Application of laser surface texturing in enhancing the performance of additives in engine oils

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Recently, surface modification has gained interest due to development of new techniques such as laser texturing which are able to generate surface features with great precision and repeatability. The use of surface modification to improve tribological performance has been demonstrated in cutting tools, metal forming tools, and mechanical seals [1-3]. The increasing need to improve fuel economy in the automotive industry has seen increased interest in the application of surface modification to reduce friction in the cylinder liner/piston assembly. Numerous studies have focused on introducing recessed features such as dimples on piston rings or piston liners to generate a hydrodynamic lift creating greater lubricant separation between the components [4]. There is however still, limited studies on the application of surface modification to enhance the performance of boundary additives in engine oils. The study therefore aims to demonstrate the potential of surface texturing in improving the performance of lubricant boundary additives. In this study, laser surface texturing was employed to generate surfaces with varying surface topographies. Friction performance of the generated surfaces was evaluated using tribological tests. The lubricant used in these tests contained a common friction modifier present in engine oils. Results showed that some of the laser-textured surfaces offer improved friction and wear performance compared to polished surfaces. The mechanism for the improved performance of the laser-textured surfaces is believed to be due to high local contact pressures at the asperities that accelerate additive decomposition to form protective low friction films. The results further showed that surface topography parameters such as feature orientation affect the additive degradation process. Overall, this study has clearly demonstrated that surface texturing is not only beneficial in increasing lubricant film thickness, as previously reported in literature, but can also be beneficial in improving the effectiveness of lubricant additives.

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