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Mechanical Stability of Lithium Complex Grease Using Tribometer

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INTRO:

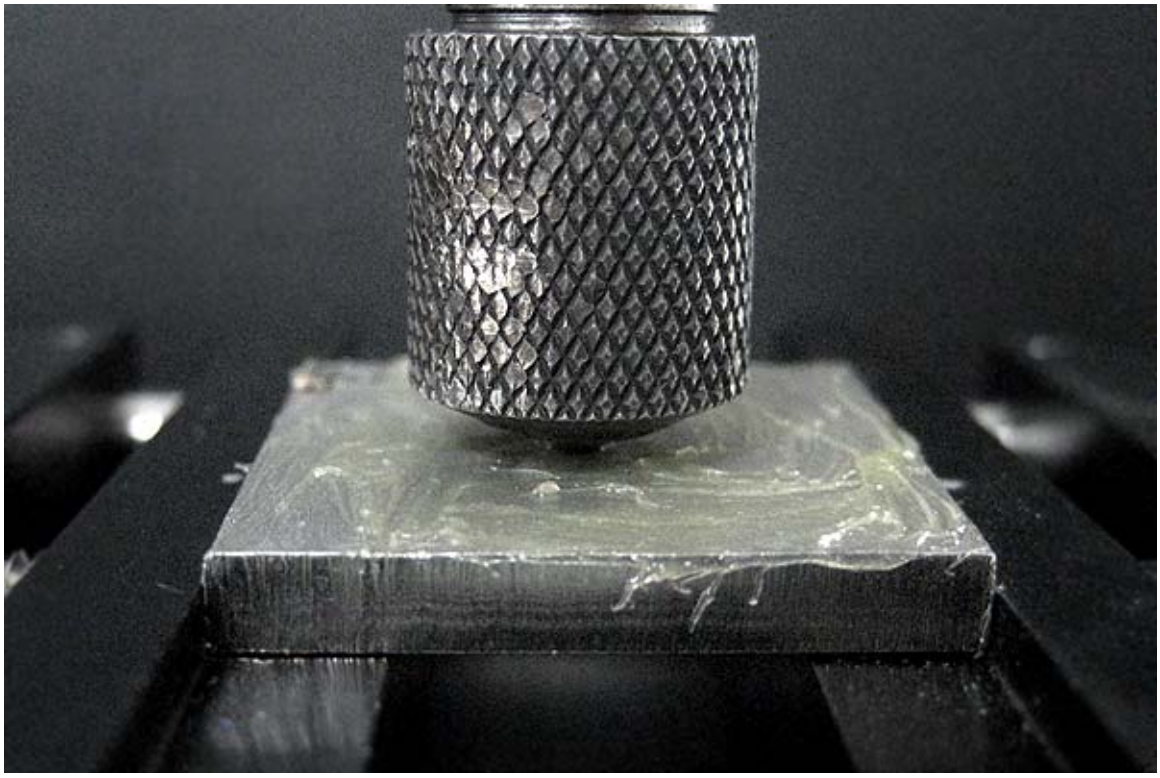
Greases made from lithium complex greases soap are known for their improved properties compared to the other alkali metal soaps. This includes better water, temperature and mechanical property resistance. Although lithium soap greases may be more expensive the advantages offset increased cost with improved performance. Understanding the enhanced performance of the grease will be critical to its use. In specific we will investigate the mechanical stability.

IMPORTANCE OF TRIBOLOGY INSPECTION FOR QUALITY CONTROL

The Tribometer plots the friction as it relates to speed, load, time, revolutions or distance. With this capability the improved mechanical stability of lithium soap greases can be studied with the forces of friction and wear. The purpose of Tribology research is ultimately the minimization and elimination of losses resulting from wear and friction of rubbing of surfaces. Tribology research is vital to greater production efficiency, application performance, controlled replacement breakdowns, and most importantly to the cost savings to allow industrial growth.

