Effect of distance between grooves on the wear of structured grinding wheels

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During roughing and surface finishing operations a lot of heat is generated in the grinding wheel/workpiece contact zone. The surface structuring/texturing of abrasive wheels has been a proposal to reduce the operating temperature. In this work, three spiral grooved abrasive discs were produced, with different distances between grooves. The wear behavior of structured grinding wheels was evaluated by lubricated pin-on-disc tests. Results show that the inclusion of grooves, and the reduction of the distance between them, allows a more efficient lubrication of pin/disc contact zone, reducing the temperature in this zone while wear debris are eliminated, thus modifying the wear conditions.

Keywords: structured grinding wheels, active area, wear

1. Introduction

Abrasive composites are widely used in industry for roughing operations and surface finishing of components. During these operations, very high cutting forces are required, and the friction between the tool and the part to wear generates a high thermal load in the contact zone. It may induce some issues in both parts, such as failures in the workpiece or reduction in grinding wheel efficiency [1,2]. The surface structuring/texturing of abrasive wheels has been a proposal to reduce the operating temperature. In this work, three spiral grooved abrasive discs were produced, with different distances between their grooves. The structured grinding wheels were evaluated for their wear behavior, being compared with an unstructured wheel.

2. Methods

Structured grinding wheels with alumina grains and a vitreous matrix were tested. All grinding discs under study were produced with ∅62 x 8 mm. Fig. 1 shows the difference between the unstructured abrasive disc (SP0) and the three spiral structured discs (SP8, SP16 and SP24).

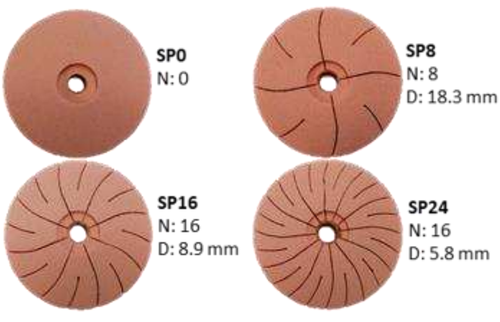

Figure 1: Produced grinding wheels. N - number of grooves (width: 0.5 mm, depth: 3 mm) and D - distance between the grooves.

Wear tests were carried out in a pin-on-disc geometry, with distillated water as a lubricating/cooling fluid. The tests were done on the structured side of the disc (Fig.1). Alumina pins (∅5 mm) were used as counterface, creating particularly hard contact conditions. The normal applied load, the sliding speed and the sliding distance were kept constant at 20 N, 0.5 $m.s^{-1}$ and 1800 m, respectively. The wear rate of both mating surfaces were measured by gravimetric method.

3. Discussion

The active area in the disc wear track was determined, being the total area minus the grooves area.

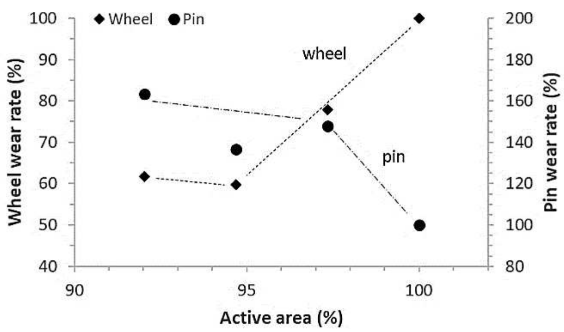

Figure 2: Pin and disc wear rate (%) as a function of the wear track active area (%).

Fig. 2 shows that by increasing the number of grooves (from 0 to 24), i.e., reducing the wear track active area (from 100 to 92 %) the pin wear rate increases and the disc wear rate decreases. The inclusion of grooves, and the reduction of the distance between them, allows a more efficient lubrication of the pin/disc contact zone, decreases the temperature at the sliding interface and facilitates the removing of loose wear debris.

4. References

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