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EVALUATION OF RESEARCH OPPORTUNITIES OF A TRIBOLOGICAL TESTING TAPE MACHINE

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ABSTRACT

A new machine for wear testing is developed, and its performance is evaluated. The article presents the existing design solutions of several tribological testers. The authors point out flaws in the current methods of implementation of the friction association using selected examples. The paper introduces a new tribological tester providing constant friction association. The proposed solution involves the use of a friction strip as countersample, while simultaneously ensuring a constant linear velocity of the tape. Design of the new tester is presented as well. The paper also discusses the basic systems of the designed equipment: a propulsion system, a measuring system, and a measuring head. The results achieved are compared to results generated using a typical tester.

Keywords: tribological wear, wear resistance, dry friction.

INTRODUCTION

Analysis of existing design solutions in tribological testers implies a friction association changes at the time of testing (Zurowski, 2012, 2013). It is reasonable to design a system capable of assuring as constant friction conditions as possible throughout testing. A pin-on-friction strip system instead of pin-on-disk is used, therefore (Zurowski, Zepchlo, 2017).

Pilot testing of the completed tester was undertaken to assess its utility by comparing results for the new tester with the test results of P. Sadowski (Sadowski, 2008), who explored energetic aspects of formation of a tribological wear particle. A series of tests was conducted using the tester T01M (pin-on-disk) produced by ITE-PIB of Radom in Poland for the purposes of this research (ITE-PIB).

RESULTS AND CONCLUSION

The pilot testing applied parameters close to those used in the T01M tester. The friction velocity was identical for both the devices, that is, 0.4 m/s.

Table 1 - Test parameters

Test parameter	T01M	TT4
Countersample	34C4880J9 friction disk (silicon carbide, grain 80, hardness - J, structure 9)	PS19F friction disk (silicon carbide, grain 80)
Loading	From **0.125** kG to **1**kG	From **0.157** kG to **0.78k**G
Sample types	Fe, Al, Cu	Fe, Al, Cu

Fe - vacuum refined Armco iron.

A substantial difference of amplitudes of the recorded friction resistances was noted. The TT4 tester exhibits a far narrower amplitude of the recorded values. This is clear for all the recorded samples of each material tested. What is also interesting about the new tester, the friction forces measured are greater than in the case of the T01M tester.

Examples of results for ARMCO iron samples are presented below.

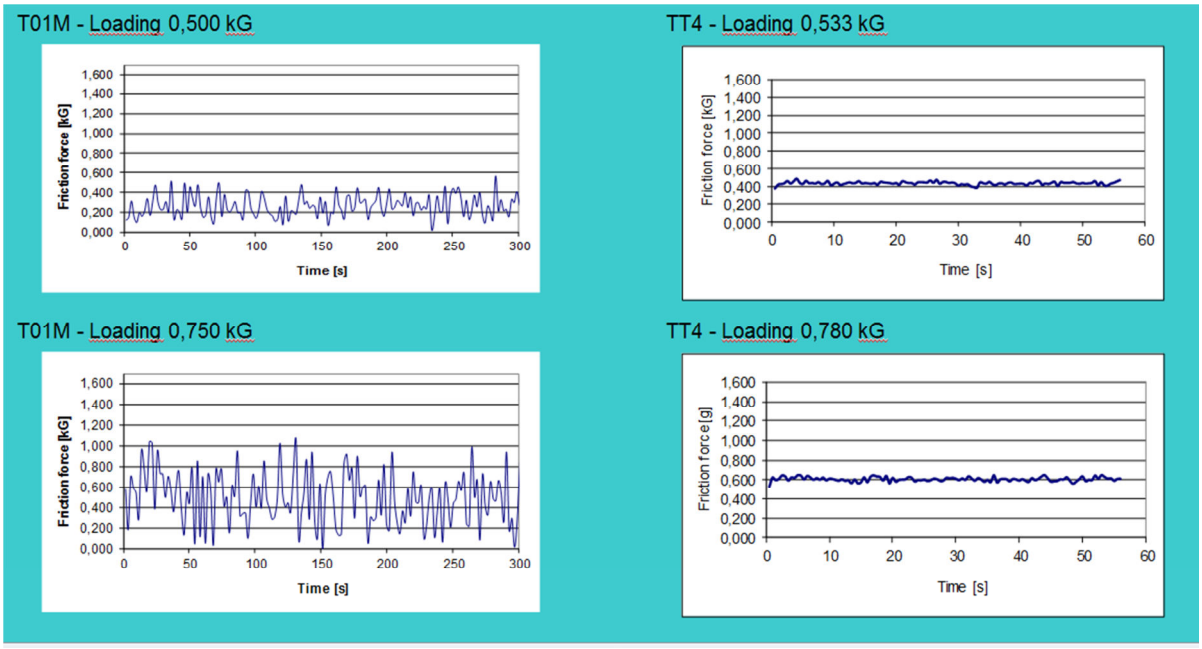

Fig. 1 - Selected testing for ARMCO sample

Friction coefficients were found to differ in the direction of their changes as the loads varied. For the T01M tester, the coefficients rose as the loading increased, the results for the TT4 indicated the friction coefficient diminished.

Impact of load values on specific work of wear is another interesting fact. The work varied as loading of T01M changed, whereas it remained virtually steady in the TT4 tester. The differences clearly point to a substantial effect of wear products on a friction association.

The pilot testing has confirmed utility of the new tribological tester. The TT4 has been found to provide for a greater stability of results.

Compared to the existing solutions, the device eliminates impact of wear products on the process of frictional wear by assuring a stable and unchanging friction association, combined with the possibility of ongoing measurements of friction resistances.

REFERENCES

[1] ITE-PIB. http://www.tribologia.org/ptt/inst/rad/T-01M.pdf

[2] Sadowski P. Energy question of the creation of particles of tribological wear [*in Polish*]. Unpublished doctoral dissertation. Technical University of Radom, Radom, 2008, Poland.

[3] Zurowski W. Structural factors contributing to increased wear resistance of steel friction couples. Eksploatacja i Niezawodność - Maintenance and Reliability, 2012; 14(1), pp. 18-23.

[4] Zurowski W. Analysis of surface layers and wear products by Mössbauer spectral analysis. Wear Volume 297, Issues 1-2, 2013, pp. 958-965.

[5] Zurowski W, Zepchlo J. Polish Patents: P. 225566, P. 227618, P. 227619, 2017.