TRITON TECHNOLOGY

DETA Applications

The Triton Dielectric **Thermal** Analyser (DETA) is a very powerful technique for probing both the molecular and rheological behaviour of materials.
The material should possess at least one component that possesses a dipolar molecule. Most polymers are good examples of typical material but powders and various liquids such as oils and waxes can also be investigated with this technique.

The information obtained can help with the identification of structure and aid process optimisation and end user performance.
In particular, molecular relaxations, the cure of resin systems and calculation of activation energies.
The sensitivity is so great that it can achieve far better resolution of beta relaxations than DMA in many cases.

Industries that could benefit from the use of DETA include for example:-

Aerospace	Food Processing
Automotive	Plastics
Electronics	Petrochemical
Coatings	Cable

Examples of the **types** of materials that can be studied by the DETA technique are:-

Thermoplastics	Films
Thermoset resins	Paint, Paint Films and Coatings
Rubbers	Adhesives
Food products	Oils, Waxes and Greases
Composites	Greases

Molecular relaxations can be easily detected in polymeric materials as long as the material possesses at least one species present that has a dipole. Polymers without an obvious dipole such as polyolefins, e.g. polyethylene, will not in themselves exhibit any dielectric response however, in many instances, impurities present will allow investigation even in these cases.

Examples of typical simple characterisations are illustrated in Figures 1 and 2

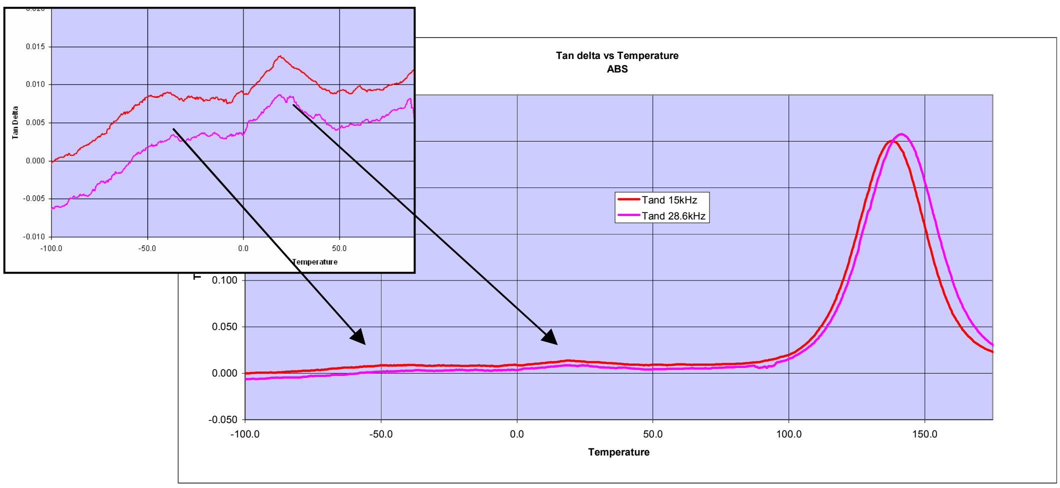

Figure 1

The example shown in Figure 1 is a dielectric **thermal** characterisation of an ABS material. Note that the polystyrene acrylonitrile component produces a very strong response and the butadiene added is clearly a minor component of the blend. Note the frequency dependence of the relaxations, both for the polystyrene acrylonitrile and the butadiene component. Also note that there is, in this particular material, a minor component that is not frequency dependant from 0ºC to around room temperature. This may be a trace of moisture in the sample.
The sample was 3.85mm thick and a 33mm disc was analysed. The heating rate was 2ºC/min. Note that it took 5 minutes to cool from ambient to -100ºC with the Triton 1 litre manual mini cryo system.

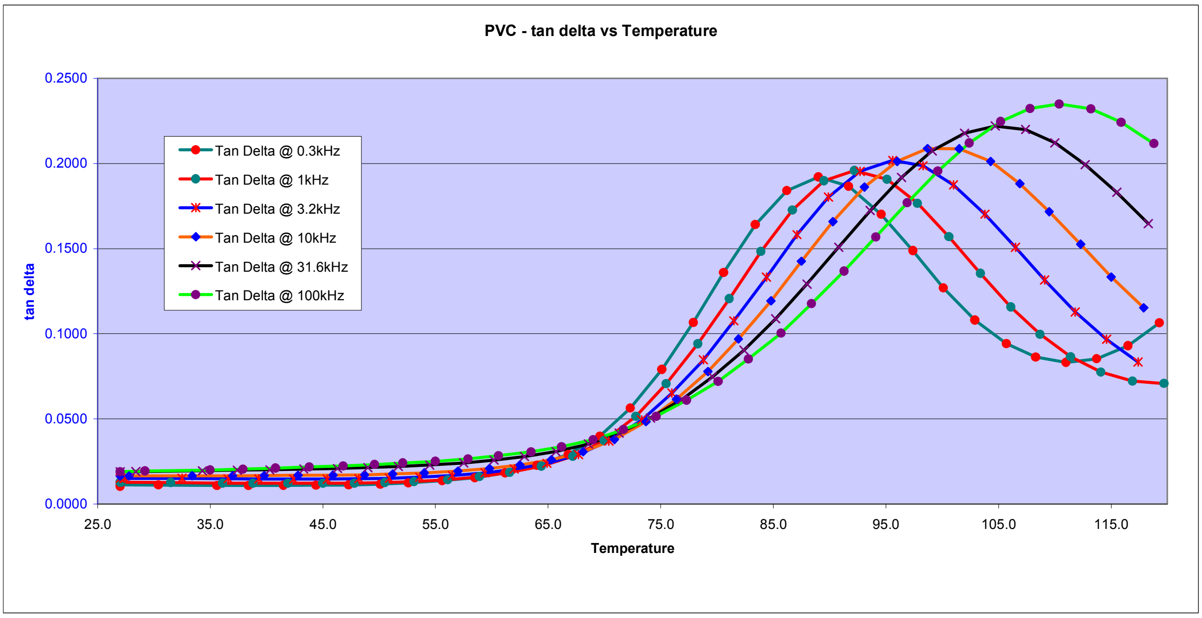

Figure 2

Figure 2 is a typical thermal scan of PVC film in the dielectric **thermal** analyser. Typically, a thin sheet material such as this is sputter coated with a conductive metal such as silver or gold prior to mounting in the instrument. This eliminates errors due to lack of contact with the sample surface and will produce excellent characterisations. The sputter coating process typically takes less than 5 minutes.
The above sample was 0.35mm thick sheet and a 33mm diameter sample was placed between the electrodes. The ramp rate was 3ºC/minute.

These examples illustrate how the dielectric thermal analyser offers a highly complimentary approach when examining thin film and sheet materials in particular. Examples of other material forms such as powders, liquids etc are available on request.

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