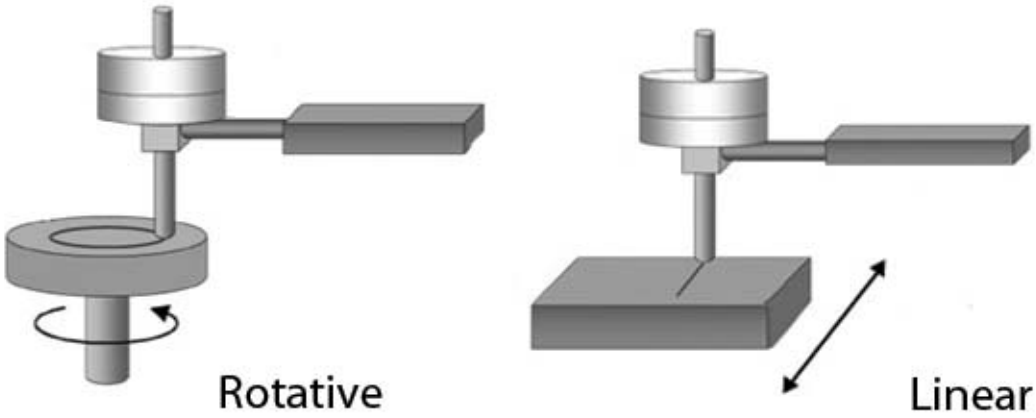
MEASUREMENT OBJECTIVE

The Nanovea Pin-On-Disk Tribometer will be used in rotative mode (linear could have also been used). A steel ball tip will be used against a steel sample coated with lithium complex grease. The load used will be at 5N with a constant speed of 150rpm. Two separately formulated lithium complex greases will be tested for comparative evaluation.



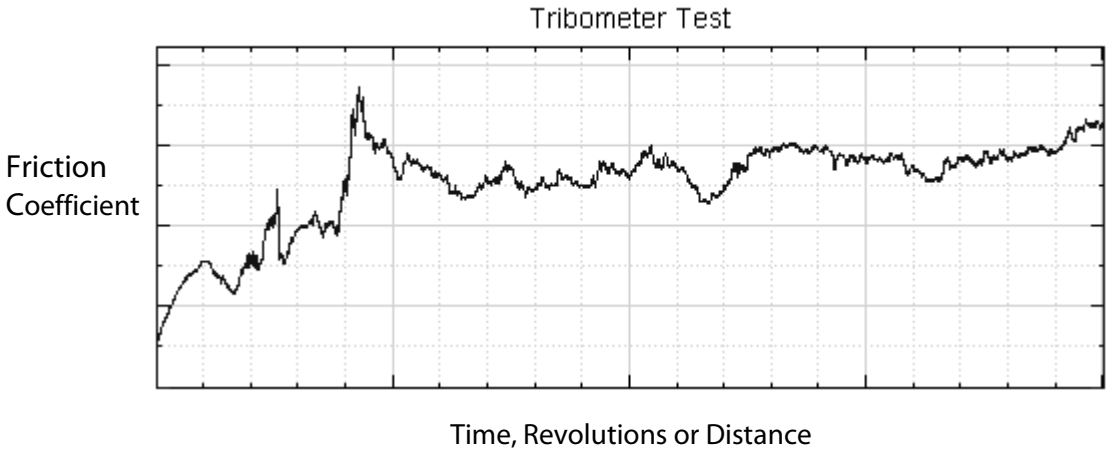
PIN-ON-DISK TEST PRINCIPLE

A flat or a sphere shaped indenter is loaded on to the test sample with a precisely known force. The indenter (a pin or a ball) is mounted on a stiff lever, designed as a frictionless force transducer. As the plate slides in a linear reciprocating motion or the disk rotates (pin-on-disk) the resulting frictional forces acting between the pin and the plate/disk are measured by very small deflections of the arm using a strain gage sensor. Wear rate values for both the pin and sample may also be calculated from the volume of material lost during a specific friction run. This simple method facilitates the determination and study of friction and wear behavior of almost every solid state material combination, with varying time, contact pressure, velocity, temperature, humidity, lubrication, etc.



