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THEORETICAL AND EXPERIMENTAL INVESTIGATION OF LASER SURFACE TEXTURING FOR PISTON-RING FRICTION REDUCTION

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ABSTRACT

Friction loss in an internal combustion engine (ICE) is an important factor in determining fuel economy and performance of the vehicle [1-4]. Laser surface texturing (LST) has emerged in recent years as a potential new technology to reduce friction in mechanical components. Surface texture may help improve some key physical characteristics of the hydraulic piston-cylinder interface, such as friction, heat transfer, and adhesion. A theoretical and experimental study is presented to evaluate the effect of laser surface texturing (LST) on friction reduction in piston rings. Several textures are designed, and the oil film pressure distribution and fluid force between the piston and cylinder are calculated. The effect of texture type, aspect ratio, depth to diameter ratio, position of placement, texture density, and distribution were investigated. A texture design optimization procedure for pistons with different geometries and subjected to a wide range of operating conditions are constructed and implemented.

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