Rtec instruments

MVT-3.5K

Liquid-Helium Ultra-Low Temperature Tribometer

Closed-Loop Liquid Helium Precision for the Quantum Frontier

Micro and Macro Hardness •
Scratch • Friction • Wear

ACCREDITED
MSCB-132
Certified ISO 9001:2015

Pushing the Limits of Cryogenic Tribology

Zero Helium Consumption. Zero Compromise.

Understanding friction, wear, hardness, and scratch resistance at ultra-low temperatures is critical for next-generation technologies—from superconducting materials to quantum devices and space exploration systems. Yet traditional cryogenic tribometers are constrained by helium consumption, unstable temperatures, and limited measurement fidelity. This breakthrough zero-helium consumption design enables long-duration experiments at ultra-low temperatures without interruption—something open-loop systems simply cannot achieve.

Key Features

01 - Precision at the Quantum Frontier

With a base temperature down to 3.5 K, the MVT-3.5K ultra-low temperature chamber is designed for the most demanding research environments

02 - Closed-Loop Down Force Control - Nano, Micro, Macro Range

Patented capacitive sensors with a test range from mN to 200 N.

03 - Nanometer-Level Vibration Isolation

Guarantees exceptionally low mechanical noise at the contact interface for ultra-sensitive measurements.

04 - Exceptional Thermal Stability

Maintain precise temperature control over hours or days of operation.

05 - Integrated Mechanical Characterization

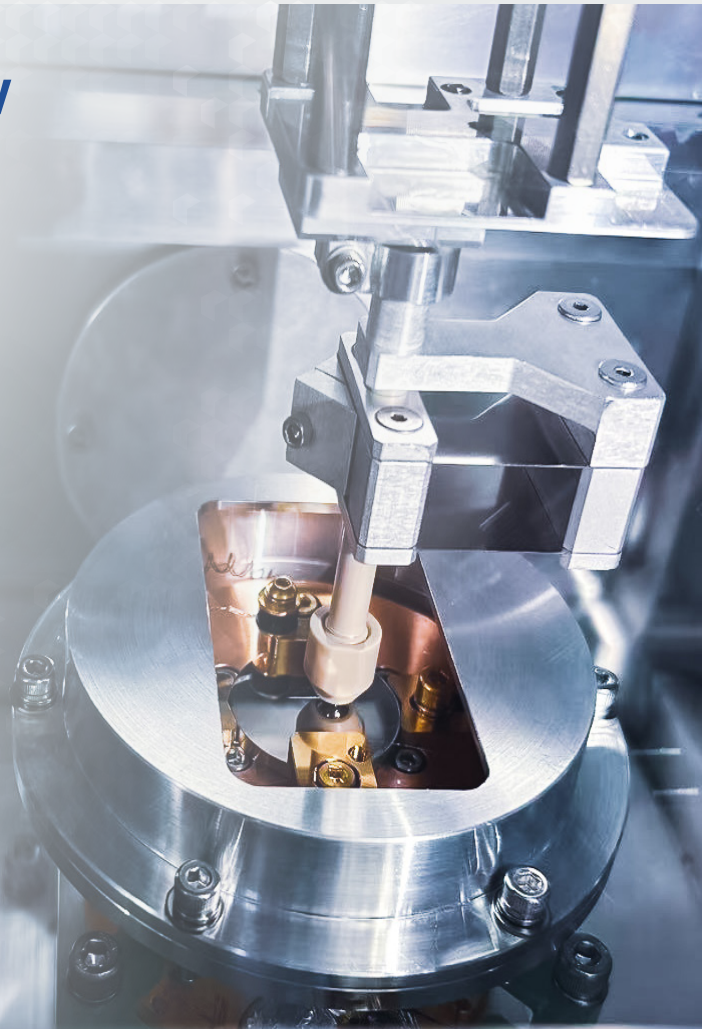
The MVT-3.5K provides micro and macro hardness, scratch, friction, and wear testing at extreme cryogenic temperatures.

06 - Real-Time Surface Temperature Feedback

Unmatched thermal stability ensures experimental accuracy where it matters most.

