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Investigation on generation of laser assisted dimples on piston ring surface and influence of dimple parameters on friction

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Abstract

In the present work, pulsed laser assisted texturing of the piston ring and its influence on tribology characteristics were studied experimentally and theoretically. Influence of laser wavelengths of 532 nm and 1064 nm on surface morphology of dimples, formed on the piston ring samples was studied. Subsequently, the laser wavelength of 532 nm was used for texturing to generate dimples with different sizes, aspect ratio and area density. Tribological characteristics of textured samples consisting of dimples with size, aspect ratio and area density ranging from 40 µm to 130 µm, 0.1 to 0.3 and 5% to 38%, respectively were measured experimentally by using reciprocating tribometer. The results showed that the aspect ratio concerning minimum friction varied with dimple size. The results also indicated that the area density of 16% showed low friction compared to other fractions for all the dimple diameters considered for the analysis. A reduction in cylinder liner wear rate of 72% was observed when tested with textured ring sample of the desired dimension compared to the liner tested with the non-textured ring. A theoretical model based on Reynolds equation was used to determine lubricant film thickness between textured surface and a non-textured counter surface. The experimental studies on friction coefficient were then compared with the theoretical results on film thickness.