

Waters™



# TA Instruments Product Overview Guide

## Overview

At TA Instruments, a division of Waters Corporation, we enable discoveries across industries and applications with reliable instrumentation that provides comprehensive insights into material properties.

We stand at the forefront of material characterization with **precision-driven instrumentation** for:



Thermal Analysis



Rheology

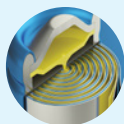


Microcalorimetry



Mechanical Analysis

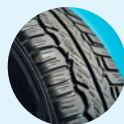
With our unwavering commitment to innovation and quality, we support breakthroughs in medicine, materials science, electronics, and other areas of science devoted to improving our world.



Batteries  
and Battery  
Materials



Composites



Elastomers



Electronics



Food and  
Food  
Products



Life  
Sciences



Materials  
Science



Organic  
Chemicals  
and  
Products



Personal  
Care and  
Household  
Products



Petroleum  
and Coal  
Products



Pharmaceutical  
Materials



Polymers

## Why customers choose TA

Innovative, accurate, and easy-to-use are words that describe TA Instruments products. Each represents an unparalleled investment because it is designed with the customer in mind, delivers outstanding performance and is backed by superior customer support. All TA Instruments hardware and software products are designed, tested and manufactured to ISO 9001 standards. Our instruments are manufactured in New Castle, DE, Lindon, UT, Eden Prairie, MN, and in Hüllhorst, Germany.





## THERMAL ANALYSIS

Thermal Analysis is important to a wide variety of industries, including polymers, composites, pharmaceuticals, foods, petroleum, inorganic and organic chemicals, and many others. Thermal analyzers typically measure heat flow, weight loss, dimension change, or mechanical properties as a function of temperature, pressure, time, and atmosphere. Properties characterized include melting, crystallization, glass transitions, cross-linking, oxidation, decomposition, volatilization, coefficient of thermal expansion, and modulus. These experiments allow the user to examine end-use performance, molecular structure and mobility, composition, processing, and stability.

### Product Highlight

#### RUN 3 DSC SAMPLES at ONCE... DISCOVERY X3

The **Discovery X3 Differential Scanning Calorimeter** features a multi-sample cell that delivers high quality heat flow data for up to three samples simultaneously. The Discovery X3 DSC combines industry-leading performance with tools to increase productivity on every level of material research.

TA Instruments' commitment to innovation enables scientists and engineers to reach their goals faster and make critical decisions with confidence.

See page 15 for cooling system information



### Differential Scanning Calorimetry (DSC)

measures temperatures and heat flows associated with thermal transitions in a material.



**Discovery DSC**  
2500, 250, 25 and X3

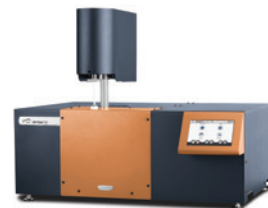


**Discovery DSC 25P**  
(High Pressure)

**Thermogravimetric Analysis (TGA)** measures weight change and the rate of weight change as a function of temperature, time, and atmosphere.



**Discovery TGA**  
5500, 550 and 55



**Discovery HP-TGA 7500, 750 and 75**  
(High Pressure TGA)

### Thermomechanical Analysis (TMA)

measures changes in the dimensions of a sample as a function of time, temperature, and force in a controlled atmosphere.



**Discovery TMA 450**



**Discovery TMA 450 RH**

### Dynamic Mechanical Analysis (DMA)

measures the mechanical properties of materials as a function of time, temperature, and frequency.



**Discovery DMA 850**  
(See page 15 for air chiller systems information)

**Simultaneous Thermal Analysis (SDT)** combines DSC and TGA to measure real-time simultaneous heat flow and weight change.



**Discovery SDT 650**  
(Simultaneous DSC and TGA)

**Sorption Analysis (SA)** measures the weight change of a solid or liquid sample due to ab- or adsorption at controlled temperature and pressure or humidity in the presence of a gas, gas mixture or vapor.



