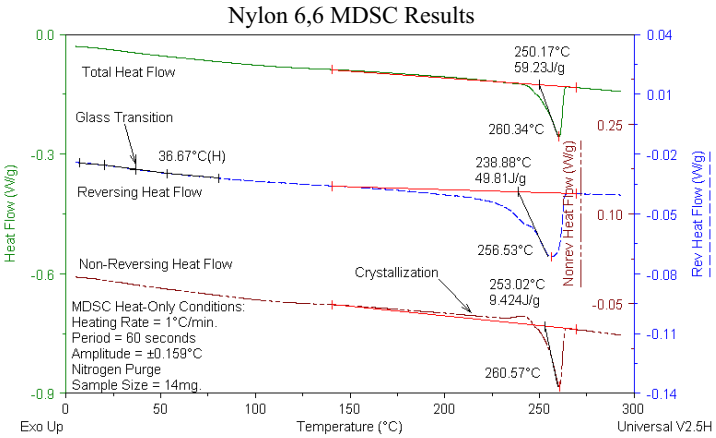
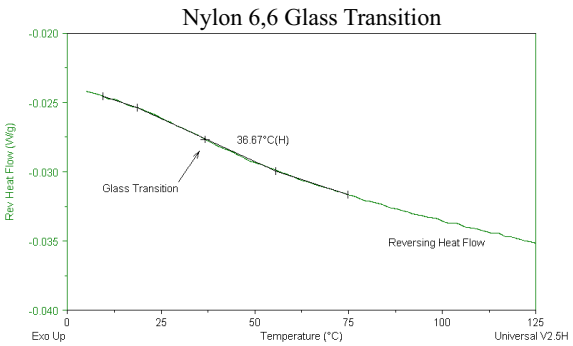
THERMAL SOLUTIONS

Nylon 6,6 Characterization by MDSC®





DSC measures the temperatures and heat flows associated with transitions in materials as a function of temperature or time in a controlled atmosphere. MDSC is an enhancement to conventional DSC whereby the total heat flow is separated into reversing (heat capacity) and non-reversing (kinetic) components. The reversing signal contains heat capacity events such as the glass transition and melting. The non-reversing signal contains kinetic events such as crystallization, crystal perfection and reorganization, cure, and decomposition.

Figure 1 shows MDSC results on an as received sample of Nylon 6,6. This technique was used to characterize the effect of moisture on the glass transition temperature and to determine if crystallization was occurring during the melt. The reversing heat flow signal shows a weak glass transition event at a lower than expected temperature. The weak glass transition event can be attributed to the sample being mostly crystalline with only a small amount of amorphous phase present (see Figure 2 for an enlarged view of the glass transition event). The lower than expected temperature is the result of the effect of moisture acting as a plasticizer. The non-reversing signal shows a small exothermic peak prior to the melting transition. Using MDSC heat only conditions (no induced cooling), this crystallization is easily detected in the non-reversing signal at the same time as melting is evident in the reversing signal. (Note: As seen in some samples, the melting transition is separated into both the reversing and non-reversing signals. Please see the Modulated DSC Training Workshop booklet (September 11, 1997) for an explanation of this phenomenon.) Note also how both the melting and crystallization processes start to occur at a temperature (approximately 130°C) well below where one would assume they start as shown in the total heat flow signal. This example clearly demonstrates the advantage MDSC has over standard DSC in characterizing material properties, often in one experiment.