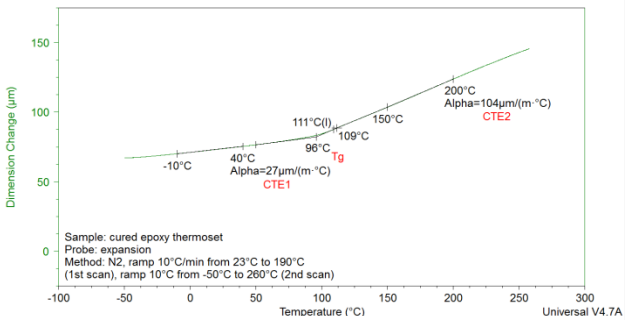
THERMAL ANALYSIS - TMA AND DMA

Services Analytiques

Thermal analysis is a group of techniques in which a physical property of a material is measured as a function of temperature whilst the material is exposed to a controlled temperature program.

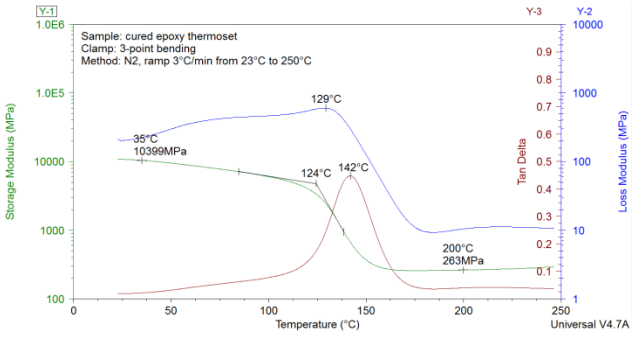
Thermo mechanical analysis (TMA) is a technique in which the change in the dimensions (length or volume) of a sample is measured as a function of temperature. TMA is commonly used to measure intrinsic material properties (e.g. coefficient of thermal expansion, glass transition temperature, softening temperature).

C2MI MA as some interesting features: cooling system, various modes of deformation (expansion, penetration) modulated temperature TMA (MTMA) mode (resolves overlapping thermal events), enhanced mode (EM) (allows transient (stress/strain, creep, stress relaxation) and dynamic oscillatory experiments which provide viscoelastic properties of materials)



TMA curve for a cured epoxy thermoset

Dynamic mechanical analysis (DMA) is a popular thermal analysis. This technique is used to measure the mechanical properties of a wide variety of materials and particularly the viscoelastic behavior of polymer. The primary measurements include modulus (storage, loss, complex, Young's), damping, glass transition temperature and secondary transitions.
The most common test in DMA is the dynamic oscillatory test which involves imposing a small cyclic stress on a sample and measuring the resulting strain response.



DMA E', E'' and tan δ curves for a cured epoxy thermoset

C2MI DMA has interesting features: gas cooling accessory (allows to extend the operating range of the DMA to -150°C), various modes of deformation (3-point bend, dual/single cantilever, shear sandwich, tension (for films and fibers) and compression) and various types of tests (transient (stress/strain, creep, stress relaxation) and dynamic oscillatory).

Note that DMA is more sensitive than other thermal analysis techniques for determination of glass transition temperature.