**Discovery SA**  
(Vapor Sorption Analysis)



**IsoSORP SA**  
(High Pressure Sorption)



**RHEOLOGY**

Rheometers measure and quantify the influence of viscoelastic flow properties on every stage of industrial production. A wide range of industrially relevant materials exhibit complex rheological behavior that determines processability, storage, and end-use performance. TA Instruments rheometers offer unparalleled measurement sensitivity and accuracy to measure materials from low viscosity liquids to stiff solids in terms of viscosity, modulus, and elasticity or damping, coupled with high-performance temperature control. Discover the advanced engineering and attention to detail that provides enhancements in every aspect of rheometer technology and user experience.



**Discovery Core  
Rheometer**



**Discovery Hybrid  
Rheometers**



**ARES-G2**



**RSA-G2**

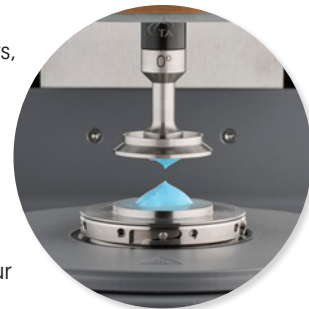




## Product Highlight

The **NEW Discovery™ Core Rheometer** empowers every user to perform rheological measurements, guiding formulation development, optimizing performance and ensuring product quality. The Core Rheometer is the first system to combine wide-ranging measurements of viscosity and viscoelasticity with streamlined, walk-up usability. The new RheoGuide™ user interface enables complete operation directly from the touchscreen, with direction, illustration and validation at every step.

Whether you are new to rheology, upgrading your quality control testing, or expanding capabilities to meet growing demands, the Core Rheometer empowers your lab to discover insights into your materials' behavior needed to advance your goals.



## DISCOVERY HYBRID RHEOMETER –

### The **MOST POWERFUL & VERSATILE RHEOMETER** for your laboratory

The **Discovery Hybrid Rheometers** are designed for scientists who need to obtain better rheological data, under the widest range of measurement conditions, collected by more users, with less training. Powerful, easy-to-use accessories allow you to replicate demanding environmental conditions, incorporate complementary simultaneous measurements, or extend your rheometer beyond conventional shear rheology. Discover the advanced engineering and attention to detail that provides enhancements in every aspect of rheometer technology and user experience.

#### Temperature & Environmental Control:

- Advanced Peltier Plate
- Dual Stage Peltier Plate
- Electrically Heated Cylinder (EHC)
- Electrically Heated Plates (EHP)
- Environmental Test Chamber (ETC)
- Peltier Concentric Cylinder
- Relative Humidity
- Upper Peltier Plate (UPP)

#### Advanced Accessories:

- Auto-Trim Accessory
- Building Materials Cell
- Dielectric Analysis
- DMA: Bending, Tension, Compression
- Electro-rheology
- Extensional Viscosity Accessory
- High Pressure Accessory
- High Sensitivity Pressure Cell (HSPC)
- Immobilization Cell
- Interfacial Exchange Cell
- Interfacial Rheology
- Magneto-rheology
- Modular Microscope Accessory (MMA)
- Orthogonal Superposition (OSP)
- Powder Rheology
- Rheo-Impedance Spectroscopy
- Rheo Raman Accessory
- Small Angle Light Scattering (SALS)
- Starch Pasting Cell
- Tribology
- UV Curing



See page 15 for  
cooling system  
information



## MICROCALORIMETRY

Microcalorimeters are powerful analytical techniques for in-depth characterization of molecular binding events and structural stability.

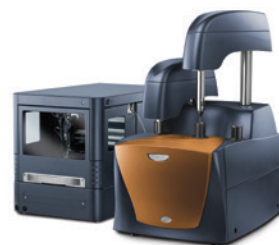
The **Affinity ITC** offers complete characterization of the basic chemical details of a binding interaction by combining an ultrasensitive calorimeter and a mechanized syringe that reliably delivers a precise quantity of sample into the calorimetric cell containing the target molecule.

The **Nano DSC** is designed for ultra-sensitive measurement of heat absorbed or released by dilute in-solution biomolecules as they are heated or cooled.

### Product Highlight

#### High-Throughput Thermal Stability Testing

The **NEW** TA Instruments **Rapid Screening-Differential Scanning Calorimeter (RS-DSC)** is a novel solution for your biotherapeutic characterization needs. Unlike other tools, the TA Instruments RS-DSC does not require samples to be diluted because it is uniquely designed to handle high-concentration biologic drug formulations with a specialized focus on antibody drugs and engineered proteins.



