

Wear Resistance Analysis
With Tribology Friction Measurements



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INTRODUCTION:

In a previous application note, we have seen that the Nanovea tribometer can be used to simulate wear of mechanical components by reproducing as closely as possible the motion of samples one against the other. In this application note, we will use the linear module to simulate a real-life wear application that is the wear of magnetic strips on cards.

In that previous application note, we had tested a bulk material and had used the Nanovea ST-400 to measure the extent of the wear in the sample. In this case, we will only use the friction readings from the tribometer to determine the lifetime of the magnetic strip under wear. To better understand the wear damage, we will also use the profiler to illustrate the result of the wear. In this test, we will be wearing two cards. One is an automobile club card, and the other an airline fidelity program card. The static sample we will be using is a flat pin with rounded edges.



Figure 1: Pin



Figure 2: Card with magnetic strip

With this type of test, we can perform controlled wear by having control of the sliding speed, amplitude of the motion, the material and geometry of the contact point, the load applied, and the duration of the test. The friction will be recorded over the duration of the test and will be able to show exactly when the coating has failed.

PIN-ON-DISK TEST METHOD:

The pin-on-disk test is generally used as a comparative test in which controlled wear is performed on the samples to study. Generally, the result of interest is the volume lost, but in this type of test, it is more interesting to look at the lifetime of a coating. The lifetime of different coatings under identical wear parameters can then be used as a comparative value of wear resistance.

PIN-ON-DISK TEST RESULTS:

For the pin-on-disk test, the following parameters are used:

Force applied	7.0 N
Speed of rotation	80.0 RPM
Length of wear track	50mm
Duration of test	<i>Sample dependent</i>
Total disk rotations	<i>Sample dependent</i>
Slide distance	<i>Sample dependent</i>

Airline fidelity program card

During the course of the test, the pin slid on the sample for several dozen minutes without causing visible damage. After approximately 15.5 minutes, the pin started removing some of the material and the full wear as shown on the following picture occurred over a couple strokes. For the remainder of the test, no significant further wear was observed.



The following graph shows the raw coefficient of friction between the pin and the sample over the course of the test as recorded on the tribometer:

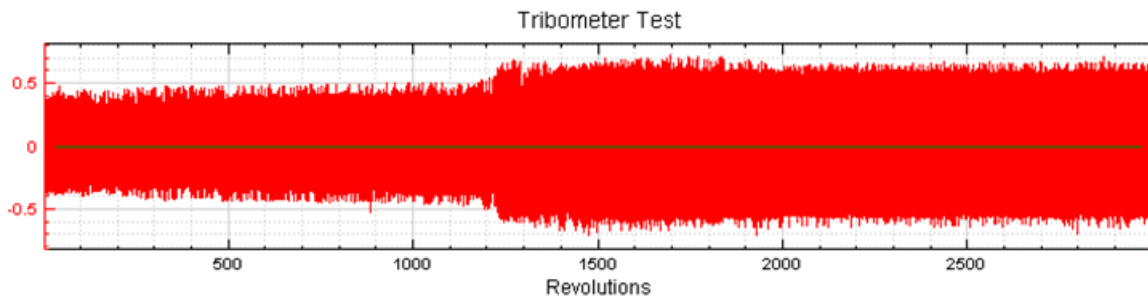
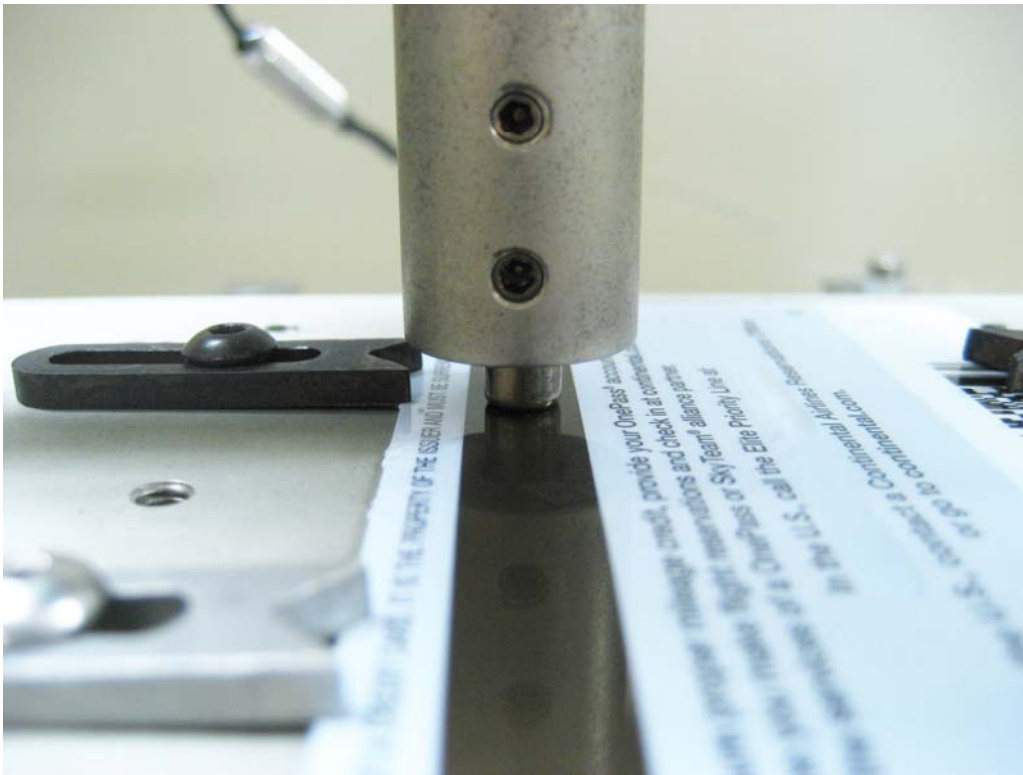


Figure 5 : Coefficient of friction over time during test

The coefficient of friction goes back and forth from positive to negative because of the back and forth motion of the stage during this test. We can clearly observe an increase in the amplitude of the coefficient of friction at approximately 1250 revolutions. The increase is due to the failure of the surface and the beginning of the wear (which was also visually confirmable).



CONCLUSION:

Although the tribometer is very often used in conjunction with the optical profilometer to evaluate wear rate of coated or uncoated samples, the standard tribometer can gather enough information to evaluate wear resistance on its own in some applications where coatings or specific properties of materials have a certain lifetime. In this case, the magnetic strip would not wear until the point of failure, but this test can also be applied to samples where a top material wears gradually over time, uncovering a second material with a different coefficient of friction, or where a surface texture is worn through. In all cases the change in friction will allow to evaluate the lifetime of the coating solely on friction readings from the tribometer.