

Martyna NOWAK

Comparative tests of samples of high-speed tool steel with high-speed steel with DLC coating in terms of abrasion resistance.

Introduction

Due to the common technical problem, which is the wear of elements in terms of their abrasiveness, experts are looking for solutions, many of which do not bring the expected results. At a time when technicians strive to achieve the best performance of machine components without loaded them, the eyes of all scientists are directed to the field of materials science. The research involving the coating of a selected steel coating that is characterized by better chemical and physical properties is becoming more and more popular.

Characteristics of high-speed steel and abrasive wear phenomenon

High-speed steels are high-alloy steels. They are made of elements that require abrasion resistance, high temperatures and adequate hardness. Fast-cutting steels have a very high technical importance due to their versatility and flexibility of applications. They are used on many levels of the technical industry, and their popularity is constantly growing. A wide range of good properties of high-speed steel broadens its use.

Abrasive wear of a material is included in the chemical-mechanical processes and is presented as the degree of mass loss, thickness or volume of the element that results from the friction existing between the cooperating elements. Exploitation resulting in wiping is based on the mutual friction of two or more parts cooperating with each other. In most of these systems there is also a rapid increase in temperature due to the high load and the forces occurring. [1]

DLC coating

One of the key and most popular solutions to the problem are technological methods, such as coating the original material with a coating corresponding to the required properties. A very good answer in this matter is the DLC coating (Diamond-Like-Carbon), which is a combination of carbon structurally corresponding to diamene and carbon with bonds adequate for graphite. Diamond-like coatings can be deposited on the base material in various ways. Techniques used so far are the sputtering, pulsed laser, PVD and CVD ion beam and PACVD plasmas. [2]

Comparative study

Samples were tested on a T-05 roll-block tester. The possibilities offered by the tester include setting the speed, resetting or setting the exact number of turns, temperature and load. The test procedure was the same for both samples and consisted of mounting a test sample and counter-sample in the test machine, running the computer program and setting the number of revolutions, load and temperature. [3]

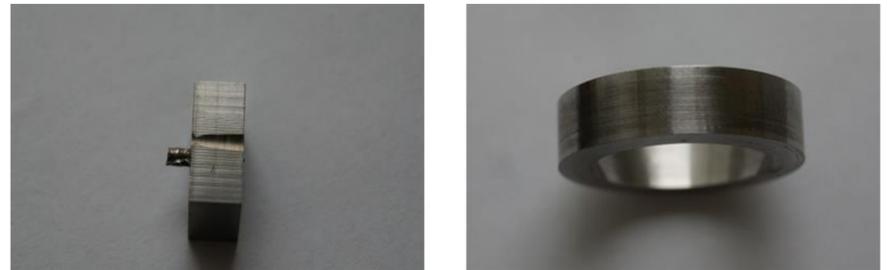


Fig. 1. Sample and counter-sample of high-speed steel without coating.

The SW7M high-speed steel sample without DLC coating was tested together with a counter-sample made of the same material. The average weight of the sample before the test differs from the average weight after the test, which indicates a significant loss of material and loss of mass of the element.



Fig. 2. Sample and counter-sample of high-speed steel with DLC coating.

The SW7M + DLC fast tool steel sample was tested with a counter-sample made of the same material. Weight of the sample and counter-sample after the test does not differ from the state before the test.

Summary

The purpose of this work was to analyze the tests carried out on samples of high-speed steels SW7M and SW7M + DLC in terms of their resistance to abrasive wear. The tests clearly show that the sample with the DLC coating showed better resistance to abrasion, its mass did not change, and only the topcoat layer was removed. However, the sample and counter-sample without the coating was destroyed, and on its surface a distinct loss is visible, which is confirmed by the mass test results.

References

- [1] U. Fischer, M. Heinzler, F. Näher, H. Paetzold, substantive development of the Polish version J. Potrykus, "Poradnik mechanika" (in original „Tabellenbuch Metal")
- [2] D. Ozimna, M. Madej, "Ocena właściwości jedno- i wielowarstwowych powłok DLC" in "Tribologia"
- [3] Zakład Tribologii, "Instrukcja obsługi systemu pomiarowo-sterującego testera typu rolka-klocek T-05"