Abstract

This doctoral dissertation addresses the issue of laser texturing of wear resistant DLC coatings with the possibility of application on the surfaces of front seal rings. The thesis presents the current state of knowledge on surface layers, with particular emphasis on the characteristics of carbon coatings, the characteristics of laser micro-machining of surfaces, and the impact of surface texture manufacturing on operational properties. The thesis is organized into 10 chapters, split between a theoretical section and an experimental section. The dissertation covers the production of DLC coatings with tungsten and chromium interlayers on the surface of 4H13 steel and 100Cr6 steel using the PVD method, followed by testing to determine their performance properties. These tests included measurements of geometric structure of the surface, adhesion, hardness, and scratch resistance. Laser texturing was performed on the tested coatings using beams with wavelengths of 343 nm and 1064 nm. Face seals underwent tribological corrosion, surface free energy, and bench tests using samples coated with laser-textured and non-textured DLC coatings.

The thesis shows that the use of laser texturing of DLC coatings that are designed to perform under lubricated conditions improves their performance properties and significantly reduces the coefficient of friction. The goal of the doctoral thesis was to develop a mathematical model based on the planned experiment, allowing for the optimization of the technological process of laser erosion of DLC coatings.