Next Generation Ultra-Low Temperature Tribometer

- Helium is Fully Contained and Continuously Recirculated
- No Helium Loss
- No Refilling Required
- Eliminates Supply Risks, Operating Costs, and Downtime



Why the Ultra-Low Temperature Tribometer

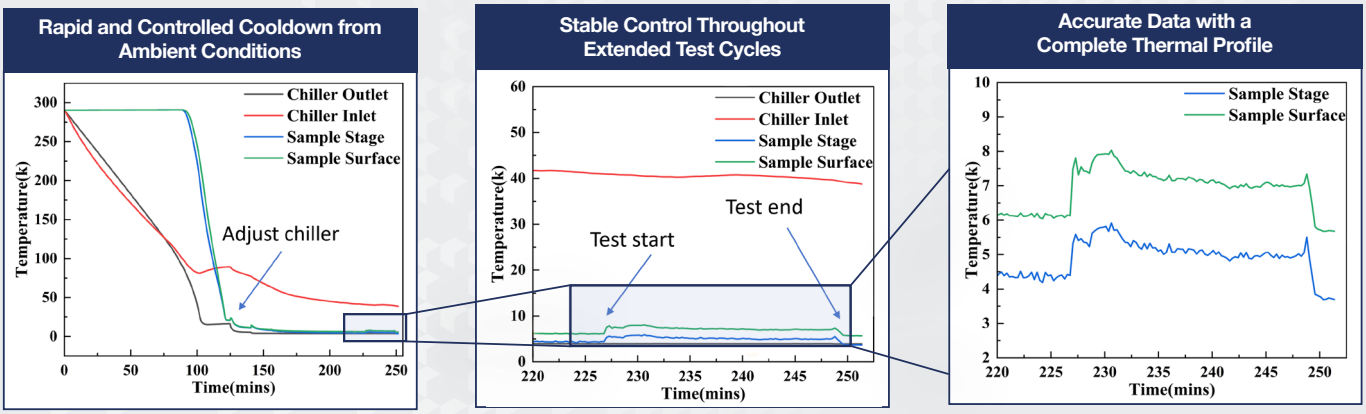
The Ultra-Low Temperature Liquid-Helium Tribometer enables precise hardness, scratch, friction and wear testing under extreme cryogenic conditions that conventional tribometers cannot reach. With pre-cool to 100K in ~1.5 hours, 10K at the sample surface in less than 5 hours, controlled testing down to 3.5 K, it provides critical insight into material, coating, and interface performance for demanding extreme temperature applications.

Ultra-Low Temperature Tribometer During Testing

Software

Understanding tribological behavior at ultra-low temperatures requires precise knowledge of temperature at every critical point. The Rtec Liquid-Helium Ultra-Low Temperature Tribometer continuously records temperature data throughout the cooling process and steady-state operation, providing complete visibility into system performance.

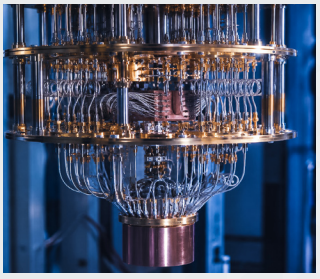
- Real-time monitoring of sample, stage, and cooling-system temperatures
- Synchronized friction, force, position, and temperature data acquisition
- Integrated data visualization, thermal profiling, and tribological analysis



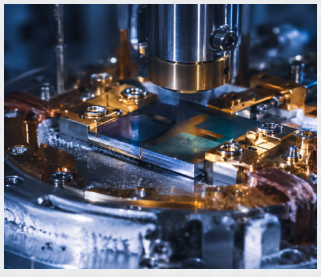
Applications

The MVT-3.5K ultra-low temperature tribometer enables precise characterization of friction, wear, and material interactions under extreme cryogenic conditions. By recreating the low-temperature environments encountered in advanced research and engineering applications, the MVT-3.5K helps evaluate materials, coatings, and interfaces where conventional tribological testing cannot replicate real-world operating conditions.

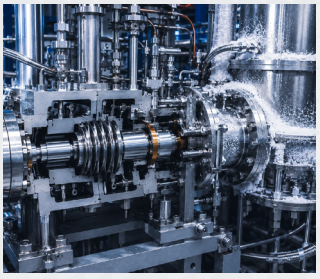
Outer Space Conditions
Vacuum mechanisms, satellites, rovers



Quantum Computing Device Environments
Positioning systems, interfaces



Superconducting Material Interfaces
Thin films, electrical contacts



Cryogenic Mechanical Systems
Seals, actuators

Technical Specifications

Test parameters:

Temperature	Down to 3.5 K
Pre-cool to 100 K	~1.5 Hours
10 K at Sample Surface	< 5 Hours
Force Range	mN to 200 N

Software:

Platform	Windows — recipe-based
Test programs	Standard + fully customizable
Material Library	500+
Data export	Binary / ASCII
Analysis	Film Thickness, refractive index, reflectance, and transmittance

Leading innovation in surface and materials testing.

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