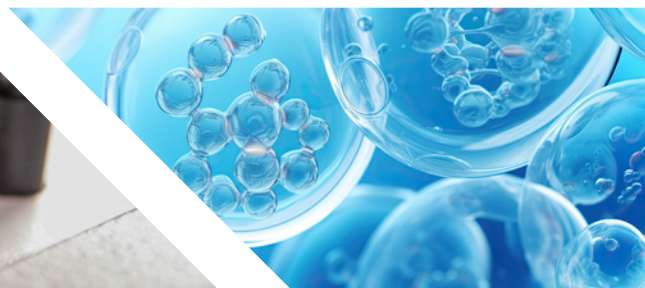
**Affinity ITC**



**Nano DSC**



**RS-DSC**  
**Rapid Screening-Differential**  
**Scanning Calorimeter**



The **TAM IV** is the most sensitive, stable and flexible microcalorimeter system in the world for directly measuring this universal heat signal and, therefore, the quantitative thermodynamic and kinetic observation of any process.

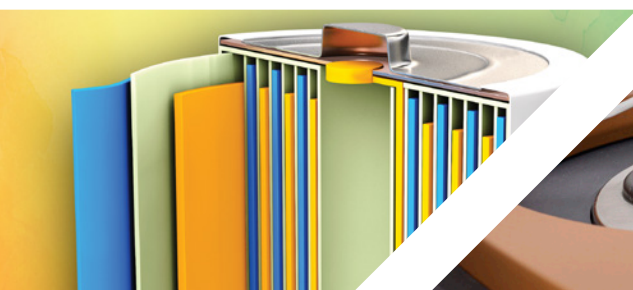


**TAM IV**

The **TAM IV Battery Cycler Microcalorimeter Solution** is a high-resolution in-operando system that can elucidate the thermo-electrochemical details of battery cells under user defined temperatures and voltage profiles. The simplified workflow solution enables simultaneous control of the TAM IV Isothermal Microcalorimeter and the VSP-300 Potentiostat (BioLogic), enabling real-time data monitoring and advanced data analytics through the integrated software interface. The Battery Cycler Microcalorimeter Solution is not only efficient in its design, but it reduces testing time, increases speed to decisions, and is capable of elucidating new insights of your battery cells and battery materials. This flexible system can be purchased as a full solution or as an upgrade to existing TAM IV or VSP-300 users.



**Battery Cycler Microcalorimeter Solution**







## ELECTROFORCE™ MECHANICAL TEST INSTRUMENTS

Mechanical testing includes a wide variety of testing techniques that aim to either characterize a material's mechanical properties or determine a structure's response to a specific force. Mechanical testing is a standard and crucial part of the design and manufacture of any product. From medical implants to airplane wings, all materials can be verified as safe and efficient for their application through mechanical testing.

TA Instruments ElectroForce offers a complete line of mechanical test instruments to match any testing need from early material selection to final product evaluation. Over 25 years of innovations have led to patented high-performance linear motors and versatile instruments that meet ASTM standards and offer exceptional force capacity, speed, precision, and accuracy.

### Product Highlight

The **NEW TA Instruments ElectroForce Apex 1 Mechanical Testing Instrument** empowers scientists, engineers, and technicians to assess mechanical properties efficiently and reliably through monotonic tests, fatigue studies, and other material characterization methods, all with minimal training required. With increased motor stroke range (100mm), the ElectroForce Apex 1 Instrument expands testing of more materials, offering greater insights from one instrument.

