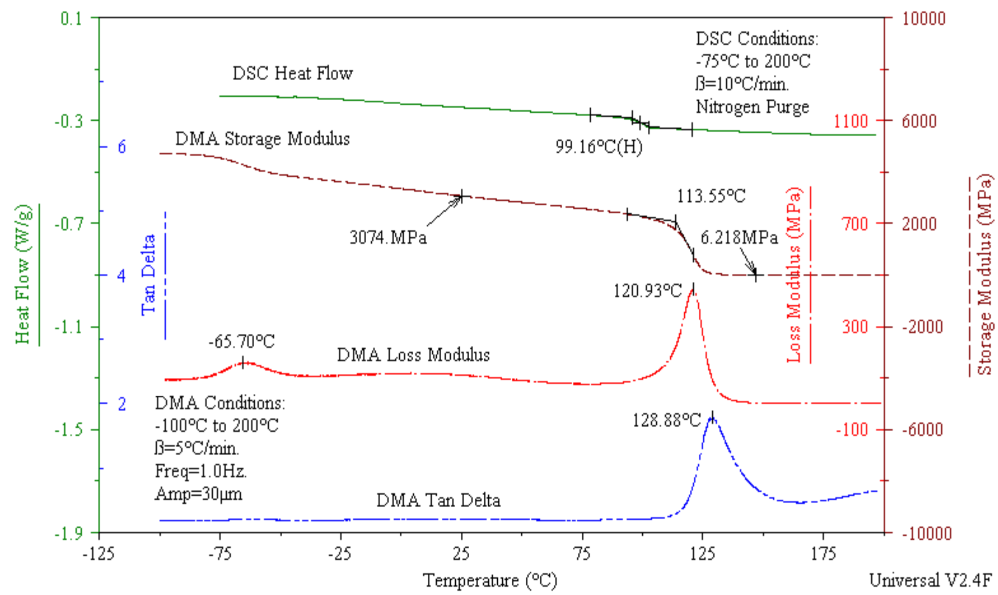
TA Instruments

Thermal Analysis & Rheology

THERMAL SOLUTIONS

Characterization of an Acrylic/Melamine Copolymer Blend by DSC and DMA



DSC measures the temperatures and heat flows associated with transitions in materials as a function of temperature or time in a controlled atmosphere. This technique provides quantitative and qualitative information about physical and chemical changes that involve endothermic or exothermic processes, or changes in heat capacity.

DMA measures the modulus (stiffness) and damping (energy dissipation) properties of materials as the materials are deformed under a periodic stress. These measurements provide quantitative and qualitative information about the performance of materials. DMA is particularly useful for evaluating polymeric materials that exhibit time, frequency, and temperature effects on mechanical properties because of their viscoelastic nature.

The above plot shows how DSC and DMA can be used to characterize the properties of an acrylic/melamine copolymer blend sample. Both DSC and DMA can be used to determine the Tg. DMA, because of its inherent sensitivity to the glass transition, is an ideal technique for identifying the Tg of highly filled systems. Absolute modulus numbers, both below and above the glass transition temperature, can be determined by plotting the storage modulus signal as a function of sample temperature. The storage modulus above Tg is related to the degree of cure (cross-link density) of the material: the higher the storage modulus above Tg, the higher the degree of cure. Tg is also an indication of degree of cure: the higher the glass transition temperature, the higher the degree of cure. Noise and vibration damping performance can be assessed by looking at the tan delta signal. DSC and DMA are valuable thermal analysis techniques that can be used to accurately characterize both thermal and mechanical properties of materials over a wide temperature range.