Ebatco Nano
A Monthly Newsletter

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Nano Brief

Next month, we will be giving presentations at two conferences. The first is a presentation on contact angle applications at the Minnesota Chapter ASM All Day Seminar. The second presentation is on a new peel strength test method at the Annual Adhesion Society Meeting. In addition to the presentation, we will also have a booth representing Kyowa Interface Science, Ltd. As always, please visit us and chat about the wonderful nanoworld, nanomaterials, nano/micro scale characterization of materials and devices. Our staff scientists will be happy to meet you in person at any of these events.

- February 22nd, Material Characterization Using Contact Angle Based Techniques, *ASM MN Chapter All Day Seminar on Materials Characterization, Brooklyn Park, MN*
- February 26th-29th, New Peel Strength Test Method with Multi-peeling Angles, *Adhesion Society Meeting, New Orleans, LA*

Ebatco

The NAT Lab at Ebatco has acquired two new thermal analysis instruments. These two instruments are a Q800 Dynamic Mechanical Analyzer (DMA) and a Q400 Thermomechanical Analyzer (TMA), both from TA Instruments. Together with the Netzsch STA 449 F3 Jupiter-Simultaneous TGA-DSC, NAT Lab has completed the thermal analytical instrument set that can satisfy most of our customers' thermal analysis needs.

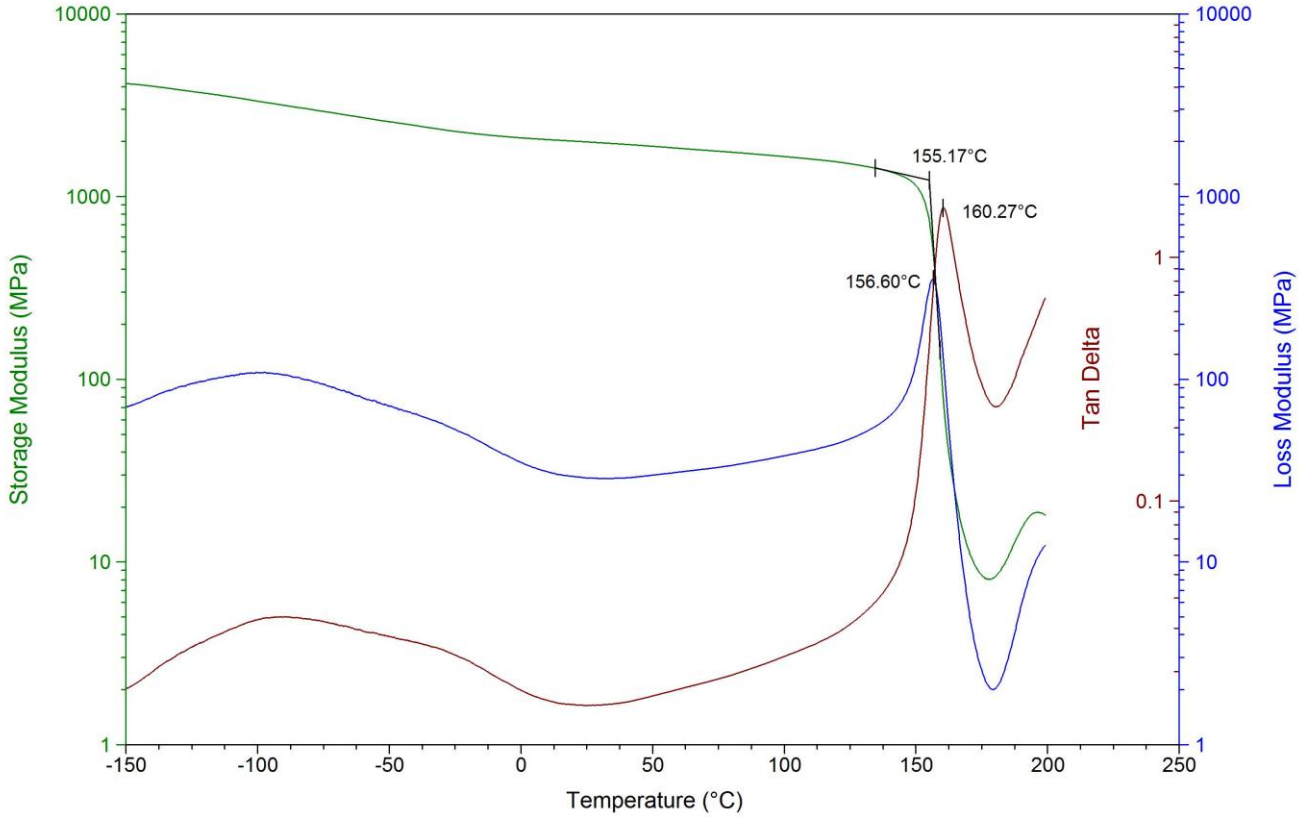
The DMA uses mechanical oscillation to measure the stiffness and damping of a viscoelastic material as a function of temperature. Typically determined material properties include storage and loss moduli, tangent delta, glass transition temperature, creep or stress relaxation characteristics. Specially designed clamps allow for single cantilever, dual cantilever, three point bending, compression and tensile tests. The TMA is capable of measuring dimensional changes in a material as related to temperature. High quality quartz probes grant the capability to measure linear thermal expansion, volumetric expansion, thermal relaxation, and stress relief of a material as it is heated.

TA Instruments Q400 TMA (left) and Q800 DMA with Gas Cooling Accessory (right)

Case Study

The glass transition temperature, Tg, is the temperature where a material transitions from a glass-like state to a rubber-like state. As the temperature passes through the Tg, an event occurs in the storage modulus, loss modulus and tan delta signals during DMA testing. The onset of decrease in the storage modulus curve is the point where the material first begins to lose mechanical strength. The peak of the loss modulus curve indicates the temperature at which maximum energy loss occurs due to material viscous flow. The peak of the tan delta curve happens at the maximum damping temperature and is the traditional Tg reference value cited in literature.

As an example, a polycarbonate bar was analyzed with the Q800 from -150°C to 200°C using a single cantilever clamp and a frequency of 1 Hz. The Tg values based on the storage modulus, loss modulus and tan delta are 155.17°C, 156.60°C and 160.27°C respectively. Typically, the Tg for polycarbonate is around 150°C, but can vary due to oscillation frequency, thermal history, or additives in the material.



DMA results for the glass transition temperature of polycarbonate at a frequency of 1 Hz.

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