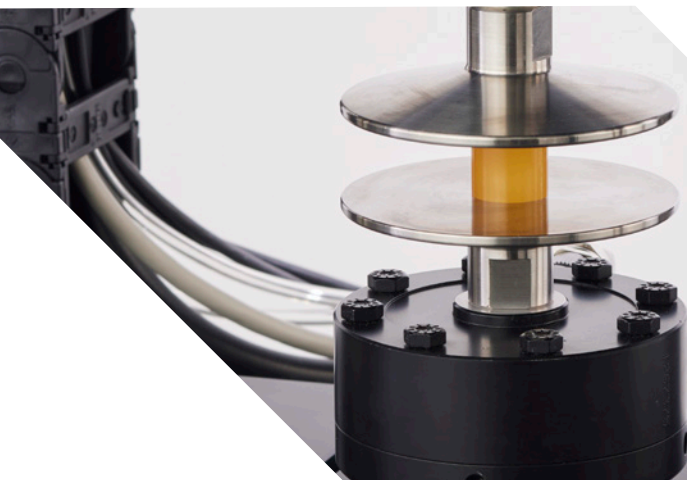
Its next-generation TuneIQ

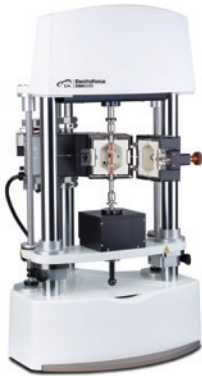
technology streamlines workflows and automates

control modes, reducing process steps and operator errors, enabling confident testing and data acquisition.

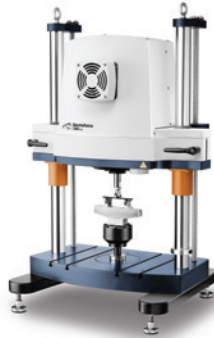


**ElectroForce™ Apex 1  
Mechanical Testing Instrument**

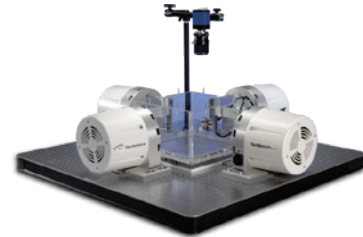




**DMA 3200**  
High Force DMA and Fatigue



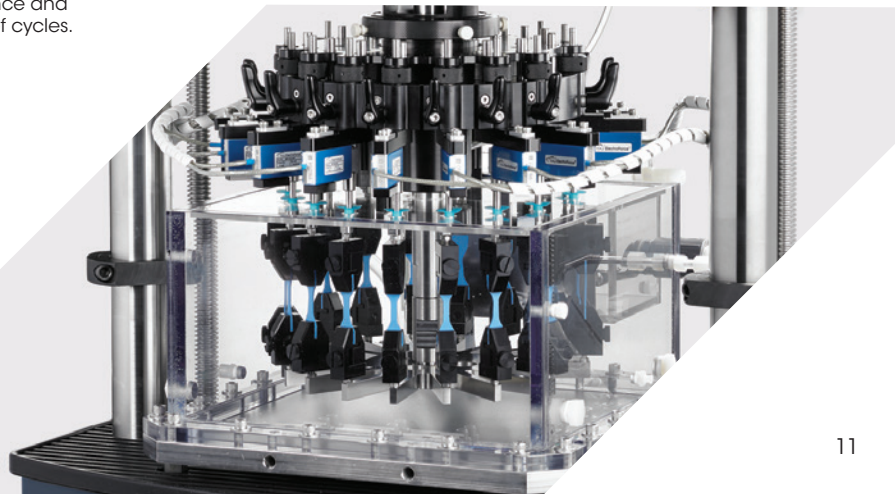
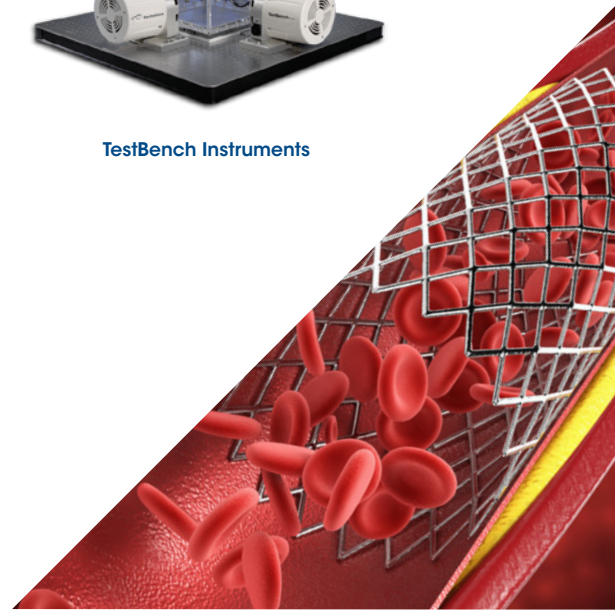
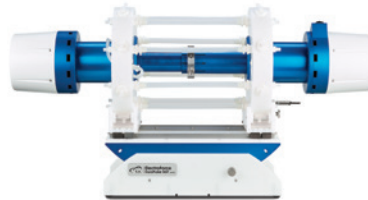
**ElectroForce Load Frame Series**  
with up to 15kN of Force



**TestBench Instruments**



**Fatigue and Durability Instruments for Medical Device Testing**  
Unrivaled dynamic performance and  
proven reliability over billions of cycles.





