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Friction effect of chromium carbon nitride coating on engine cylinder liner surface

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The automotive industry is under great pressure to meet the legislative demands for producing environmentally friendly vehicles with reduced resource utilisation as well as to satisfy customer demands. In terms of improving the performance of the engine components and forming very demanding, high strength materials, the contact surfaces must show reduced friction, anti-adhesive properties and increased wear resistance. Therefore, the automotive, tool and forming industries are keenly interested in various surface-engineering techniques, especially hard physical vapour deposition (PVD) coatings. The motivation for the choice of hard coatings is mainly based on their superior mechanical properties, such as high hardness and excellent galling and wear resistance. Chromium Carbon Nitride (CrCN) Coating is deposited with PVD method by KAPCO Coating Industry and Trade Ltd. Simulation and measurement of friction and wear were conducted using a reciprocating tribometer. The tribometer tests were carried out with 1st piston ring rubbing on uncoated and CrCN coated cylinder liner using 5w40 synthetic engine oil, under boundary lubrication conditions. The liner material is a spheroidal graphite cast iron. Surface analysis was performed using a 3D digital optical microscope, Scanning Electron Microscope (SEM)/X-Ray and 2D-3D roughness profilometer. Chromium (Cr) from CrCN coating is well detected on the surface and it is found mixed with other elements of additives protecting the surface under boundary lubrication conditions. The results indicated that CrCN protected the cylinder liner worn the piston ring surface. Although the CrCN coating eliminated the wear of the coated liner, the restricted tribofilm formation and the high coating hardness led to more intense wear of the piston ring. CrCN coating showed slightly higher friction value between piston ring and coated cylinder liner pairs related non-coated liner. At the end of the tests, while abrasive wear lines-grooves occurred on the rubbed surface of non coated liner, a good protection of wide hills with full of the asperities (of the honed surface) formed on the wear track of CrCN coated cylinder liner which protected the surface.

Biography

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