TEST PROCEDURE

The instrument base is first leveled in the horizontal position by screwing or unscrewing the adjustable rubber pads at each corner. A ball-holder containing a 3 or 6 mm diameter ball is held in the load arm and placed at a height that allow the tribometer arm to be leveled horizontally when resting on the sample to ensure that normal load will be applied vertically. The arm is then balanced with counter weights to ensure that the arm and ball holder initially apply no force on the sample surface. Finally, weights corresponding to the load required for the test are finely placed on the arm over the ball holder. Through software, the test is then launched and the test is performed at a specified speed for a specified duration, and the frictional force is recorded over time. Below is an example of a friction curve during a tribometer test.



TEST CONDITIONS

Test parameters

Sample	All samples
Load	**5 N**
Duration of test	**10 min**
Speed rate	**150 rpm**
Radius	**4 mm**
Revolutions	**1487**
Ball Diameter	**6 mm**
Ball Material	**Steel**
Substrate Material	**Steel**

Environmental Conditions

Lubricant	**Samples provided**
Atmosphere	**Air**
Temperature	**24°C (room)**
Humidity	**40%**

RESULTS

This section includes summary table of the main numerical results and graphs of coefficient of friction over time

Summary Table

Sample	Initial Failure (Revs)	Complete Failure (Revs)	Average COF
1	200	310	0.109
2	360	460	0.132

DETAILED RESULTS – Sample 1

	Initial Failure (Revs)	Complete Failure (Revs)	Max COF	Min COF	Average COF
Sample 1	200	310	0.113	0.106	0.109

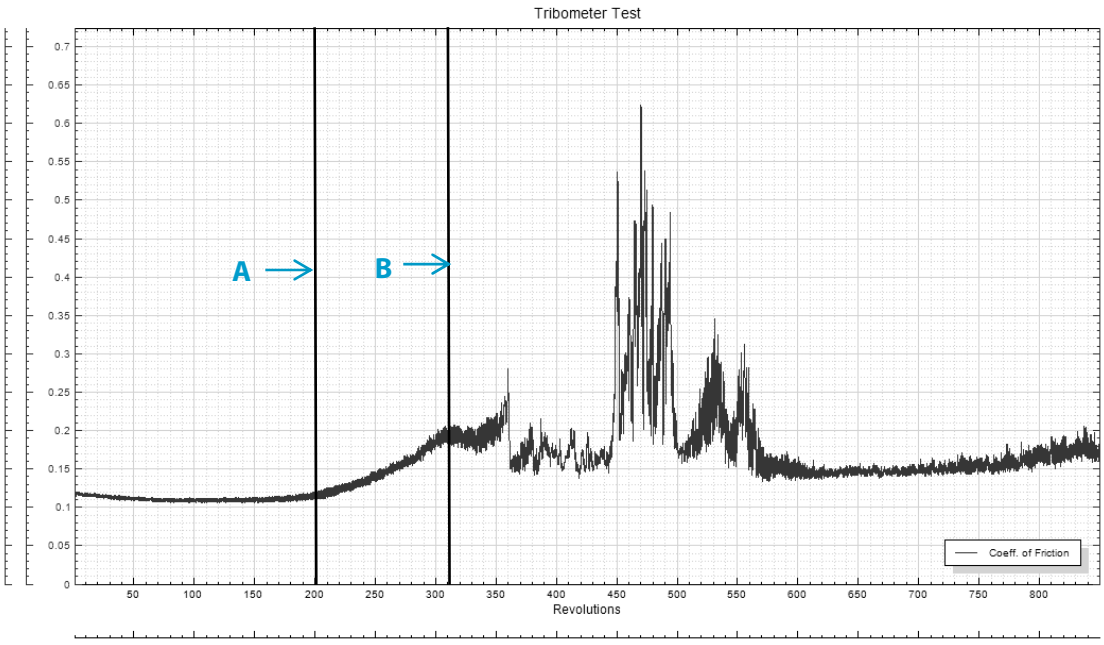


Figure 1 : Graph of COF for Sample 1 (0-850 Revs) showing points of (A) Initial failure and (B) Complete failure

