

CDSolutions

APPLICATIONS INFORMATION USING ADVANCED SAMPLE HANDLING TECHNOLOGY

Evolved Gas Analysis of a Polyurethane Foam

Many polymers, including PVC and polyurethanes, degrade in a step-wise fashion when pyrolyzed. This may easily be demonstrated and studied by interfacing the Pyroprobe directly to a mass spectrometer. By replacing the GC column with a one-meter length of 0.1 mm fused silica, the pyrolysis products are transferred rapidly to the detector as they are made. The interfacing, inlet pressure and split ratio are used just as they would be for GC-MS analysis, but rather than producing a chromatogram of individual compounds, the results are composite peaks of the materials made during the heating process.

Figure 1 shows a piece of polymer foam heated from 200° to 800°C at 100°C/minute. Two large peaks result, with maxima at 2.2 and 3.2 minutes. These correspond to the major products formed from polyurethanes when heated. First, at a relatively low emperature, the diisocyanate is released. In the second stage, the remaining polyol fraction is pyrolyzed. Examining the mass spectra of these composite peaks reveals a large mass for ion 174 in the first peak, which is characteristic for toluene diisocyanate. Just as with normal chromatography, individual ions may be plotted out to show the evolution of specific compounds. In Figure 2, ion 174 for toluene diisocyanate is shown, creating the first peak. The second peak is represented by ion 43 for polyol fragments.

This technique may also be used to study the evolution of volatiles such as residual monomers and additives, creating a simulated TGA with mass spec information about the compounds evolved during a specific heating regime.

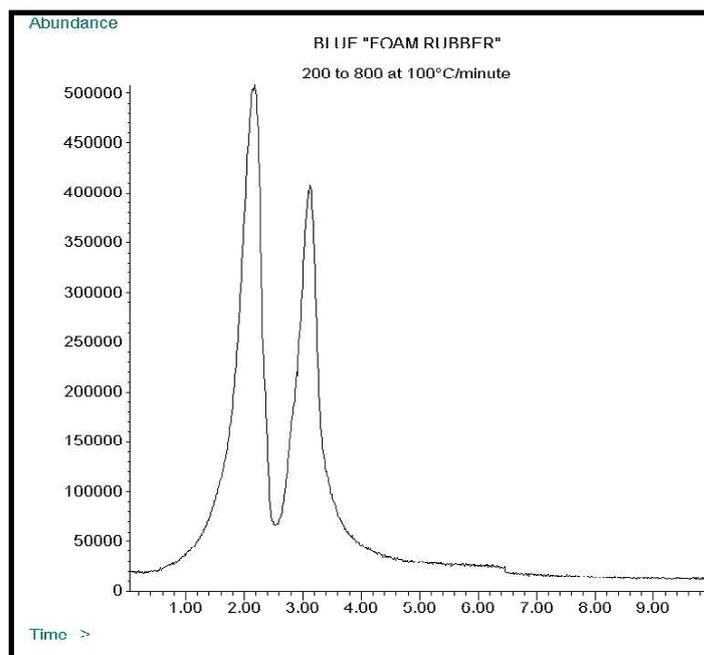


Figure 1. Polyurethane foam heated at 100°C/minute direct to mass spectrometer.

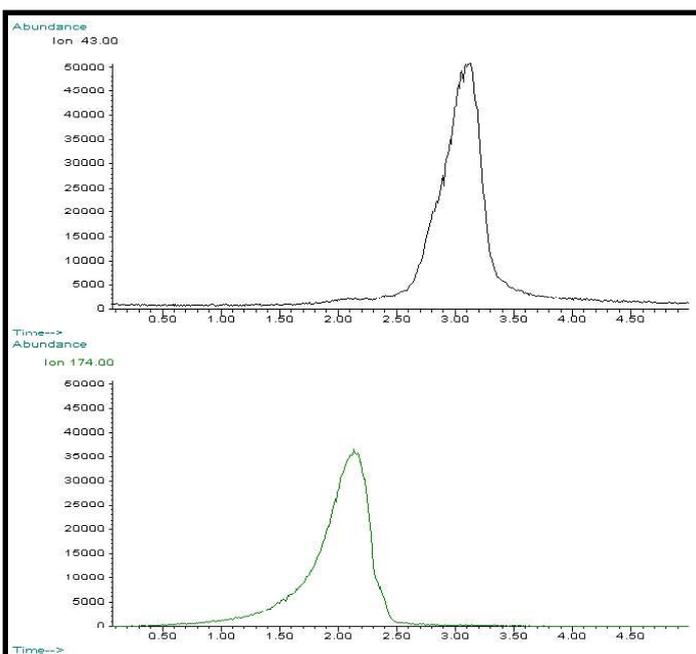


Figure 2. Ion 43 for polyol (top) and ion 174 for diisocyanate (bottom).

Equipment

Pyrolysis

CDS Analytical Pyroprobe 5200, in the Direct mode, interfaced to a GC/MS.

Pyrolysis

Initial: 200°C
Ramp: 100°C/minute
Final: 800°C

Valve oven: 300°C
Transfer Line: 300°C

Chromatography

Column: 1 m x 0.1 mm fused silica

Oven: 250°C, isothermal
10 minutes

Injector: 300°C
Carrier: Helium, 50:1 split

Mass range: 35 to 500 amu

FOR MORE INFORMATION
CONCERNING THIS APPLICATION,
WE RECOMMEND THE
FOLLOWING READING:

T. Wampler, C. Zawodny, K. Jansson,
Multistep thermal characterization of
polymers using GC-MS, American Lab,
39, 6, (2007) 16-19.

Additional literature on this and related
applications may be obtained by con-
tacting your local CDS Analytical rep-
resentative, or directly from CDS at the
address below.

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