TECHNICAL FORMING OF SURFACE LAYERS CONDITION ON THE CAST IRON COLLABORATING WITH FRICTIONAL COMPOSITE

J. SENATORSKI
Institute of Precision Mechanics, Duchnicka 3 str., PL 00-967 Warsaw, POLAND; e-mail: info@imp.edu.pl

T. PASTERUK, L. STARCZEWSKI, J. SZUMNIAK
Military Institute of Armoured and Car Technology – Sulejówek, POLAND;

Keywords: Frictional composite, cast iron, wear, friction

ABSTRACT

The solving of tribological problems with minimalization of wear and simultaneously maximalization of friction coefficient value of frictional unit can be realized among others trough material selection. The elements of tribological frictional pair usually are: polymer composite and ferrous alloy. In the field of research and production the composite frictional materials in the last years we observed a distinct progress. On the contrary fewer attention is dedicated to forming a surface layer of metallic material, collaborating with frictional composite.

A study has shown, that wearing of tribological pair depends on properties of both elements of the unit. Change the properties of one from this element but also influentted for wear intensity of surface layer of the collaborating elements. Many possibilities in this range gives thermal chemical treatment of ferrous alloy, particular nitriding. The properties of diffusion layers obtaining in nitriding process are well known, but it is any dadies concerning their applying in frictional composite.

This paper gives some information about such applying of nitriding process. To the investigations were chose the unit working in extreme conditions i.e. disk brake. The average temperature of surfaces in this set reached up to 700 °C by unit pressure – 5 MPa and sliding velocity – 14 m/s. For experiment a cast iron disk of the brake with modified surface layer has been selected. The surface layer generated through diffusion impregnation with nitrogen in ionnitriding and gas nitriding process. The investigations of structure carried out in surface layer zone of the nitriding disk has shown, that after thermo-chemical process were keepped a flakly graphite configuration. However, surface roughness of cast-iron disk increased in comparison with non thermo-chemical treated surface (Ra = 0.84 ± 0.03 µm and Ra = 0.73 ± 0.01 µm).

Tribological investigations of selected frictional sets were carried out in automatic inertial stand with possibility of measure such quantities as: sliding velocity, unit pressure, moment of friction, temperature on disk surfaces, time of braking and wear. On this stand were tested: a new non treated disk, ionitriding and gas nitriding disk. Results of coefficient of friction and wear resistance tests in function of temperature shown, that;

- unit with nitriding disk shown higher value coefficient of friction in a temperature range from 100 to 400 °C in comparison with results receiving for a new disk i.e. without thermo-chemical treatment,
- distinctly increase wear resistance of composite straps collaborating with nitriding disk from 25 %, by braking start temperature 100 °C up to 100 %, by braking start temperature 300 °C.

The analysis of all obtained results are shown;

- coefficient of friction for sets: frictional composite–ionitriding disk and frictional composite–gas nitriding disk are higher in comparison to set frictional composite – disk without diffusion layer.
- average threefold smaller value of linear wear for nitrided disk in comparison to non treated disk, up to 1100 braking cycles from temperature of the braking beginning – 200 °C,
- twofold smaller wear of the composite (straps), collaborating with nitriding disk in comparison to set with composite and non treated disk, up to 1100 braking cycles from temperature of the braking beginning – 200 °C.

A positive effect of application the thermo – chemical treatment of brake plate was verified during the exploitation investigations of cars.

ACKNOWLEDGEMENT

This work was supported by State Committee for Scientific Research in Poland (Project No 7T08C04715).