TRIBOLOGICAL ASPECTS OF THE SOLID-FLUID INTERACTION FOR FRESH AND USED LUBRICANTS

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1. Introduction

The paper presents the tribological aspects of the solid-fluid interaction, in order to obtain a new evaluation method for the lubricant durability. Its purpose is the development of a fast diagnoses method for the liquid lubricants, with minimal investments and a high precision level, easy to use, [1].

The principal result of this project is a new, efficient, performed and ecological methodology, for the evaluation and quantification of the wear degree and lubricants durability. In addition, it is important that a new complex device must be obtained for diagnosis of lubricants oils "life reserve". The project assures a modern laboratory and creates new premise for developing new approach directions for the lubricants durability problems, [2].

2. Experimental procedure

The test programme, using a TIMKEN equipment, had in view the influence of the lubricant state of degradation, considering the tribological behavior of the friction couple during the working time. Thus, six parallelepiped samples and twelve cylindrical samples were used. Each one of the parallelepiped samples has two active plane surfaces, made of OLC45-heat-treatable steel, and the final mechanical working process of the active surfaces was rough grinding. The cylindrical samples were made also of OLC45-heat-treatable steel and the final mechanical working process was finish grinding.

The length of the linear contact obtained in this way (cylinder/plane) is 12,7 mm and it corresponds to the parallepipedic sample width. All the tests were carried out in the presence of two lubricants, 15W40 oil and LHP 46 oil, in fresh and used state. The cylinder-plane friction couple was immersed in a tank filled with this lubricant; also, during all tests, the oil temperature was kept to a constant value ($T = 40^0$ C) and the same relative velocity (v = 3,83 m/s) was used. Tests were carried out using three values of the normal load F_n (30 N, 40 N and 50 N) and, during the tests, the wear trace (width and depth) were measured. Finally, pictures of the damage area were obtained with NEOPHOT 21 metallographic microscope.

3. Results

The results of the experiments are presented in Table 1; Figures 1 and 2 show the microscopically pictures.

Proof No.	Load [N]	Lubricant	State of the lubricant	Width of the wear trace [mm]	Depth of the wear trace [mm]
1	50	15W40	fresh	1,230	0,015
2			used	1,512	0,023
3		LHP 46	fresh	1,230	0,015
4			used	1,688	0,025
5	40	15W40	fresh	1,045	0,012
6			used	1,132	0,018

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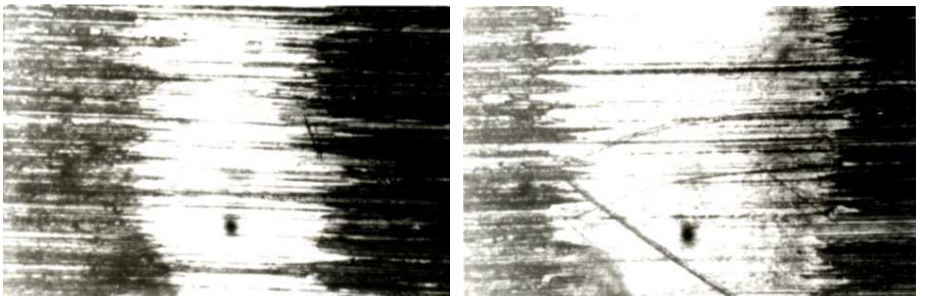
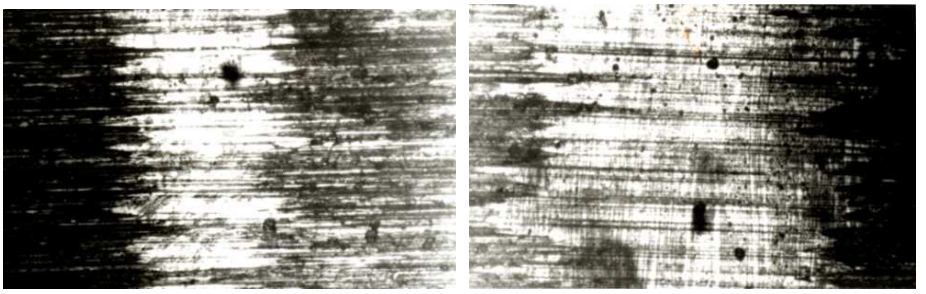
Proof No.	Load [N]	Lubricant	State of the lubricant	Width of the wear trace [mm]	Depth of the wear trace [mm]
7	30	LHP 46	fresh	1,008	0,011
8			used	1,383	0,018
9		15W40	fresh	0,832	0,008
10			used	1,014	0,012
11		LHP 46	fresh	0,895	0,007
12			used	0,998	0,014

Table 1. Experimental results.



a. Fresh lubricant b. Used lubricant

Figure 1. Wear trace for 15W40 oil



a. Fresh lubricant b. Used lubricant

Figure 2. Wear trace for LHP 46 oil

4. Conclusions

The tribological method proposed is able to diagnose the state of degradation of the lubricants, with high precision and accuracy. As a signalized conclusion - the wear degree of the friction couples which utilizes used lubricants is more important than the sames which utilizes fresh lubricants.

5. References (selected)

[1] Hutching, I. M., Tribology – Friction and Wear of Engineering Materials, Edward Arnold, Great Britain, 1992.

[2] Lockwood, F. E., Dally, R., Lubricant Analysis, ASTM Handbook, ASM International, Metals Park, OH, Vol. 18, 1992.

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