Rebuilding of the Brugger Tribometer and Case Study of Direct Laser Interference Patterns (DLIP)

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Supporting parts of machining tools are often made of hard materials, e.g., cemented carbide, and they often require adequate mechanical and tribological properties. Laser surface texturing (LST) as a method of surface engineering has been proven beneficial in prolonging the ifespan of these machine elements. More precisely, the microscale laser textured patterns can reduce friction by changing the lubrication condition and retaining lubricant for future use. In this study, a Brugger tribometer will be reconstructed to provide a line-contact through a contacting flat part and a rotating ring. The friction and wear of Direct Laser Interference Patterns (DLIP) with different geometric features will be investigated on the modified Brugger tribometer.

Keywords: Laser surface texturing, Tribology, Brugger Tribometer, Cemented carbide.

1. Introduction

Novel surface engineering methods, such as laser surface texturing (LST), have proven beneficial for frictional performances. The unique topography of laser patterns allows lubricant retention in the contact zone, providing the necessary lubrication when external supply is insufficient [1]. Line-contact or profile contact is common between workpieces and tools when machining cylinders, for example, honing, where supporting parts made from hard materials are often implemented to support the rotating shafts. In previous work [2], LST was applied to produce line-like patterns on cemented carbide parts, which could be used as supporting parts in honing. These patterns were proven to be able to reduce friction using a standard micro-tribometer. However, standard tribotests in the laboratories are often carried out under point-contact conditions, such as pin-on-disk or ball-on-disk tests. A Brugger Tribometer will be reconstructed (Figure 1), which approaches a similar sliding motion with a line- or profile-contact. The upper specimen, conventionally a steel cylinder, is replaced by a customized clamping test part, i.e., the laser textured cemented carbides in this study. Meanwhile, the dimensions and material of the counterpart, i.e., the rotating cylinder, can also be adjusted.

Figure 1: The modified Brugger Tribometer.

2. Experiments and Discussion

Direct Laser Interference Patterns (DLIP) will be produced on selected cemented carbide grades using an ultrashort pulse laser installation, and their tribological performances will be evaluated using a modified Brugger Tribometer. More precisely, three patterns with geometrically different microscales will be produced and tested using the Brugger tribometer (Figure 2).

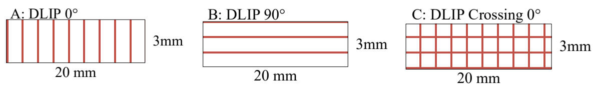

Figure 2: DLIP patterns tested.

A line-contact induced by the laser textured cemented carbide parts (upper body) to the rotating ring (lower body) is demonstrated by the modified Brugger Tribometer. The wear loss will determine the frictional performance of the textured samples. Therefore, the influence of the DLIP geometric features, such as periodicity and direction, will be revealed through the case study.

3. References

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