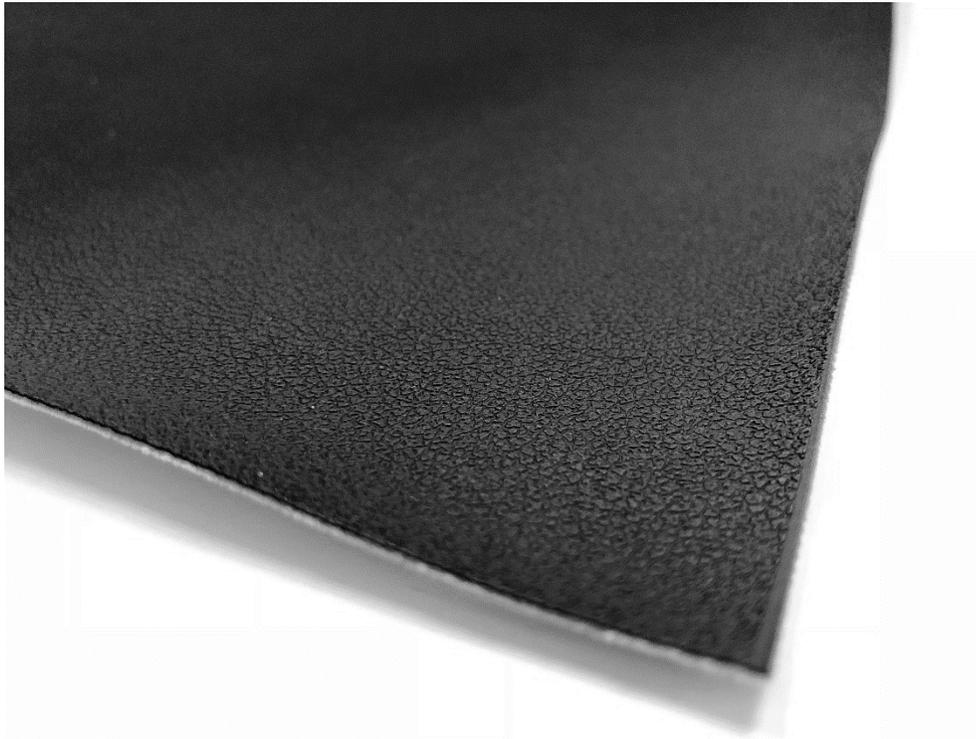


LEATHER COEFFICIENT OF FRICTION EVALUATION



Prepared by
Frank Liu

INTRO

Leather has always been a desirable material used to produce various goods. Its high durability and flexibility makes it ideal for creating quality goods that can withstand forces that would normally wear or tear conventional fabrics. Nowadays, leather has been used in many modern industries ranging from clothing, tools, cars and upholstery. The Nanovea Tribometer can be used to determine if the quality of the leather is acceptable for its application since it can precisely measure an important material parameter for leather: Coefficient of friction.

IMPORTANCE OF COF TESTING ON LEATHER

Coefficient of friction (COF) is quite important for leather since it can be used to characterize properties such as slip resistance, finish and material degradation. For leather used in footwear, the slip resistance must be sufficiently high. Slip resistance can be characterized by observing the static COF and dynamic COF. COF also determines how much friction is produced when rubbing between two surfaces occur. This can be used to determine the aesthetic quality and durability of the leather finish when applied to clothing, tooling, and upholstery.

MEASUREMENT OBJECTIVE

In this study, the Nanovea tribometer shows its ability to effectively conduct COF testing on leather. Both the static and dynamic COF can be obtained with a single test.

