Using High-Volume Sample Pans to Characterize the Curing Reaction of a Phenolic Resin Sample

C. Jay Lundgren
TA Instruments, 109 Lukens Drive, New Castle DE 19720

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.

Characterization of the curing reaction of phenolic resin by DSC is often made difficult because of the water that is liberated during the curing process. The water vaporizes at the elevated temperature during the cure. This vaporization process is highly endothermic and masks the exothermic curing reaction. Pressure DSC (PDSC) is normally used to suppress the water to better characterize the curing reaction. However, in the absence of a PDSC cell, high-volume sample pans may be used to facilitate this measurement. High-volume sample pans are designed to accommodate 100 µL sample sizes, an internal pressure capability of 3.8 MPa (600 psig), and an upper temperature limit of 250 °C.

Figure 1 - Phenolic Curing Reaction using High-Volume Pans

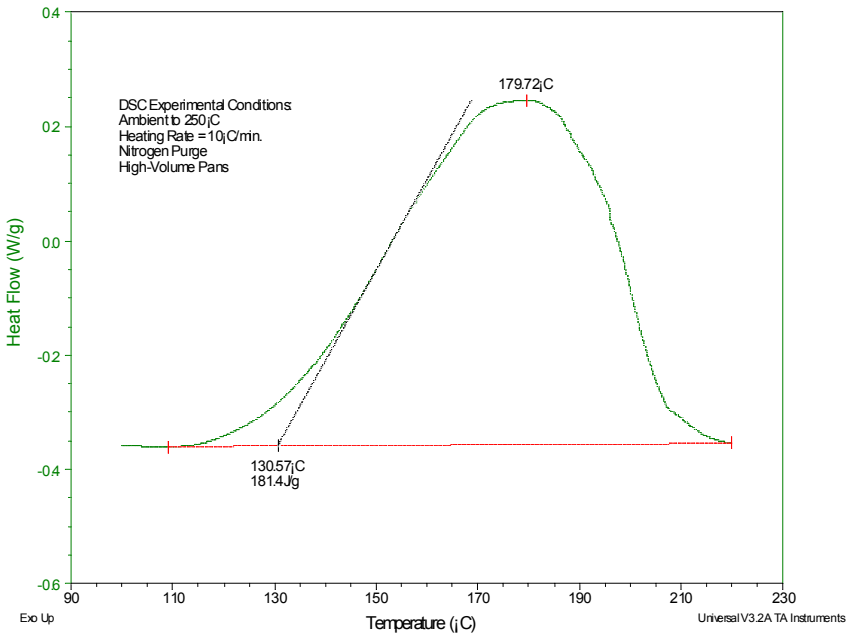

Figure 1 above shows DSC data on a phenolic resin sample. The sample was first sealed in a high volume sample pan and then heated from ambient to 250 °C at 10 °C/min. The exotherm represents the curing reaction during the heating experiment. Because of the internal pressure capability of the high-volume sample pan, the water that is liberated during the curing reaction has been successfully suppressed. The resulting DSC data shows a well-defined exotherm that can be integrated to determine the heat associated with this reaction.

While the high-volume sample pans are not designed as a replacement for a PDSC cell, this example shows how these pans can be used to successfully characterize a phenolic sample using the DSC.

Suggested by C. Jay Lundgren, TA Instruments, Inc., 109 Lukens Drive, New Castle, DE 19720

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TA Instruments

United States, 109 Lukens Drive , New Castle, DE 19720
Phone: 1-302-427-4000 • Fax: 1-302-427-4001 • E-mail: info@tainst.com

United Kingdom • Phone: 44-1-372-360363 • Fax: 44-1-372-360135 • E-mail: uk@tainst.com

Spain • Phone: 34-93-600-9300 • Fax: 34-93-325-9896 • E-mail: spain@tainst.com

Belgium/Luxembourg • Phone: 32-2-706-0080 • Fax: 32-2-706-0081 • E-mail: Belgium@tainst.com

Netherlands • Phone: 31-76-508-7270 • Fax: 31-76-508-7280 • E-mail: Netherlands@tainst.com

Germany • Phone: 49-6023-9647-0 • Fax: 49-6023-96477-7 • E-mail: germany@tainst.com

France • Phone: 33-1-304-89460 • Fax: 33-1-304-89451 • E-mail: france@tainst.com

Italy • Phone: 39-02-27421-283 • Fax: 39-02-2501-827 • E-mail: italia@tainst.com

Sweden/Norway • Phone: 46-8-594-69-200 • Fax: 46-8-594-69-209 • E-mail: Sweden@tainst.com

Japan • Phone: 813 5479 8418)• Fax: 813 5479 7488 • E-mail: nurayama@taij.po-jp.com

Australia • Phone: 613 9553 0813 • Fax: 61 3 9553 0813 • E-mail: steve_shamis@waters.com

To contact your local TA Instruments representative visit our website at www.tainst.com