

### Pyrolysis-GC/MS of Automobile Paints

Pyrolysis-GC has been used in the study of automobile paints in both industrial and forensic laboratories for decades. When a paint sample is pyrolyzed, the polymeric material involved is fragmented to smaller molecules, permitting analysis by gas chromatography. Consequently, Py-GC can provide information not only about the kinds and relative amounts of the various monomers used, but about other constituents as well.

Through the 1980's, automotive paint formulations included primarily copolymers of methyl methacrylate (MMA), butyl acrylate (BA), styrene and butyl methacrylate (BMA), with additives to provide flexibility, stabilization, etc. Later, formulations were changed to incorporate smaller polymer chains which were crosslinked in place, for example, using urethane or epoxy bonds. In addition, plasticity is often provided by including longer side chain monomers into the polymer itself instead of adding a separate plasticizing agent. Evidence of these newer constituents appears in the pyrograms, marking them as clearly different from pyrograms obtained from paints of earlier formulations.

The two paint pyrograms shown in Figure 1 illustrate many of these changes.

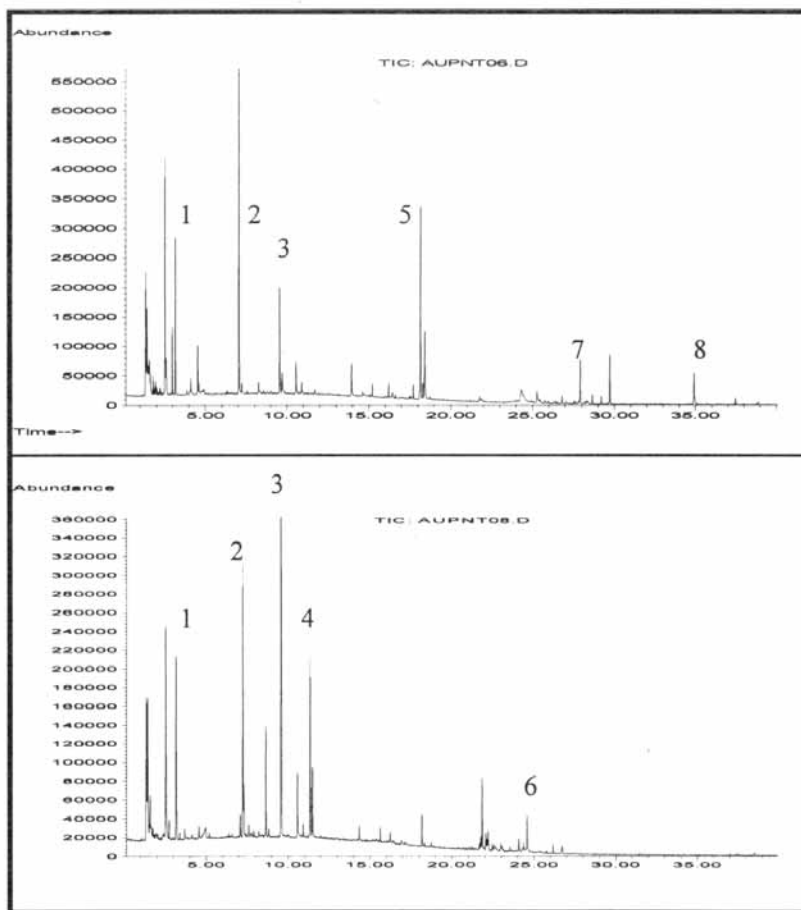


Figure 1. Comparison of two post-1990 automotive paints.

#### Peak Identification:

1. Methyl methacrylate
2. Styrene
3. Butyl methacrylate
4. Hydroxypropyl methacrylate
5. Octyl methacrylate
6. IDI (A diisocyanate)
7. Decyl methacrylate
8. Bisphenol A

Like many earlier formulations, each paint includes MMA, BMA and styrene. The upper pyrogram also reveals both octyl and decyl methacrylate, long chain methacrylates added to incorporate flexibility into the polymer, as well as Bisphenol A from the epoxy crosslinking. The lower pyrogram shows hydroxypropyl methacrylate and a diisocyanate used in the urethane crosslinking of this paint.

## Equipment

All samples were pyrolyzed using a CDS Model 2500 Pyrolysis Autosampler interfaced to a Hewlett-Packard 6890 gas chromatograph with a mass selective detector.

## Pyrolysis

Interface oven: 300°C  
Ramp: 10°C/ms  
Temperature: 750°C  
Time: 15 seconds  
Clean: 1000°C for 10 seconds

## Chromatography

Carrier: He  
Column: HP-5  
30 m x 0.25 mm  
Split: 75:1  
Initial temperature: 40°C for 2 minutes  
Ramp: 8°C/minute  
Final temperature: 290°C for 10 minutes

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

*Gas Chromatographic-mass spectrometric determination of phenols and heterocyclic nitrogen compounds in the thermal degradation products of epoxy powder paint*, K. Peltonen, JAAP 10 (1986) 51.

*Examination of forensic evidence*, J. Challinor, in Applied Pyrolysis Handbook, T. Wampler, Editor, Marcel Dekker, New York.

Additional literature on this and related topics may be obtained by contacting your CDS Analytical representative, or directly from CDS at the address below.

CDS Analytical, LLC has been a leader in the design and manufacture of laboratory instruments for sample preparation and analysis since 1969. We are dedicated to providing the best possible instruments for both research and routine analysis. Well known in the field of pyrolysis, CDS manufactures the Pyroprobe® 5000, 5150, 5200 and 5250 autosampler for the introduction and analysis of solid materials by GC, MS and FT-IR. CDS offers a complete line of dynamic headspace instruments for the analysis of volatile organic compounds in environmental, pharmaceutical and food applications, including the model 8400 four-position autosampler. CDS also manufactures the Dynatherm line of thermal desorption instruments including the 9000 series for air monitoring and the 9300 TDA. Our customers, their requirements and applications are important to us. To help meet your needs, we offer a wide range of analytical information and the services of our applications laboratory. If you would like additional information, please contact us at the address below, call us at 1 800 541 6593, or log onto [www.cdsanalytical.com](http://www.cdsanalytical.com).