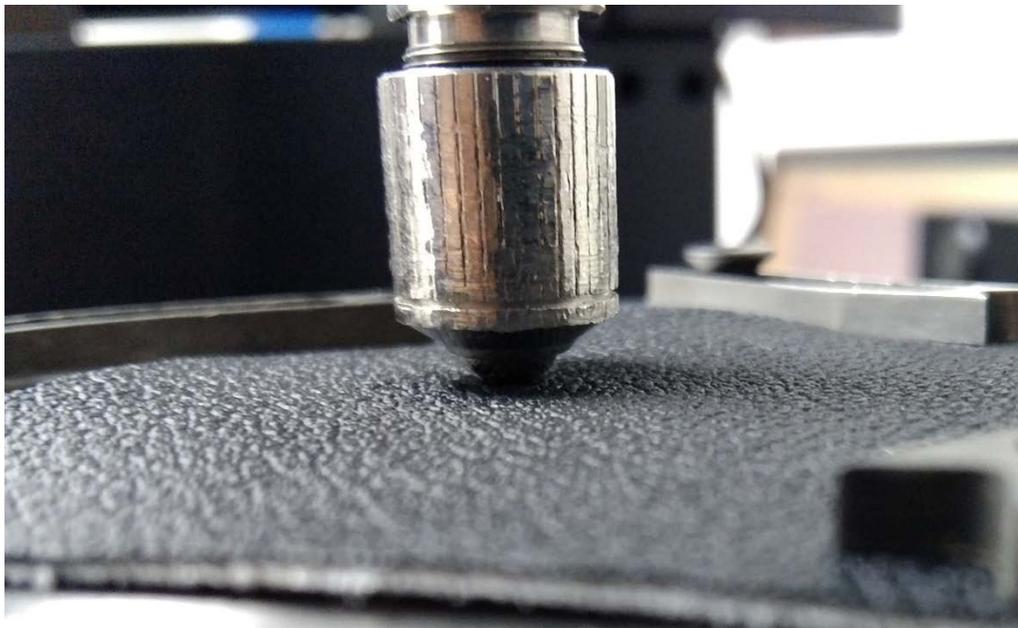


Figure 1: Tribology test setup for COF of leather

TEST PROCEDURE

The leather sample was cut and mounted onto the rotational stage on the Nanovea tribometer. A SS440C 6mm diameter ball was used as a counter material to the leather. Throughout the test, the ball was kept in contact with the sample by applying a dead weight of 5N. In order to precisely determine the static COF, a linear speed ramp was used to gather more data points at the start of the test.

Test parameters	Value
Normal force	5 N
Rotational speed	0.1-50 rpm
Duration of test	5 min
Revolutions	125.22
Distance traveled	3.93m
Atmosphere	Air
Temperature	24°C (room)
Wear track radius	5 mm

Table 1: Test parameters for the leather COF test

RESULTS AND DISCUSSION

The rotative COF tribometer test conducted with a linear ramp speed precisely shows the static and dynamic COF of the leather sample. The peak observed at the beginning of the testing is the static COF (see Figure 2). The data collected after the first peak will be the dynamic COF. The force necessary to overcome static condition must occur before friction from motion can be observed.