## THERMAL CONDUCTIVITY



**Xenon Flash**



**Discovery Laser Flash**



**FOX Building Materials  
Heat Flow Meters**



**Thermal Conductivity Meters**

TA Instruments provides the most extensive and comprehensive range of instruments for the precise and accurate measurement of heat transfer properties over a wide range of material types and temperatures.

Thermal conductivity, thermal diffusivity and specific heat capacity define a material's ability to store and transfer heat. A thorough understanding of these properties is critical for any process or material which experiences a rapid or significant temperature change, subjected to large temperature gradients, or for which temperature must be precisely controlled or maintained. Accurate values of these properties are essential for modeling and managing heat and may also reflect important information about material composition, purity and structure, and secondary performance characteristics such as tolerance to thermal shock.

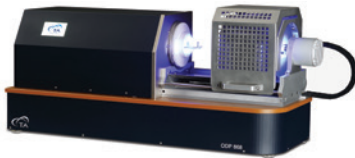




## DILATOMETRY



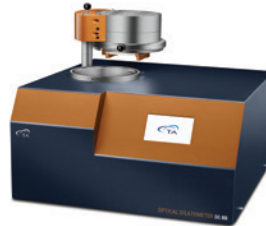
Horizontal Dilatometers



Heating Microscope



Vertical Dilatometers

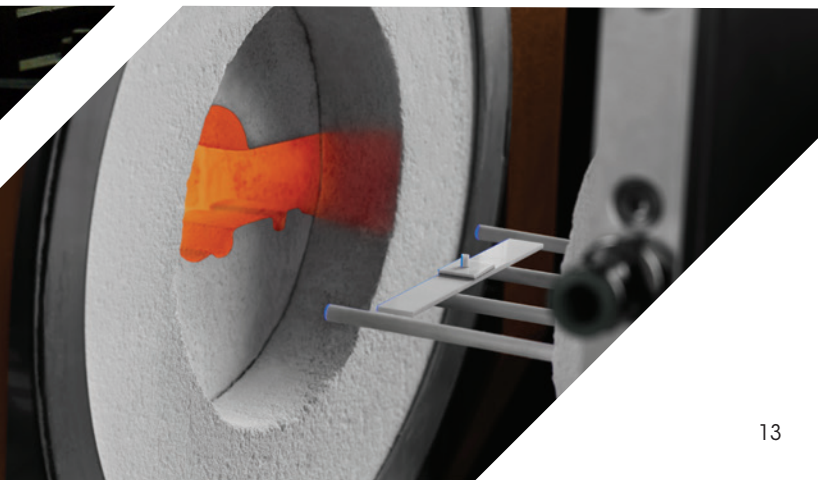
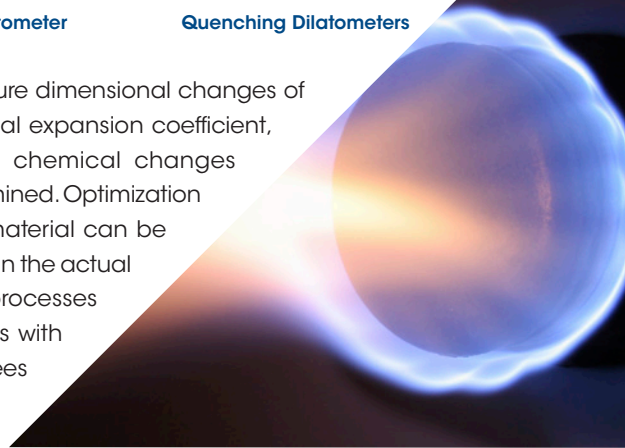


Optical Dilatometer



Quenching Dilatometers

TA Instruments Dilatometers are high-precision systems designed to measure dimensional changes of a specimen caused by changes in its thermal environment. Linear thermal expansion coefficient, annealing characteristics, sintering processes and other physical or chemical changes manifesting themselves as a change of dimensions can be precisely determined. Optimization of processing parameters as reflected by dimensional changes of the material can be studied in great detail through duplication of thermal cycles and rates used in the actual process. Due to the flexible programming of thermal cycles, complex processes can be easily simulated. In quenching dilatometry temperature programs with extremely high heating and cooling rates of up to several thousand degrees per second are precisely controlled to simulate, analyze and optimize metal heat treatment processes.