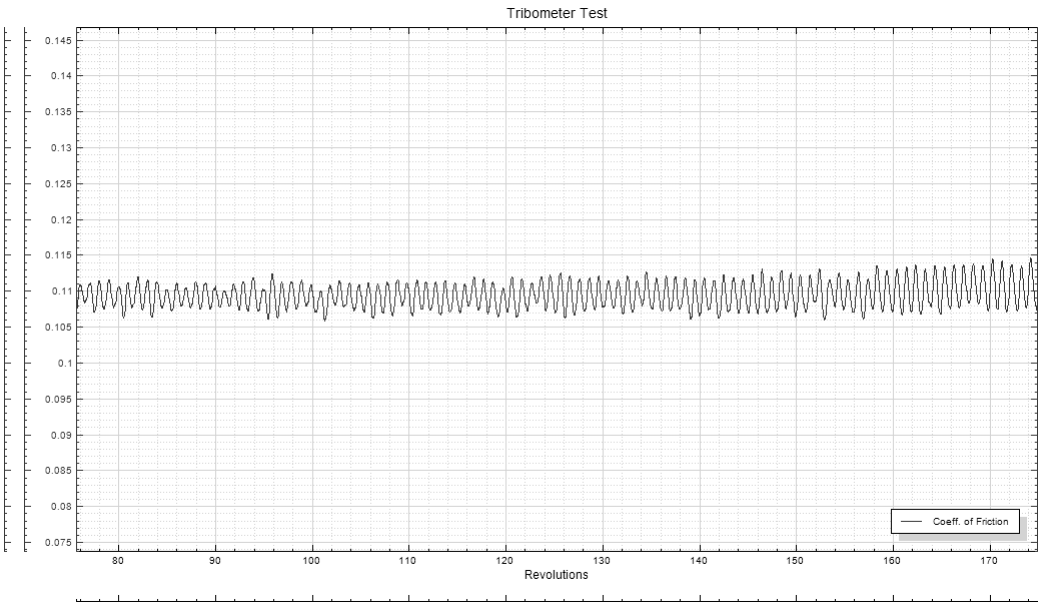


Figure 2 : Graph of COF for Sample 1 (75-175 Revs)

DETAILED RESULTS – Sample 2

	Initial Failure (Revs)	Complete Failure (Revs)	Max COF	Min COF	Average COF
Sample 2	360	460	0.136	0.128	0.132

