DETERMINATION OF WARNING PRODUCTS IN CONTACT OF TOOL STEEL AND IYOTHERMALLY IMPROVED NODULAR CAST

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ABSTRACT

During the realization of contact, changes appear on the contact surfaces of the elements of tribomechanical systems, which refer both to the change of roughness and to the changes of their shape or dimensions.

Contact between the elements of tribomechanical systems can be achieved in several ways. In this case, the contact is made in the line. This means that a contact is made between the front surface of the pin and the circumferential surface of the disk, which is visible in the cutting fluid (wear particles) and on the front surface of the pin. There is a direct proportionality between the amount of wear particles and the PQ index. The higher the PQ index, the better the disk material is machined if the wear path on the pin is smaller. During this test, two wear parameters were measured. The PQ index was measured at PQ 2000, and the wear strips (surface profilometer) Talysurf No. 6 and tool microscope.

During the test, an attempt was made to define the processing quality values of a group of isothermally improved ductile iron in contact with steels by measuring the PQ index in cutting fluids at the end of 120 minutes of tribological contact on a Pin on disk tribometer.

The normal load is for the value of the radial component of the cutting force at the tool load as pina and sliding speeds which are harmonized with the cutting speed of 0.65 m / s.

INTRODUCTION

Tribological processes in tribomechanical systems, which as a rule form two solid elements in contact with the presence of lubricant as the third element.

The development of tribological processes in basic tribomechanical systems may or may not be influenced by the environment in which they exist.

Productivity and reliability of production processes in industrial systems, maintenance costs. Production and equipment, energy costs and production costs as a whole depend on the amount of friction and wear intensity in the contact zones, numerous tribomechanical systems.

The characteristics of tribomechanical systems in which the processes of friction and wear take place during the production processes also depend on the type of material of all three tribological elements of the system and the conditions under which contact is made in them.

The machinability of isothermally improved nodular castings is the second most important characteristic in the practice of machine workshops because it is based on an important factor influencing machine productivity processes and machining prices.

During these tests, an attempt was made to define the value of machining of group materials of multiphase alloys of ductile cast and high-speed steels designation JUS 6981- BRC averadge hardness 62HRC after hardening and firing and by measuring PQ index in various fluids at the end of one 120 minute sliding contact on a pin on disk tribometer.

Wear processes can be observed in the cutting fluid and on the front surface of the pin.

Normal load was determined for the value of radial cutting force at load (315) N and sliding speeds which are harmonized with the cutting speed o.65 m / s, and the geometry of the sliding contact is realized in the line. Direct proportionality was achieved between the amount of PQ index wear particles. The higher the PQ index the material of the disk is better machined if the wear path on the pin is smaller.

Through this test, both wear parameters are measured on the wear strips (Talysurf surface profilometer and tool microscope.

In this paper, a part of the results for disk D will be presented

PROGRAM AND TEST CONDITIONS

Nodular castings belong to multiphase materials whose tribological characteristics have not been sufficiently investigated. The issue of ductility of nodular castings is in the initial phase of research. Especially if it is about the resilience of isothermally treated nodular castings. The paper presents tests of two types of isothermally improved castings EN-GJS 500-7 and EN-GJS700-2. The difference between tribological characteristics in contact with high - speed steel pin was determined.

Table 1: The chemical composition and heat treatment regimes of nodular cast iron EN-GJS-500-7 and EN-GJS-700-2

Material of Disk	Heat Treatment		Hardness [HB]	Legend	Structure
	Ta [°C]	Tp [°C] / t [min]			
EN-GJS-500-7	900	390/30	355	EN-GJS-500-7-30	ferrite-pearlite
		520/60	302	EN-GJS-500-7-k	
EN-GJS-700-2		520/60	320	EN-GJS-700-2-k	mostly pearlitic
		390/30	365	EN-GJS-700-2-30	
Chemical					

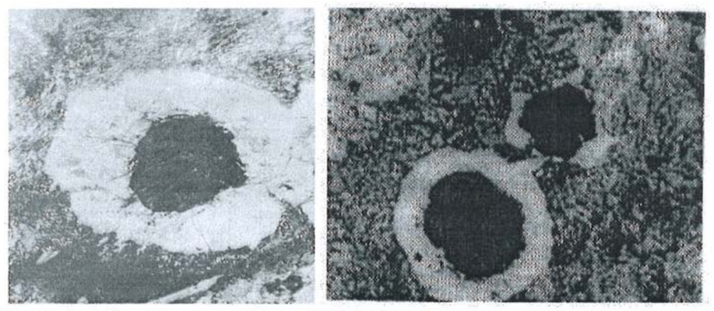

Figure 1: Microstructure of EN-GJS-500-7 (left), EN-GJS-700-2 (right)

