IMPROVING PROCESSING QUALITY AND TRIBOLOGICAL BEHAVIOR OF LASER SURFACE TEXTURES USING OIL MASK METHOD

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ABSTRA

Rapid progressing of surface texturing technology has been widely witnessed within the past couple of decades [1]. In laser texturing technology, materials under irradiation spot of laser are partially vaporized and partially fused. Those highly heat fused materials, under the impact of successive laser pulsation, are pushed from the pool to splash along the rim edge of dimple, thus forming ridges/burrs [2]. Under wet lubrication condition, geometry of the splashed material accumulating along ridge/burr may be detrimental to tribological behaviors of the sliding friction pair [3].

The study allows the derivation of an effective oil mask method for improving the processing quality and the tribological behavior of laser textured surface. It goes on to investigate the influences of oil film thickness on formation of the coverage of oxides (Fig.1) and on the generated height of ridges/burrs (Fig.2). Analyses of experimental results suggest the possible reduction of the coverage area of metallic oxide and the average height of edge ridges/burrs around the rim edge of laser textured dimple. The possible mechanisms are summarized as mainly to be attributed to three effects: i) the cooling down effect of oil layer; ii) the shielding of oil film to reduce the laser ablation energy onto the base metal; iii) depleting effectively the oxidation and the adhesion of laser ablated melt on the irradiated surface of metal base. However, improperly too thick masking oil layer tends to reduce the laser ablation efficiency due to diminishing laser energy density or intensity on focal spot as it creates more severe refraction of laser beam. Tribological experimental tests confirm the favorable effect of textures obtain using oil mask method on reducing friction coefficient and wear.

Fig.1 Mean gray level changing with film thickness

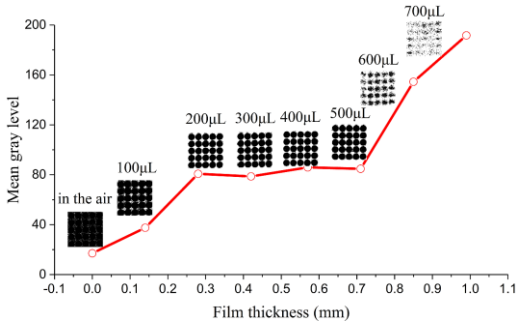
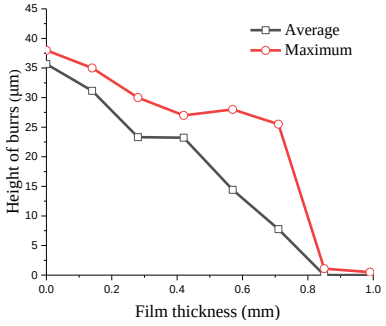


Fig.2 Dimple height of burrs changing with film thickness



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