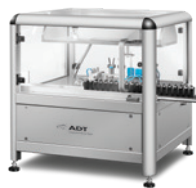
## RUBBER TESTING



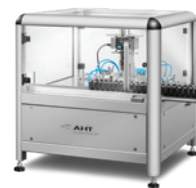
**RPA elite, RPA flex,  
MDR one**



**MV one**



**ADT**  
(Automated Density  
Tester)

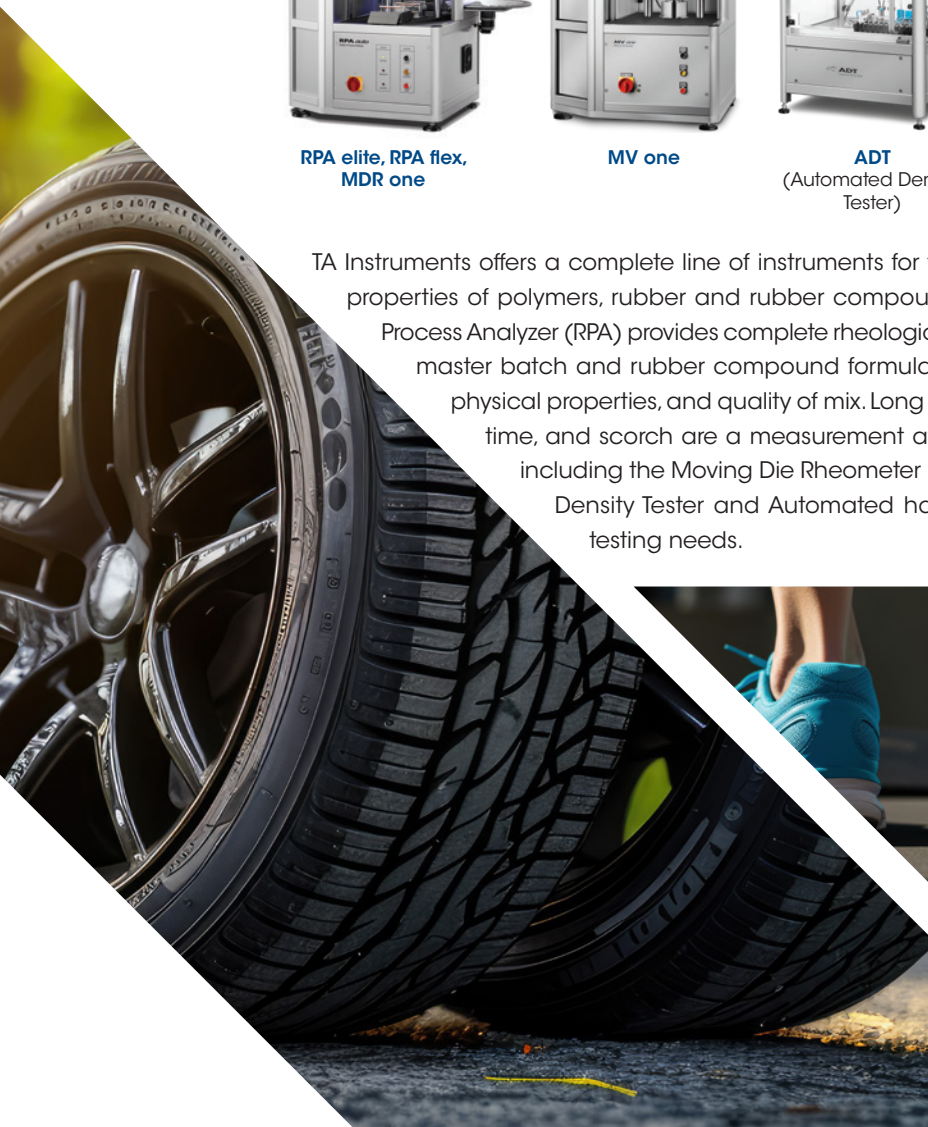


**AHT**  
(Automated  
Hardness Tester)



**Sample Cutter**  
RPA, MDR and Mooney  
Instruments

TA Instruments offers a complete line of instruments for the measurement of rheological and physical properties of polymers, rubber and rubber compounds at all stages of manufacture. The Rubber Process Analyzer (RPA) provides complete rheological characterization of raw polymer architecture, master batch and rubber compound formulations, directly impacting processing behavior, physical properties, and quality of mix. Long chain branching, Payne effect, extend of cure time, and scorch are a measurement away with our family of rubber instruments, including the Moving Die Rheometer (MDR), Mooney Viscometer, Automated Density Tester and Automated hardness Tester for all of your rubber testing needs.





RCS 120 • RCS 90 • RCS 40

ACS-2 • ACS-3

## Refrigerated Cooling Systems (RCS)

Take advantage of the convenient Refrigerated Cooling Systems (RCS) for unattended DSC and MDSC® operation over broad temperature ranges. The new RCS 120 provides enhanced safety and is the only liquid nitrogen-free system capable of conducting experiments down to -120 °C.

- One-, Two-, or Three-stage refrigeration systems that achieve temperature ranges down to -40 °C, -90 °C or -120 °C
- Sealed system eliminates the need for liquid nitrogen cooling
- Enables cycling, MDSC®, controlled, and ballistic cooling experiments
- Safe, convenient, and continuous cooling operation for your laboratory needs

## Air Chiller Systems (ACS-2 and ACS-3)

The new Air Chiller Systems are unique gas flow cooling systems that enable sub-ambient temperature control without the use of liquid nitrogen. Equipped with multi-stage cascading compressors, the ACS-2 and ACS-3 enable testing to unprecedented temperatures as low as -55 °C and -100 °C, respectively. This flexible Air Chiller is available for use with the DMA 850, all DHR Rheometer models with ETC, ElectroForce Ovens, and the ARES-G2 Rheometer & RSA-G2 Solids Analyzer with FCO. Utilizing compressed air, the Air Chiller Systems can help eliminate or reduce liquid nitrogen usage from any laboratory and offers an incredible return on investment.



