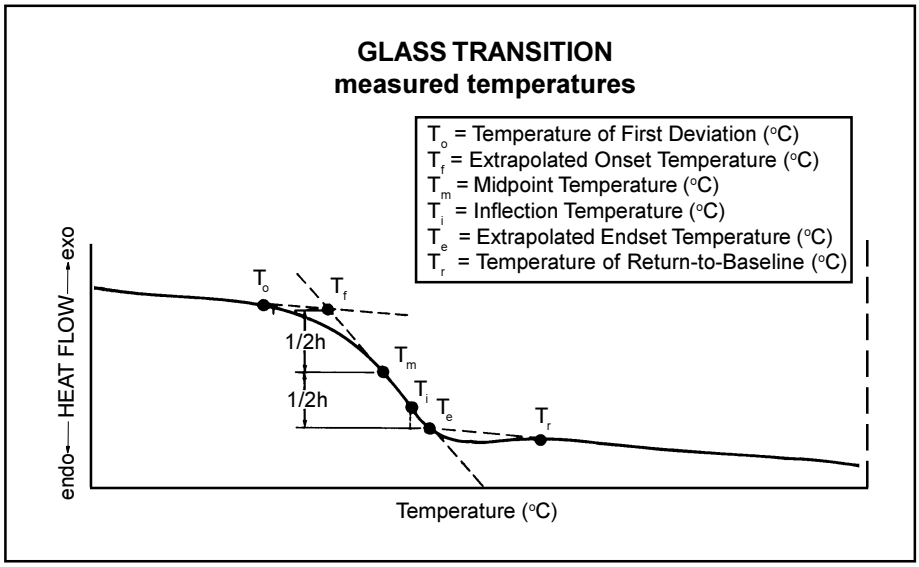
TA Instruments

Thermal Analysis & Rheology

THERMAL APPLICATIONS NOTE

Enhanced DSC Glass Transition Measurements

DSC sensitivity for glass transitions is enhanced by temperature programming at higher rates*. The glass transition is measured, in DSC, through the increase in specimen heat capacity across the transition, manifested as a sigmoidal shift (increase) in baseline (ΔY).



This change in baseline is directly proportional to the specimen's heat capacity change (ΔCp), as well as the program heating rate (Hr).

$$\Delta Y = \Delta Cp * Hr$$

Thus, increasing the experimental heating rate from 20 to 40°C/minute will result in a doubling of glass transition sensitivity (ΔY change observed).

To use increased heating rate to its greatest advantage, the initial temperature for the experiment should be at least 50°C below the onset of the glass transition and the specimen should have a stable (preferably flat) baseline both before and after Tg.

Note: Apparent melting temperatures may be elevated (by several degrees) if determined in the same experiment. This can be overcome by temperature calibrating the instrument at the increased heating rate.

* Glass transition events can also be enhanced using Modulated DSC™. In Modulated DSC, a sinusoidal ripple (modulation) is overlaid on the conventional linear profile. The temperature is still continuously increasing with time, but not in a linear fashion. Rather, the temperature increases at a rate which is sometimes faster than the underlying linear heating rate and sometimes slower. The net result is increased sensitivity (detection) of the glass transition even using slow heating rates. For additional details on MDSC, see the product brochure (TA-074).

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