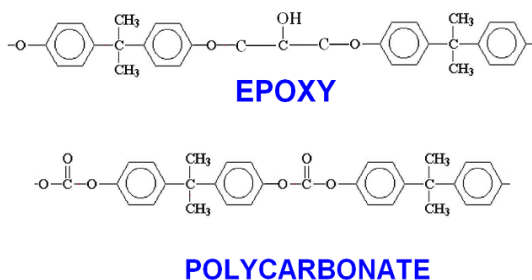


### Pyrolysis of the Bisphenol A Polymers Epoxy and Polycarbonate

Bisphenol A makes up the majority of the polymer chain in both epoxies and polycarbonate. When pyrolyzed, each produces a peak for bisphenol A as well as smaller phenolic compounds, although polycarbonates produce more ethyl and propyl phenol than epoxies do.

The chemical difference is in the link between the bisphenol A molecules, as shown below.



In the case of the epoxy, the link contains three carbons and a hydroxyl group, but the polycarbonate has just one carbon, with a carbon-oxygen double bond. This makes the polycarbonate more thermally stable, and causes bond breaking between the benzene rings.

The different degradation paths are also seen in the production of small molecules from the links. Polycarbonate, with a single carbon bound only to oxygens is likely to produce more CO<sub>2</sub>, while the epoxy can produce water from the OH group, not seen in the polycarbonate. The fixed gas analyses for both polymers are shown in Figure 3.

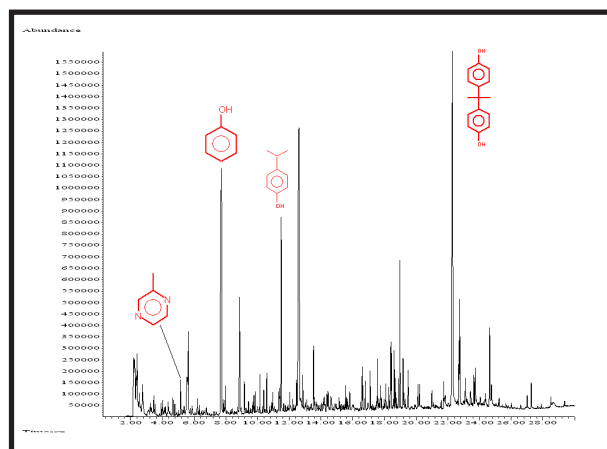


Figure 1. Pyrolysis of epoxy.

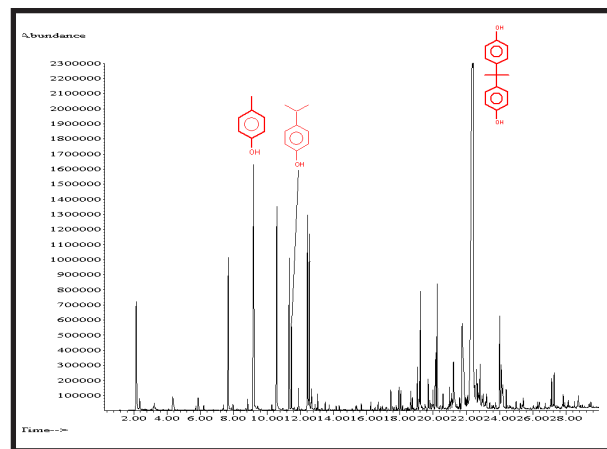


Figure 2. Pyrolysis of polycarbonate

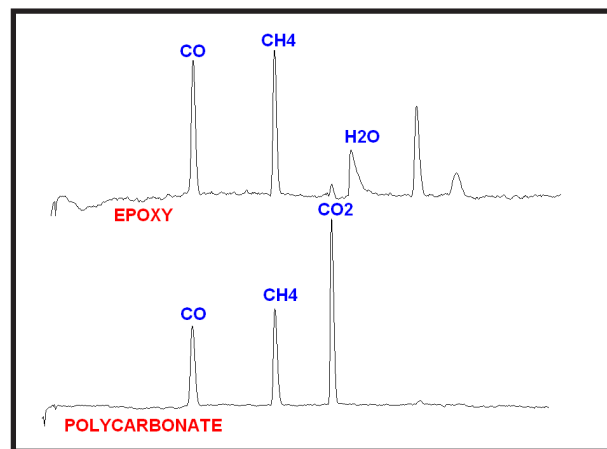


Figure 3. Fixed gas analysis.

## Experimental Parameters

All samples were pyrolyzed using a CDS Pyroprobe 5200 equipped with a Tenax trap.

### Pyroprobe

Pyrolysis: 750°C for 15 seconds  
Interface: 300°C for 4 minutes  
Carrier flow: 30 ml/min  
Trap initial: 40°C  
Trap desorption: 300°C for 4 minutes

### GC/MS

Column: 30 m x 0.25 mm 5% phenyl MS  
Carrier: Helium  
Split: 50:1  
Oven program:  
40°C for 2 minutes  
10°C/minute to 325°C

### Fixed Gas Analysis

Column: Carboxen 1000 1/8" X 9 "  
Detector: TCD  
Oven: 30°C for 2 minutes, then  
30°C/min to 300°C

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

S. Tsuge, Characterization of epoxy resins cured with dicyandiamide in the presence of imidazole catalysts by high-resolution pyrolysis-gas chromatography, *Journal of Analytical and Applied Pyrolysis* 33 (1995) 157- 166

Additional literature on this and related applications may be obtained by contacting your local 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).