# DISCOVER INSTRUMENTS and TECHNIQUES PERFECTLY SUITED to your **SPECIFIC APPLICATION AREA**



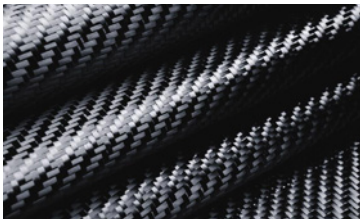
Aerospace, Military, & Defense



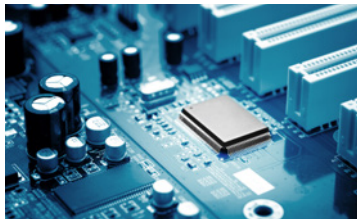
Batteries & Battery Materials



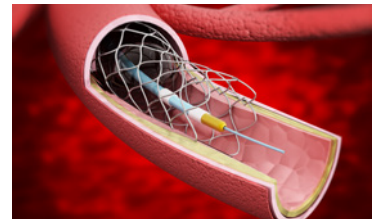
Biopharmaceuticals



Composites



Electronics



Medical Devices



Pharmaceuticals



Polymers



Paints Inks and Coatings



VISCOELASTICITY • TGA-MS • FATIGUE • CONSTRUCTION • PROTEIN BINDING • DIL • CRYSTALLINITY • TITRATION  
 CALORIMETRY • DSC • OLEFINS • MOLECULAR STABILITY • COMPLEX FLUIDS • DMA • TRIBOLOGY • SMART  
 FLUIDS • POLYMORPH ANALYSIS • THIXOTROPY • **MICROCALORIMETRY** • VISCOSITY • SCORCH TIME • EPOXIES  
 • MECHANICAL STABILITY • SUPPORT • EXTENSIONAL VISCOSITY • DAMPING • ITC • FAST-FIRING • MOVING DIE  
 RHEOMETER • **THERMAL CONDUCTIVITY** • AEROSPACE • THERMAL EXPANSION • LFA • STIFFNESS • COMPRESSIVE  
 MODULUS • HFM • TGA-FTIR • PRESSURE SENSITIVE ADHESIVES • REACTION KINETICS • DRILLING FLUIDS • FIBERS •  
 DENATURATION • ENERGY EFFICIENCY • **RHEOLOGY** • ELECTORRHEOLOGY • HYPHENATED TECHNIQUES •  
 • THERMOPLASTICS • HYGROSCOPIC EXPANSION • PHASE TRANSITIONS • MOLECULAR MOBILITY • TRAINING  
 • SHORE A HARDNESS • POLYMER BLENDS • COATINGS • GLASSES • ENZYMES • URETHANES • INSULATION •  
 BATTERIES • THERMAL SHOCK • SURFACE AREA • MV • **THERMAL ANALYSIS** • INKS • FUEL CELLS • FOOD • PROTEINS  
 • CEMENT • RPA • THERMAL BARRIERS • COEFFICIENT OF FRICTION • MATERIALS SCIENCE • MAGNETORHEOLOGY •  
 THERMAL INTERFACE MATERIALS • PURITY • CTE • PROTEIN STRUCTURE • DTA • DRUG DEVELOPMENT  
 • FILMS • SUSPENSIONS • CCT DIAGRAMS • STEEL • POLYMERS • PLASTICS • GLAZES • SHEAR THINNING •  
 PETROCHEMICALS • **DILATOMETRY** • VULCANIZATION • COMPETITIVE ANALYSIS • MICROBIAL DETECTION  