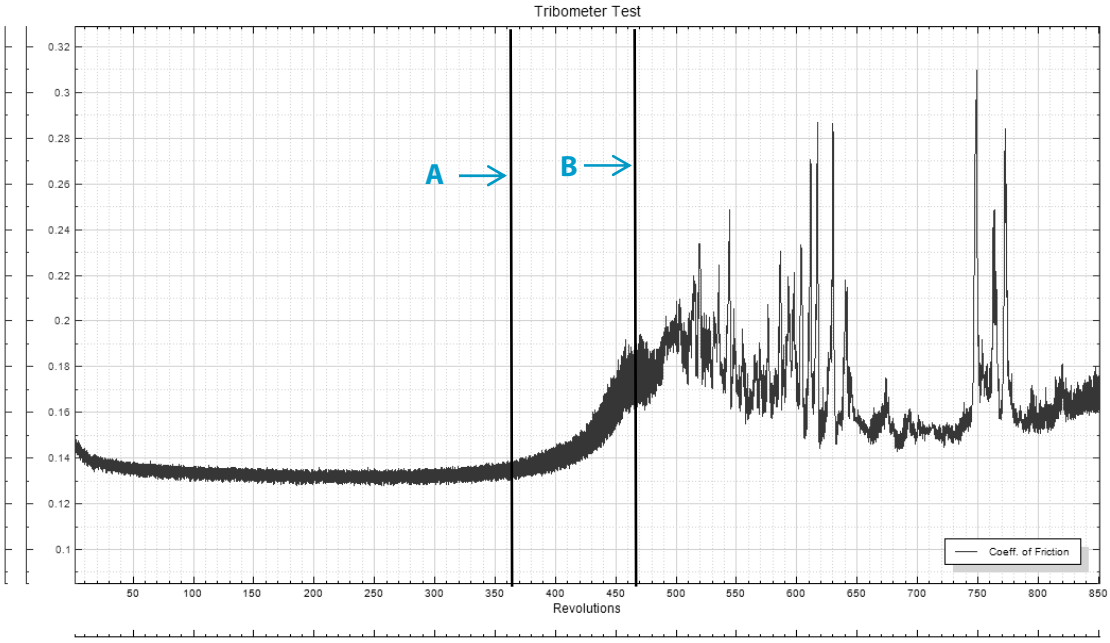


Figure 3 : Graph of COF for Sample 2 (0-850 Revs) showing points of (A) Initial failure and (B) Complete failure

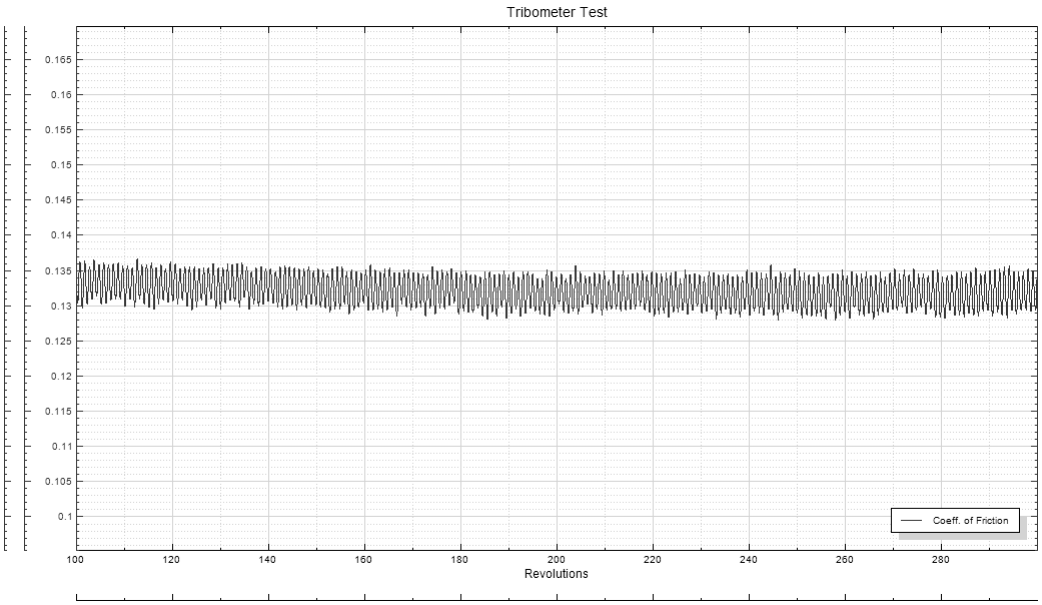


Figure 4 : Graph of COF for Sample 2 (100-300 Revs)

CONCLUSION:

Using the Nanovea Tribometer the mechanical stability of the two lithium complex greases were comparatively evaluated. It is clearly shown in the graphs the change in consistency after mechanical working. Sample 1 begins loss of stability at 200 revs with complete loss of stability at 310 rev; where as, Sample 2 begins loss of stability at 360 revs with complete loss of stability at 460 revs. Here we see a user friendly, simply and yet extremely precise test method for comparatively evaluating the mechanical stability of grease formulas. The sensitivity of sensor allows for detecting small change in friction and the full range of speed from 0.01rpm (and lower) to 2000rpm allows for the full range of lubrication behavior to be studied. The Nanovea Tribometer can be equipped with a temperature module to study these properties up to 900°C. A liquid cup can also be used to test lubrications by fully submerging or by using an optional lubrication module that adds a drop-by-drop or spray mode. With this list features and precision, the Nanovea Pin-on-Disk Tribometer is the ideal tool for Tribology study.
Learn more about the Nanovea Tribometer or Lab Services