Determination of the Glass Transition Temperatures of a Polymer (Polyamide) Blend using MDSC®

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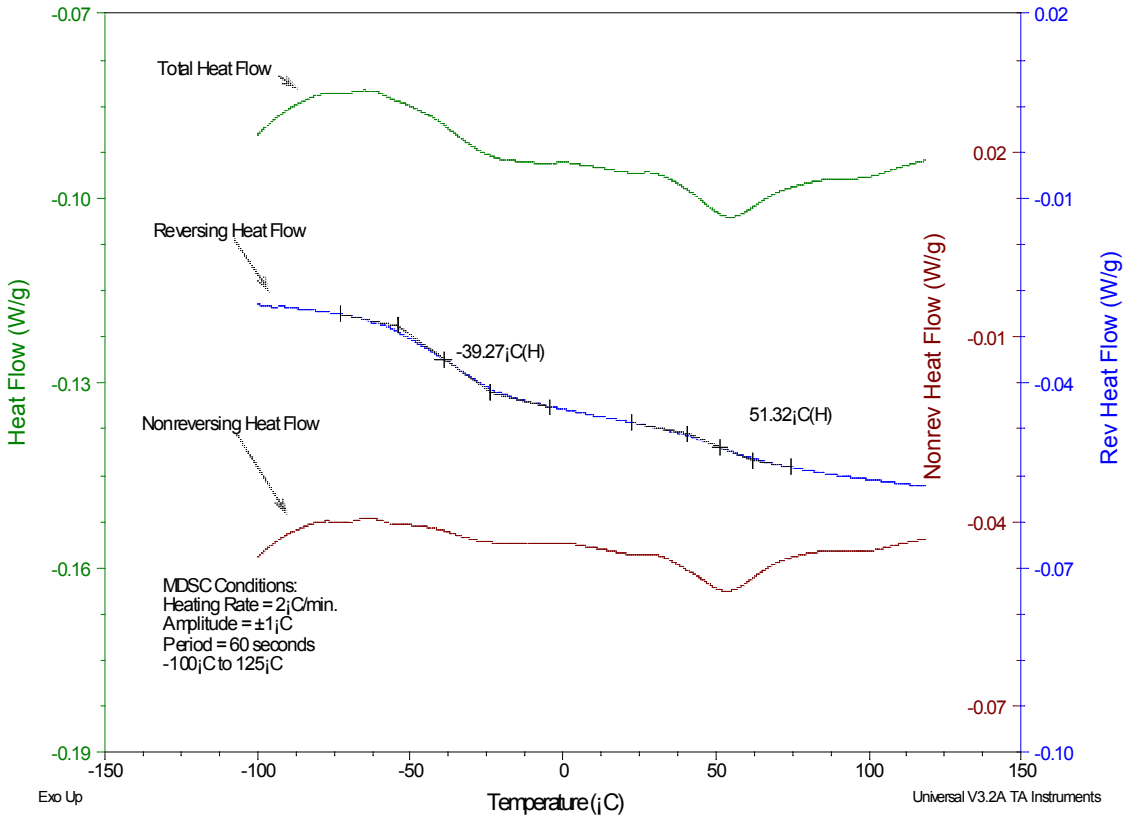
DSC measures the temperatures and heat flows associated with transitions in materials as a function of temperature or time in a controlled atmosphere. MDSC® is an enhancement to conventional DSC where the total heat flow is separated into reversing and non-reversing components. The reversing signal contains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



The above plot shows MDSC data generated on a polyamide blend material commonly used in adhesives, inks, and other commercial applications. The sample is thought to have two glass transition regions. Characterization of the glass transition temperatures of this material is important in predicting its performance over a broad temperature range. Unfortunately, the total heat flow signal (similar to that obtained on

traditional DSC) shows no clear glass transition regions. Characterization is difficult because the lower temperature transition is poorly defined and the higher temperature transition is hidden by an overlapping enthalpic relaxation. However, the reversing heat flow MDSC data shows the glass transition temperatures clearly in the reversing signal. Additionally, the nonreversing heat flow data shows that the endotherm near 50 °C is due to stress relaxation at temperatures just above the second glass transition.

This example clearly demonstrates the ability of MDSC to separate overlapping transitions and to enhance interpretation of complex thermal curves.

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KEYWORDS

glass transition, modulated differential scanning calorimetry, polyamide, thermoplastic polymers.

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