A Critical Review on Physical Vapor Deposition Coatings Applied on Different Engine Components

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ABSTRACT

Friction and wear in different engine components have crucial effects on the engine performance, combustion efficiency, oil consumption and lifetime of the internal combustion (IC) engine. Under certain loads, speeds, and temperatures, the metallic components of the IC engine, especially the piston and valve system suffer from a higher friction. Thin film coating is one of the novel techniques to reduce the frictional forces and improve the mechanical properties of engine components. Due to some versatile tribological properties, increasing attention has been paid to the physical vapor deposition (PVD) technology in the recent decade to deposit thin film coating on engine components. This article presents a comprehensive literature review on thin film coatings for IC engine components deposited by PVD technique. Issues related to tribological properties (wear and coefficient of friction) and mechanical properties (hardness and roughness) are also highlighted. Scientific improvements are presented in the light of literature. It is revealed that PVD coating is significantly effective on wear resistance, scuffing resistance, surface roughness, and friction of the components in IC engine. Laboratory test and data from actual service so far suggest that the plasma-activated electron beam evaporation coating is perhaps one of the best choices for smooth surface finishing with improved mechanical and tribological properties.