

TRITON
TECHNOLOGY

Exceptional Technology for Material Science



TT DMA
Dynamic Mechanical Analyser



The Company

Triton Technology Ltd was first established in 1997 to design, manufacture and sell a range of instrumentation used for characterising the properties of materials in a variety of environments.

The technology uses predominantly thermal scientific technology with a strong focus on dynamic mechanical and dielectrical thermal analysis.

Triton Technology Ltd is recognised by users, not only for providing exceptional instrumentation but service and support to match.



The TT DMA

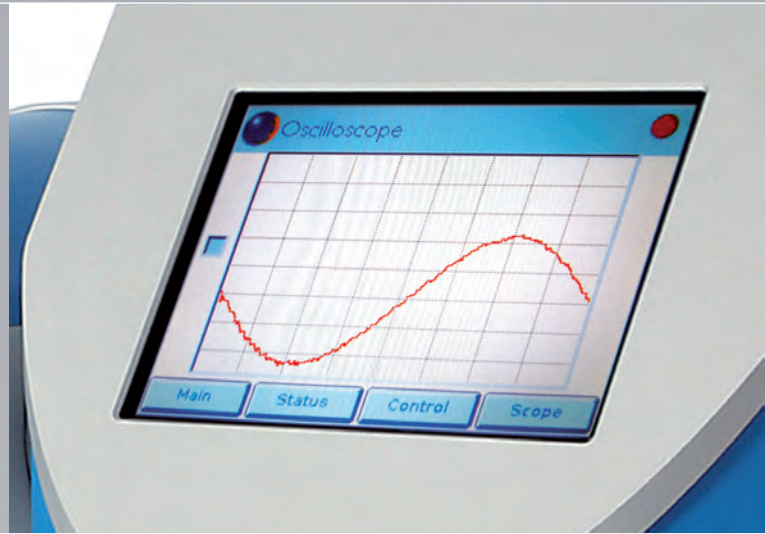
The TT DMA is the latest product from Triton and continues to push the technological boundaries and capabilities of dynamic mechanical analysis to new heights of competence and flexibility. The overall package offers users an unbeatable array of features and benefits.

Key Highlights

- Analytical head is detachable but with an umbilical connection to the base unit. This allows positioning of the system for simultaneous measurement of mechanical information and data from a third party instrument, such as an FTIR, or location of head in an extraction chamber or other environment
- Multi positioning allows for any required orientation of the Analytical Head; vertical up, vertical down, horizontal etc. This allows optimum sample access and convenience for the different geometries and samples
- The all new clamping system allows any number of free length selections in bending modes. It is not restricted to set selections (although these are available). The new slide mechanism allows for easy additions of future planned upgrades of geometry choices
- Colour LCD Touch Screen allows display of status of force, temperature, head orientation, ramp rate, end temperature etc. Control of temperature, frequency etc., choice of geometries and input of dimensions, sine wave display of measured displacement, run/start facilitation – all locally from instrument, if required
- System now operates from the new Triton Laboratory[®] Software platform. This seamlessly allows simultaneous operation of accessories such as the Triton Humidity Generator and Controller with the TT DMA or other Triton instruments, such as the Dielectric Thermal Analyser
- All new and improved accessories are also available including the TT Immersion accessory, the all new TT 85/85 Chamber, identiPol QA system for producing test plaques of thermoplastics for samples of unusual form (e.g. polymer pellets) and improved materials pockets. Also available are sealable tubes for running liquids e.g. for the study of glass transitions in sugar solutions, biological systems etc.



The Technique



Dynamic mechanical analysis is widely used to characterise materials' specific properties such as modulus and damping factor. Peaks observed in the damping ($\tan\delta$) yield information on macroscopic or microscopic loss mechanisms, such as interfacial failure or internal molecular motions, respectively.

Dynamic mechanical analysis involves the application of a periodic stress to a sample and the measurement of the resultant strain. From these parameters a complex dynamic stiffness is obtained and this can be resolved into the in-phase component, or real stiffness (S') and the out-of-phase component, or imaginary stiffness (S''). The ratio of these two quantities (S''/S') defines the damping or $\tan\delta$.

Elastic samples, such as metals, have low damping whereas a viscous liquid has a phase angle approaching 90° . Most polymeric materials are viscoelastic, with glassy $\tan\delta$ values typically <0.01 .

On passing through the glass transition (T_g) or sub- T_g relaxation, the $\tan\delta$ value is seen to increase dramatically, yielding a sensitive measurement of the process. The activation energy for the process may be calculated from the shift of the $\tan\delta$ peaks as a function of frequency.

A typical experiment consists of single or multiple frequencies applied to the test sample, which is subjected to a temperature ramp. Temperature profiles can be more complex, allowing for ramp and soak segments. Kinetic data can be obtained from isothermal experiments, which is useful in curing studies and for verifying the equilibration of samples exposed to varying humidity conditions.