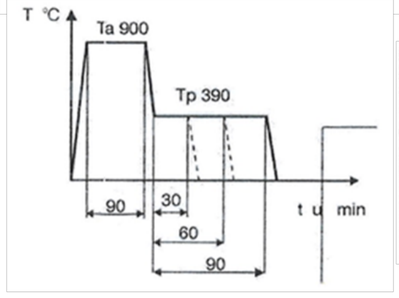

Figure 2. Isothermal austempering of disc

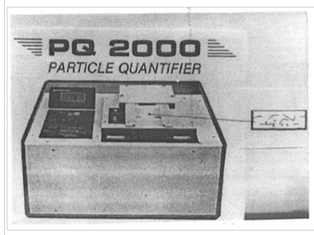

Figure 4. PQ 2000 Particle quantifie

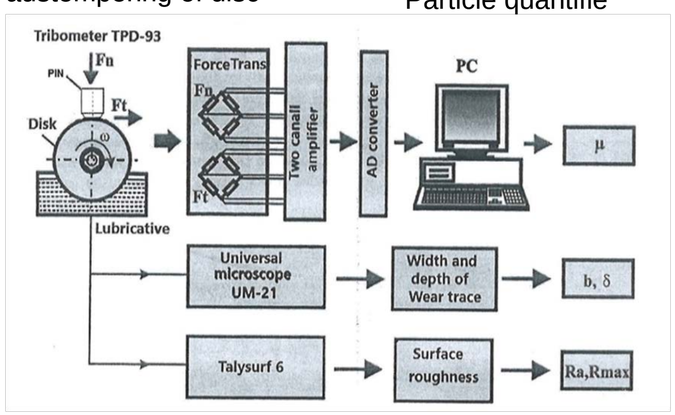

Figure 3. Geometry of contact with the measuring chain

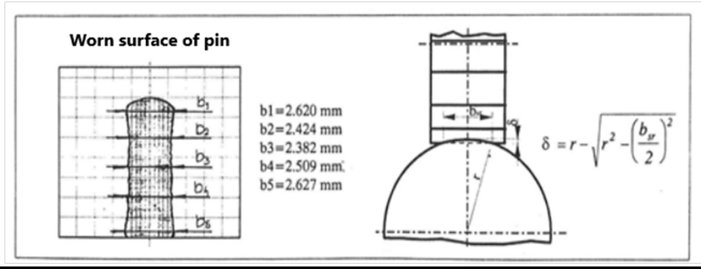

Figure 5. Worn surface of pin

The discs are made of both types of ductile iron with a diameter of 6.8 mm and a width of 8 mm. They were thermally treated in the Laboratory for Heat Treatment, Faculty of Mechanical Engineering and Naval Architecture in Zagreb, Croatia

Figure 1 shows the isothermal improvement procedure for three different times tp (the time of holding the discs at a temperature slightly higher than the temperature at which the formation of martensite begins).

Experimental investigations were performed on a Pin on disk tribometer with the line contact geometry shown in Figure 3.

A pin is made of high-speed steel of average hardness was used in all experiments

Lubrication was performed by passing the lower part of the disk through an oil bath in which there was always the same amount of UBA 5 oil. In this way, boundary lubrication was achieved in the contact zone of the pin and the disk. S

amount of oil UBA 5. In this way, the limit lubrication in the contact zone of the pin and the disk is achieved. With the change of the disc, the oil was also changed. The oil with the wear products was placed in special vessels with the test mark.

The duration of contact in all in all experiments was the same and was 120 minutes and the friction force Fn = 315 N.

Determination of disc wear after contact was performed by measuring PQ index on PQ 2000 Particle Qua Figure 4 PQ Particle quantifier with oil samples.

The duration of contact in all in all experiments was the same and was 120 minutes and the friction force Fn = 315 N.

