Multi-Step Pyrolysis-GC/MS Analysis of PVC Copolymer

Application Note
Plastics

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Pyrolysis-gas chromatography/mass spectrometry is a convenient and sensitive way to analyze complex polymeric materials. Frequently, the pertinent information may be obtained from a single run, for example, at 700°C. Other times, a thermal separation may be desired, by analyzing for volatiles at a low temperature and then pyrolyzing the remaining polymer.

For a better understanding of the behavior of a specific material, however, it may be advantageous to analyze the sample using a series of increasing temperatures. A CDS Pyroprobe Autosampler, used in these analyses, is capable of performing an unlimited number of runs on each sample, complete with automatic start of the GC-MS for each run.

The plastic material shown here was a copolymer of poly vinylchloride and poly methylmethacrylate. When heated, PVC releases HCl, then produces aromatics, including benzene and toluene. Figure 1 shows the benzene peak for a series of runs on the same sample, heating sequentially to 200°, 300°, 400°, 500°, 600°, 700° and then 1000°C. Although the greatest production of benzene is seen at 700°, some is still released when the sample is heated to 1000°C.

Figure 2 compares the production of benzene, from the PVC to the formation of methyl methacrylate from the PMMA, at 600° and 1000°C. Although the PVC continues to generate benzene at higher temperatures, the PMMA is essentially unzipped well before that temperature.

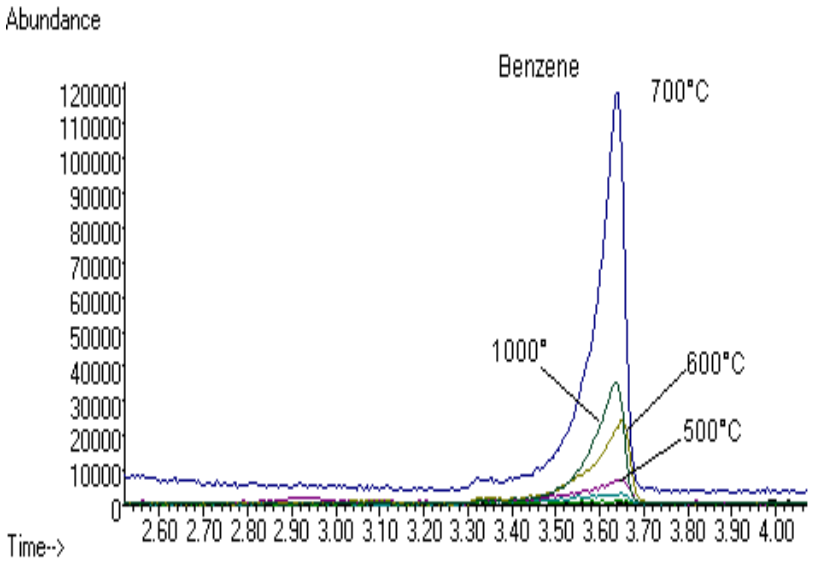

Figure 1. Benzene from PVC at a series of temperatures

Instrument Conditions

Pyroprobe Autosampler

Pyrolysis Setpoint: 200-1000°C 15s
Valve Oven: 300°C

GC/MS

Column:	5% phenyl (30m x 0.25mm x .25μm)
Carrier:	Helium, 50:1 split
Injector:	300°C
Oven:	40°C for 2 minutes
	8°C/min to 300°C

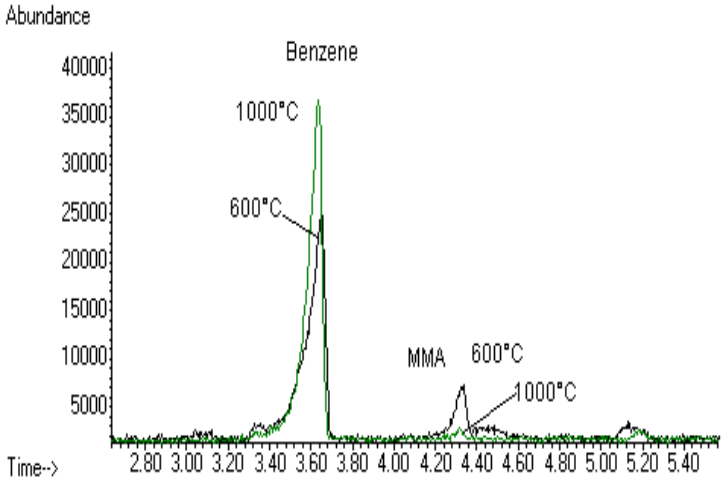

Figure 2. Benzene from PVC compared to the formation of methyl methacrylate from the PMMA, at 600° and 1000°C.

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

S. A. Liebman, et al., Thermal degradation Studies of PVC with Time-Resolved Pyrolysis GC and Derivative TGA, J. Polymer Sci., 16, (1978) 3139.