Relative humidity has a significant effect on mechanical properties of natural and synthetic hygroscopic materials. The fully programmable humidity controller and TT DMA humidity chamber facilitates studies as a function of relative humidity (RH).



Standard Features

- All standard geometry options available; single and dual cantilever bending, 3-point bending, shear, tension and compression. The mounting may be either vertical up down, horizontal or other as desired by the user to offer maximum versatility
- Creep and constant force (TMA) mode
- Stress stain and stress relaxation
- Single or multi frequency
- Single or multi strain
- Isothermal, step isothermal
- Single or multi-ramp heating/cooling
- Ability to cover a wide frequency range from 0.001 to 1000Hz with 1mHz resolution. An unlimited range of frequencies or strains can be scanned isothermally. In multi frequency and strain experiments, values are entered as number of data points required per decade, within minimum and maximum value. Used in conjunction with the DETA provides direct measurement of visco elastic behaviour of materials from 1mHz to 100KHz.
- >4.5 decades of dynamic stiffness range
- Extensive use of titanium clamp parts reduces thermal and mass inertia
- Low mass drive train, sample length compensation in tension unnecessary, low compliance, no air bearing and state of the art electronics provide unsurpassed reliability and virtually maintenance free operation
- Instrument pre-calibrated. Annual check only required. No requirement to reset zero balance in different head orientations. System identifies orientation automatically
- Advanced design features gives easy access to the sample clamping arrangement, able to handle large samples with negligible instrument compliance, ability to use a wide range of environments, including liquids, precise automatic controlled cooling
- Superior software to complement mechanical excellence
- Standard temperature range -190°C to 600°C
- Ready access to the raw data for specialist studies. Low noise high resolution
- Sine wave of measured displacement display is always available via the LCD screen
- Quality data for engineering properties. Gives absolute moduli values for engineering design and quality assurance use
- Extensive capability with a range of options including immersion, humidity, gas purging, highly efficient cryogenic control to <-190°C, optical windows and ports etc.
- Astonishing cooling capability using standard one litre or ten litre cryogenic accessories. These can easily cool to -190°C using less than one litre of liquid nitrogen or will cool to -100°C at least four times from ambient in less than three minutes per cooling cycle.

All combine to make the TT DMA the market leader in dynamic mechanical thermal analysis.

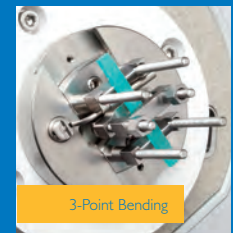
Modes of Operation



Single Cantilever



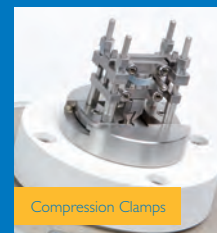
Dual Cantilever



3-Point Bending



Shear Clamps



Compression Clamps



Tension Clamps

Single Cantilever Bending – clamped

Sample lengths up to 28mm long and 13mm wide can be accommodated in Single Cantilever.

There are 18 defined fixed lengths and the ability to accommodate any specific length in between.

Dual Cantilever Bending – clamped

Sample lengths up to 55mm long and 13mm wide can be accommodated in Dual Cantilever.

There are 18 defined fixed lengths and the ability to accommodate any specific length in between.

3-Point Bending – simply supported

Sample lengths up to 55mm long and 13mm wide can be accommodated in 3-Point Bending.

There are six defined fixed lengths and the ability to accommodate any specific length in between.

Shear Clamps

Standard shear sample diameter is 10mm and thicknesses up to 11mm can be accommodated.

Note that thicknesses beyond 2mm should be regarded as a bending geometry of a rod.

Tension Clamps

These can accommodate a free length of up to 20mm. Seven pre-defined lengths can be chosen or any user specified values.

Compression Clamps

Samples up to 10mm diameter can be accommodated with thicknesses up to 12mm possible.

identiPol QA Holder Clamps

Clamp configuration to hold the identiPol QA holders, used in conjunction with the identiPol QA, for measurement of thermoplastic pellets.

All geometries can be used with humidity and immersion accessories.

Actual sample sizes that can be used in the above geometries are defined by the properties of the material being examined.

Associated Products

TT DMA Humidity 85/85 Chamber

The Triton Technology 85/85 Humidity Chamber is a unique solution to deliver an accurate relative humidity up to 85°C and up to 85% humidity in a TT DMA.

TT DETA

This unit is ideal for characterising many polymeric thin films and sheet material. Relaxation information such as the glass transition (T_g) is readily obtained using this system.

TT DMA Fluid Bath

The fluid bath enables a sample to be immersed in a solvent or media whilst the DMA experiment is being performed.

identiPol QA

A compact instrument that provides a fast and efficient way of characterising and analysing thermoplastic material at any point of the process.

Cryo

Allows work to be carried out at sub ambient levels (-190°C to room temperature).

Material Pockets

Material Pockets allow powdered or non self supporting materials to be investigated by DMA and have found good utility in various applications: mainly in detecting small amounts of amorphous material from samples that can not be formed into bar or film.

