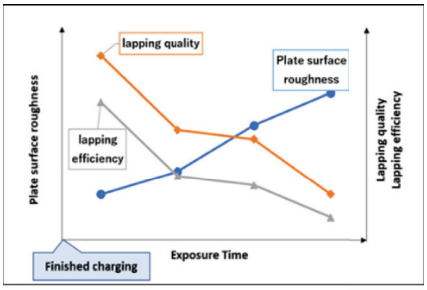
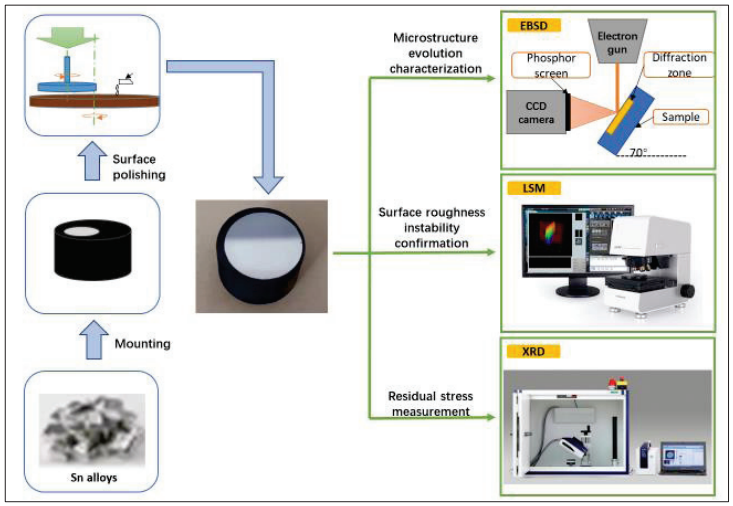


Figure 3 Sn alloy plate surface roughness instability

It was found in the previous experiment that the tin alloy plate surface become rougher during exposure time after charging and before lapping the products (seen in the **Figure 3**). Such surface roughness instability existed in the current tool will result in process instability, poor product lapping quality and lower lapping efficiency, which finally leads to negative product qualities and increased costs as well.

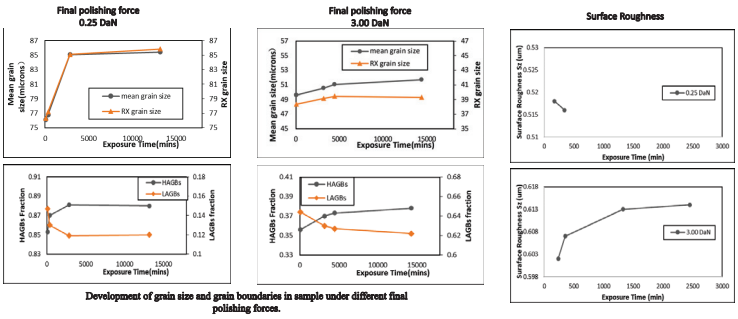
The purpose of this study is to elucidate the mechanism of existing Sn alloy tool instability and to find methods obtaining the stable plate surface.

Method



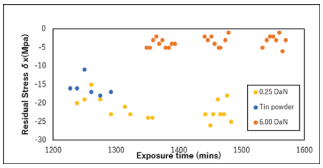
The tool surface instability is considered due to the metallic structure changing of tin alloy. We applied EBSD and XRD to depict development of microstructure and residual stress for Sn alloy under different manufacture process.

Results



Development of grain size and grain boundaries in sample under different final polishing forces.

Different forces are utilized with OPU as suspension in the final polishing steps for Sn-1%Bi samples. EBSD and XRD indicates that the recrystallization and energy release are force dependent. LSM confirmed the surface instability.



The results suggest that a small level of force should be applied to the lapping plate to maintain the surface stable.

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