Fretting Tester
FFT Series

Fretting and Wear Tester with
Environment Control

Highly Accurate Stroke Control, Rigid Design
Fretting

Voice Coil

Fretting test modules cover a wide test load range. Technology break through in voice coil control, high frequency signal processing algorithms are capable of running fretting wear tests with less than 5 micron stroke.

The test module comprehensively characterizes fretting wear from micron to macro scale. Ultra sensitive piezo based load cells, combined with a robust design, high stiffness holders, and low floor noise provides quantitative fretting wear characterization of materials, interfaces, thin films, components, etc.

To simulate real life scenarios, the tests can be done in controlled environmental conditions. Easy to use and intuitive data interpretation makes this tester an ideal tool in hands of researchers or quality control engineers.

Real Time Stroke Control

The Smallest Controllable Stroke - less than 5um to 4mm, up to 500Hz

Real time stroke, frequency monitoring, and correction using LVDT.

Environmental Control, Surface Electrical Measurement

Humidity, temperature, inert gas, and electrical measurements for real life simulation.

High Reliability - Flexure Design

The flexural suspension guides the magnet assembly without bearings.

High Frequency Response Force Sensors

Piezo based sensors that can measure friction force with ultra high accuracy at high frequency reciprocating test.

Unmatched Performance
The applied forces can be controlled to gram force ranges with ease. Real time correction to account for sample wear, force change. The force can be maintained constant or dynamically changed during the test.

Electromagnetic actuators that impart fretting motion. Dependent on the number of coils and coil power FFT series comes in 3 standard modules. FFT-m1, FFT-m2, FFT-1, FFT-2

The most accurate and precise displacement control in the market. Up to 1nm resolution and micron level of accuracy. Extremely low noise. High responsiveness for dynamic performance of system.

The environmental chamber allows to control and measure temperature and humidity. Dual high resolution thermocouple allows to measure heater temperature and the sample/lubricant temperature independently.

The tester comes with advanced piezo sensors to measure real time friction at high frequency. Ultra low noise amplifiers allows to detect minute changes in friction in real time with ease.

Without the friction of rolling or bearings, the magnetic flexure based design provides the control required for the most sensitive of tests. The motor controls the smallest of increments of waveform change precisely to stroke control

Sensors such as Acoustic emission to detect onset of cracks, ECR to measure surface resistance change allows to gain more insight on the material interface.

Liquid and sample holder both for standard and non standard tests. The holders and liquid container are easy to customise based on specific application need.
Applications

Fretting nm to mm
Thick Coatings
High Temperature

• Automotive
• Lubricant
• Aerospace
• Electronics
• Power Plants
• Coatings

• Composite
• Polymers
• Metals
• Components
• Biomaterials
• Medical

Test Data

3D Wear Scar Mark
3D Wear Scar Mark
Volume Wear

4-Ball
High Frequency Data
Fretting Loops
A Size For Your Needs

FFT-M Benchtop
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FFT-2
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Fretting Fundamentals

Fretting
Fretting wear is a test where surface damage occurs between two contacting surfaces experiencing oscillatory displacement of a small amplitude.

Debris
- Debris formation from asperity contacts
- Oxidation at contacting surface due to humidity, temperature, or chemical composition change
- Oil, lubrication starvation regimes causing wear
- Wear due to electric discharge
- Repetitive collision between surfaces
- Fatigue related cracks - onset of debris
- Polymerization of organic materials at surface
- Fine powdered debris - highly oxidized
- Residual steady stage flow of debris
- Diffusive wear
- Melting wear

Fretting Regimes
The tester can work across all fretting regimes stick, stick slip regime and gross slip regimes. The boundaries between these regimes are controlled by several fretting parameters including surface finishes, environment etc.

Fretting Loops
Fretting loop is a hysteresis plot for coefficient of friction (COF) vs. displacement. As the COF varies along the direction of motion the fretting loop given by \( \mu(x,y) = q(x,y)/p(x,y) \) where \( q(x,y) \) is the shear traction distribution along the interface and \( p(x,y) \) is the normal pressure distribution.
High Speed Controllers

Software
The tester comes with operation and data analysis package. The test operation is recipe based software that allows it to run standard or previously created recipe with click of button. The analysis package comes with visualization and statistical data analysis. Multiple files can be opened for easy comparison.

- Advanced control algorithms
- Intuitive and easy to use software
- Fully automatic motions
- Compliant with several standards
- Fast data reporting
- Set of features to analyze any kind of sample
- Automatic data analysis

Test Programme

Specification Summary

Fretting And Wear Tester With Environment Control

Actuators
- Displacement 5um-4mm
- Resolution: 0.1um
- Oscillation frequency: Up to 500Hz

Environment
- Up to -40°C, 180°C, 500°C, 1000°C
- Humidity controlled chamber

Sensors
- Potentiostat
- Acoustic Emission
- Electrical Contact Resistance

Common standards
- ASTM E2789
- ISO 19291
- ASTM D6425
- ASTM D7421
- ASTM D5707
- ASTM D5706
- ASTM D7594
- DIN 51834-2
- DIN 51834-3
- DIN 51834-4

FFT-M2 1000N Down Force
FFT-M1 300N Down Force

3D profiler wear track image
Fretting loop data
2500N, 300Hz Data
About us

Rtec Instruments develops and manufactures advanced imaging and surface mechanical property measurement solutions for research and industrial applications. Based in Silicon Valley, we are the leading provider of testing instrumentation such as tribometer, optical profilometer, 3D scratch tester and micro/nano hardness tester.

We share a philosophy that embraces collaboration and partnership with customers, leaders in academia and industry, to ensure that our products answer real needs with innovative solutions.