 • ISOTHERMAL CALORIMETRY • MDR • ENTHALPY • VOLATILES ANALYSIS • OIT • ANALYTICAL CHEMISTRY •  
 DIFFERENTIAL SCANNING CALORIMETRY • PAINTS • MELT STRENGTH • **LASER FLASH** • AUTOMOTIVE • DENSITY •  
 CREEP • ORTHOGONAL SUPERPOSITION • CURING • RHEO-MICROSCOPY • DEGREE OF CURE • SHEAR RHEOLOGY  
 • ADVANCED CERAMICS • TMA • CRYSTALLIZATION • THERMOPHYSICAL PROPERTIES • MICROBIOLOGY • OILS •  
 MOLECULAR WEIGHT • DUCTILITY • DURABILITY • POLYMER BRANCHING • AMORPHOUS CONTENT • ENERGY •  
 HEAT TRANSFER • DIELECTRIC ANALYSIS • **RUBBER TESTING** • BRITTLINESS • ENTHALPY OF MIXING • SOFTENING  
 POINT • SINTERING • TTT DIAGRAMS • WAXES • COSMETICS • FLASH DIFFUSIVITY • TENSILE MODULUS • MODULUS  
 • TGA • MATERIAL CHARACTERIZATION • SETTING TIME • ASPHALT • FOAMS • MOLECULAR WEIGHT DISTRIBUTION  
 • MOONEY VISCOSITY • DSC-TGA • SUPER ALLOYS • BIO MATERIALS • PHOTOCURING • BINDING • DVS •  
 ELECTROFORCE • GLASS TRANSITION • ADHESIVES • **THERMAL DIFFUSIVITY** • PERSONAL CARE PRODUCTS •  
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 ELASTICITY • CALORIMETRY • PACKAGING FILMS • PROTEIN STABILITY • MELT POINT • STARCH • CRYSTALLIZATION  
 KINETICS • GHP • RUBBER • ENERGETICS • STRESS RELAXATION • SDT • HEAT CAPACITY • SURFACTANTS •  
 LUBRICATION • INTERFACIAL STABILITY • SORPTION ANALYSIS • GELATION • PLASTISOLS • THERMAL STABILITY  
 • THERMOGRAVIMETRIC ANALYSIS • PHARMACEUTICALS • COMPRESSION SET • DYNAMIC MECHANICAL  
 ANALYSIS • THERMOMECHANICAL ANALYSIS • COMPOSITES • HEAT OF REACTION • ELECTRONICS • EMULSIONS  
 • THERMOELECTRICS • LABEL-FREE ANALYSIS • THERMOSETS • CERAMICS • FLOW MICROSCOPY • COATINGS •  
 MOLECULAR STRUCTURE • ALLOYS • THERMAL SHOCK • CEMENT HYDRATION • ABRASIVE WEAR • SHEAR MODULUS



## AMERICAS

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