RESEARCH RESULTS

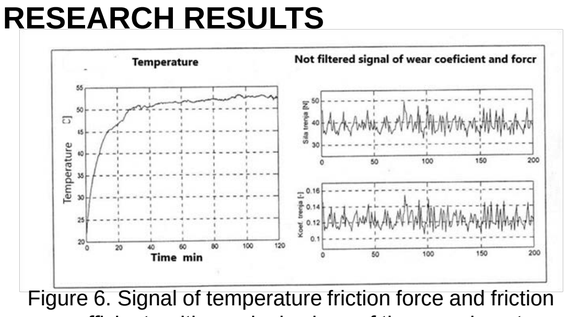

Figure 6. Signal of temperature friction force and friction coefficients with nominal values of the experiment.

Measurement of the friction force and PQ index was performed by experiments in which the contact of the pin and disk was made with an external load of Fn = 315 N, and a sliding speed v = 0.65 m / s. The measured values of value of the friction force and the coefficient of friction are approximate. This indicates the fact that the relatively low wear of the pin and disk do not have a greater impact on the coefficient of friction than the wear intensity.

The results of measuring the friction force within the realized research program also show that the types of heat treatment of disks made of ductile iron are not large. The stated values of friction forces and coefficients of friction refer to measurements performed immediately after starting and at the end of the experiment. The stated temperature values refer to the initial (room) and maximum SHP temperature during the experiment.

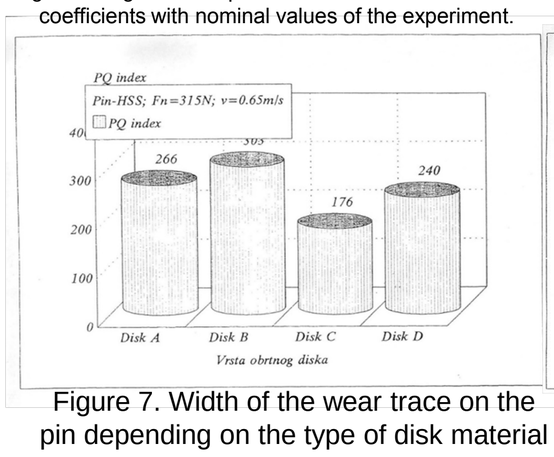

Figure 7. Width of the wear trace on the pin depending on the type of disk material

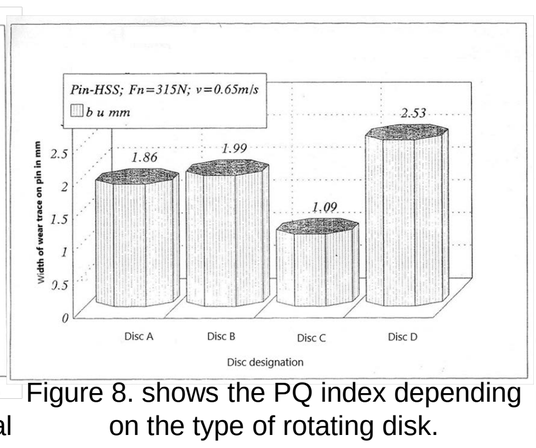

Figure 8. shows the PQ index depending on the type of rotating disk.

The results of measuring the PQ index as a representative of the amount of wear products generated during the contacts between the pin and the disk in the duration of 120 min show, however, that the type of heat treatment used on the wear intensity of the disks. The size of the PQ index is proportional to the amount of wear product found in the oil sample used to lubricate the disk-pin contact.

The largest number of cases of measurement error did not exceed 10%. Figure 8 shows the results of measuring the PQ index of oils used for lubrication, which were improved by the isotemic method and others by the classical method.

CONCLUSION

The results obtained by the examination confirmed that the tribological characteristics of the material are relative and if to some extent they depend on the chosen movement in their determination. The determination of tribological characteristics of the elements of tribomechanical systems determined by differently thermally treated nodular cast irons by the coefficient of friction that heat treatment has practically no greater influence on the cross section of the pin and different wear of the surface of the true unevenness and groove appearance were measured. The cause should be sought in the hard plugs in the disk that are in contact with the pin.

The tribological characteristic of wear after a certain time of the same elements is very large.

The PQ index as a wear parameter can be used to compare the resistance or wear intensity of multiple materials. The reliability of PQ index measurements depends on the number of measurements. 10 repeated measurements are enough.

The advantage of measuring the PQ index over other methods is that oil samples can be taken from real tribological systems of laboratory tribometers. It can be said that the values of PQ index range from 154.6 ± 5.86 (75.4 ± 4.82)

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