The Applicability and Efficiency of a Tribo-Corrosion Cell Integrated in a SRV® Tribometer

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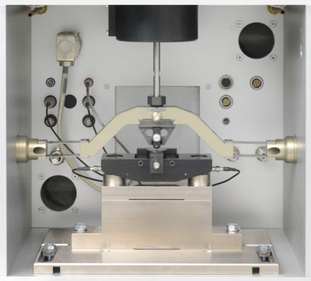
Overview

Although the presence of tribo-corrosion has been known for a while, its focus and interests are still on the rise. Corrosion and tribology are both surface properties and are linked via tribocorrosion and form an intersection. In particular, the development, implication, and application of a tribo-corrosion cell for the SRV ® tribometer has been of great interest. Methods for identifying the tribo-corrosive properties can be achieved through electrochemical means. Such an integration has the potential for enhanced material and chemical testing, such as electrical fields and defined currents (arcing) in tribocontacts. The design features include oscillating motion, and electrically isolated cell, electrical contact resistance and flow conductive electrolytes. The usage of a tribo-corrosion cell is vital in that this information can assist in determining the impact of electrical fields and currents through tribological contacts on the tribological profile and aging of oils and greases. Oftentimes the mechanical stress of a system is understood, but not in combination with electrochemical stresses and became now measureable.

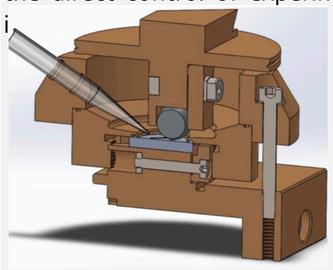
SRV Tribometer

One of the most methods of testing tribological properties is through the use of an SRV ® tribometer, where the German acronym SRV stands for for oscillation, friction, and wear. The SRV ® tribometer operates through oscillating motion and delivers coefficient of friction, wear volumes and extreme pressure. In addition, the tribometer can be set to perform tests at specific temperatures, loads, frequency, stroke, and duration. The SRV is globally recognized by 26 standardized test methods and 30 ASTM research reports underline the proven precision. Furthermore, versatile and can be u applications. Countless company specs illuminate the application oriented Test capabilities.



Tribo-corrosion Cell

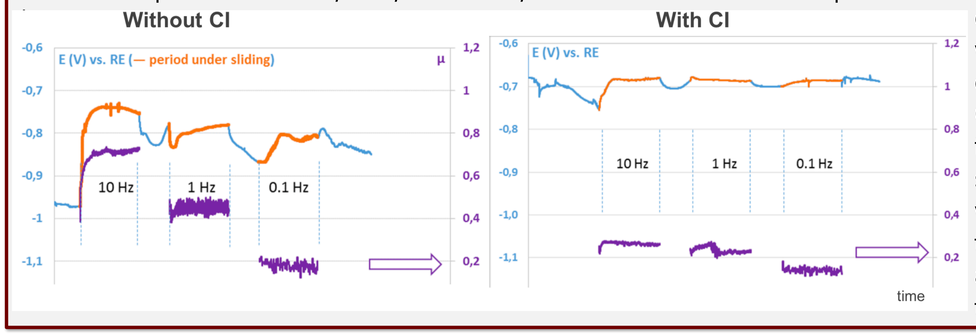
Tribo-corrosion is the tribologically enhanced corrosion of a combination or tribological with corrosive solicitations. While mechanical stress is commonly suspected as the cause of wear, critical electrochemistry is often overlooked. Therefore, electrochemical methods are applied to study and analyze tribo-corrosive effects. For this purpose, tribo-corrosion cell has been specifically developed for use in a SRV® tribometer. The addition of a potentiometer allowed the direct control of experiments. The material poly-ether-ether-ketone (PEEK) is use due to its great electrical i



isolation properties in addition to its chemical, mechanical, and thermal stability. Electrodes are also used and set up specifically so that the tribo-corrosion cell can be used to test against low conductive electrolytes. Various experimental results have shown that this cell can be used for the testing in electric fields and currents in tribological contacts occurring in electrical vehicles. Due to the integration of the cell in a SRV ® tribometer, material and coating characterization, lubricant/additive interaction and lubricant/additive degradation, ability to test both materials and liquids, all while maintaining its performance and acclerated testing

Results

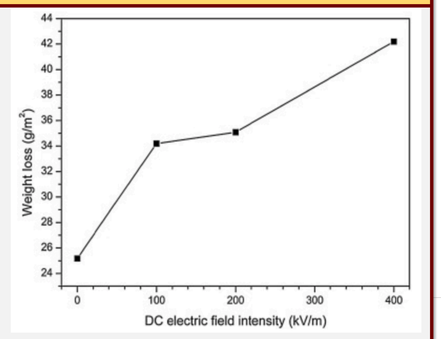
A 100Cr6 steel was used for tribo-corrosion testing and the values were graphed with and without a corrosion inhibitor (CI) at open circuit potential (OCP). The test results showed that E(V) is much less stable for the one performed without CI, while the one performed with CI showed stable E(V) values around -0.7. Furthermore, when comparing the stress results at frequencies of 10 Hz, 1 Hz, and 0.1 Hz, the test done with CI had superior values according to expectations. For



done without CI, the voltage varied from approximately 0.75 at 10 Hz to 0.2 at 0.1 Hz. Conversely, the stress values for the test done with CI showed a small variation in values, from 0.3 to 0.2. These tests demonstrate the applicability and ability of the tribocell.

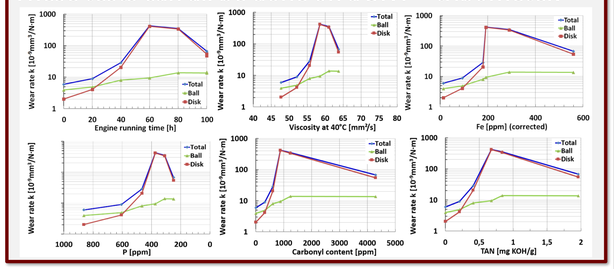
Electric Fields and Currents

Magnetic fields cause Eddie currents and consequently electrostatic charges that in turn can cause arcing/discharges in the tribocontacts. Metallic parts, while durable, are prone to corrosion and the presence of arcing will speed up this oxidation and surface damages. In electric vehicles, where electrostatic fields are much more prominent than compared to a traditional gasoline automobile, the thread of a tribo-corrosion is very real. Previous tests have shown that as the intensity of the electric field increases, the weight loss of steel also increases. In the long run, these wear and corrosion will greatly damage the metallic bearing components of the vehicle. In addition, the electric currents will also cause the premature degradation of oil and lubricants.



Function Condition Monitoring

Condition monitoring helps to recognize functional losses early so it can be corrected. Additional values come from the combination of analytical sciences with SRV® tribometry. Moreover, cliff-testing, which can determine root cause relations for critical additive contents during depletion. "Cliff" tests are for determining the transition point in engine or gear oil tests after friction increased or a failure occurred. These tests can all be done on a SRV ® tribometer.



Conclusion

Tribo-corrosion in the presence of electric fields and currents can cause various issues. The increased corrosion and loss of metallic substances can lead to the loss of structural integrity and electricity can cause the premature degradation of materials, engine oils and lubricants. This leads to their necessary replacement, increasing spending costs. In order to prevent these scenarios from occurring, it is vital to anticipate events beforehand. The integration of a tribo-corrosion cell in a SRV ® tribometer can test various materials in multiple parameters effectively and efficiently. This can ensure that any new materials produced will be able to withstand their operating parameters.

References

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