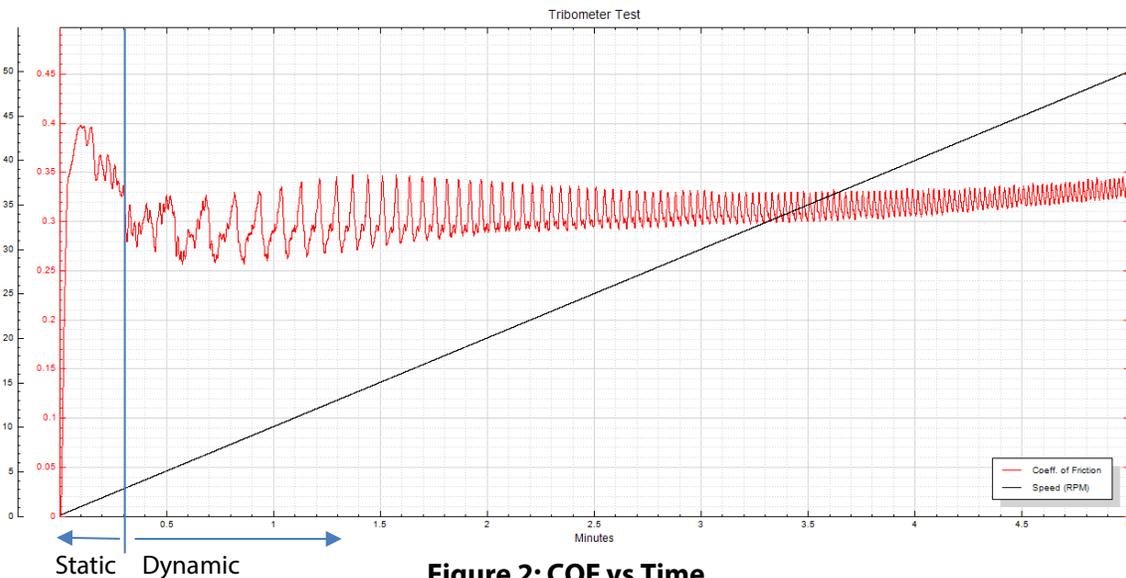


Figure 2: COF vs Time

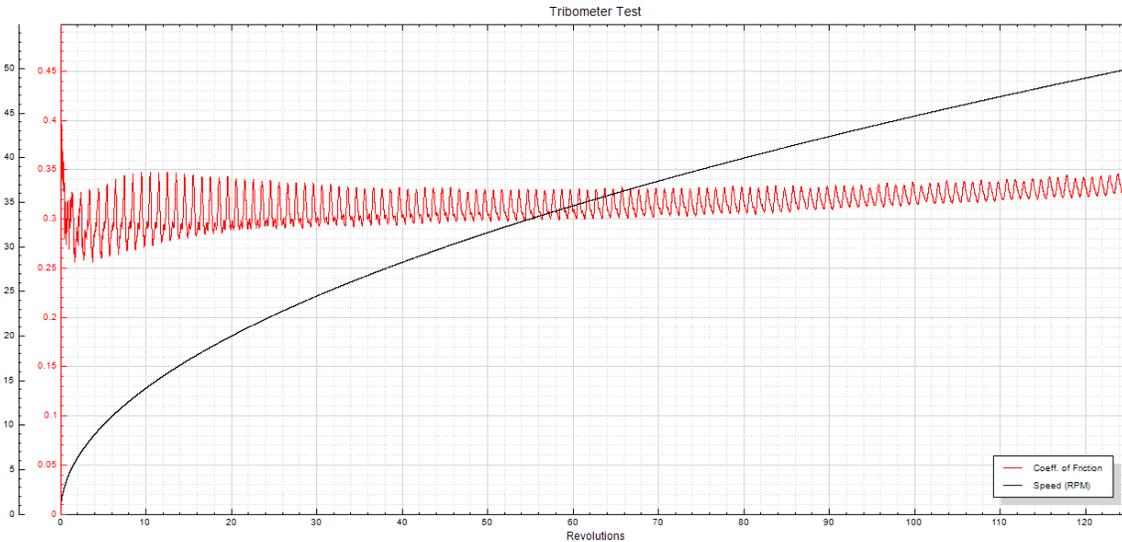


Figure 3: COF vs Revolutions

The Nanovea tribometer’s ability to ramp speed allows the static COF to be precisely obtained as seen from Figure 2. This allows for easy separation between static and dynamic COF. The cut off between static and dynamic COF was determined to be at 0.3 min. The static COF obtained is 0.398 and the dynamic COF is 0.309. The software also offers a logarithmic ramp if smaller speed ramp is needed to observe the static COF.

The graph obtained is an ideal COF graph. The sharp peak at the beginning is observed, and a flat COF curve is observed afterwards. The force required to overcome static conditions is easily observed, and minimal wear on the surface occurred with the applied load, giving consistent COF data on the leather’s surface.

CONCLUSION

From the test conducted, the Nanovea tribometer is a reliable instrument in determining the COF of leather. Not only can precise data be obtained, but additional modules, such as humidity, lubrication, and temperature, can be easily added onto the tribometer to simulate different environments, e.g. slip resistance under wet conditions. While these modules are not shown in this specific app note, they can be found under our other tribometer application notes.

Nanovea Tribometer offers precise and repeatable wear and friction testing using ISO and ASTM compliant rotative and linear modes, with optional high temperature wear, lubrication and tribo-corrosion modules available in one pre-integrated system. Optional 3D non-contact profiler is available for high resolution 3D imaging of wear track in addition to other surface measurements such as roughness.

Learn More about the [Nanovea Tribometer](#)

MEASUREMENT PRINCIPLE

TRIBOMETER PRINCIPLE

The sample is mounted on a rotating stage, while a known force is applied on a pin, or ball, in contact with the sample surface to create the wear. The pin-on-disk test is generally used as a comparative test to study the tribological properties of the materials. The COF is recorded in situ. The volume lost allows calculating the wear rate of the material. Since the action performed on all samples is identical, the wear rate can be used as a quantitative comparative value for wear resistance.

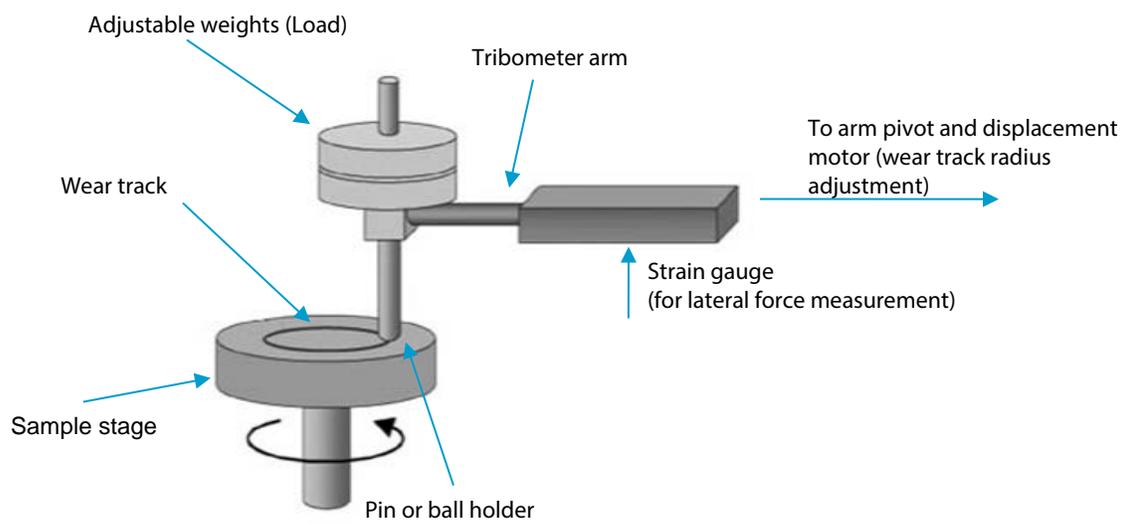


Fig. 1: Schematic of the pin-on-disk test.