

Tribological behaviors of textured surfaces under lubricated point contact conditions

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1. Abstract

Surface texturing has been shown to provide tribological benefits in terms of friction reduction in conformal contact. The problem of the effect of surface texturing under non-conformal contact condition has not been solved yet. Studies using a ball-on-flat contact configuration suggested that surface texturing could be detrimental to tribological performance in the non-conformal contact configuration [1]. Some studies showed that surface texturing can reduce friction only if the dimple diameters are smaller than the contact width [2, 3], while others show that friction increases under these conditions [4].

Wear tests were conducted using a pin-on disc tester. A steel disc of 40 HRC hardness was put in contact with a steel ball of 3.175 mm radius and hardness of 64 HRC. Normal load was 20 N, Hertzian contact diameter was 140 μm, before each test one drop of oil L-An 46 was supplied into the inlet side of the contact zone. After polishing, disc surfaces were textured using burnishing technique. Diameters of dimples changed, they were smaller and larger than elastic contact diameter, the number of oil pockets within friction track also varied. Friction tests were carried out for different sliding speeds and distances.

Figure 1 and 2 present views of textured disc surfaces after test of 30 min duration (sliding distance was 282.6 m, sliding speed was 0.157 m/s).

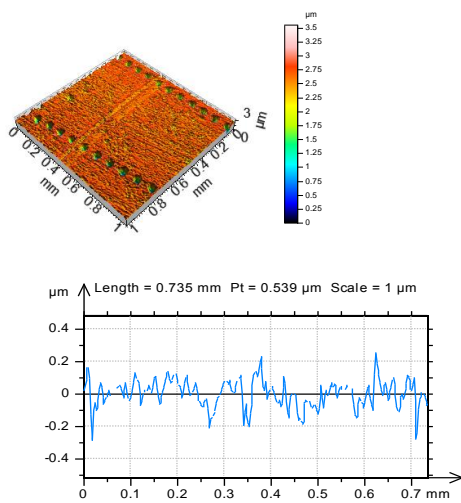


Fig.1 Surface with oil pockets after tribologic test and profile perpendicular to wear track

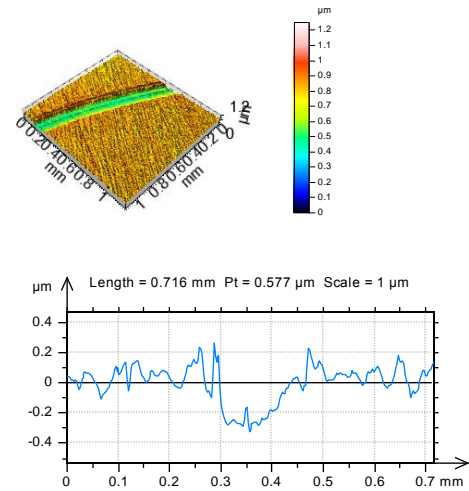


Fig.2 Polished surface after tribologic test and profile perpendicular to wear track

Depth of dimples was about 3 μm and diameter was smaller than elastic contact width. Wear track is invisible on surface profile contrary to reference disc without the dimples shown in Figure 2. Under this test condition friction forces were similar for textured and un-textured surfaces. However when duration of test was 90 min, friction force increased for assembly with polished disc sample contrary to textured specimen, which confirmed beneficial effect of texturing under non-conformal boundary lubricated contact for dimple diameter smaller than contact width.

2. References

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