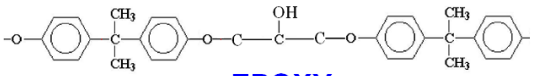
CDS solutions

APPLICATIONS INFORMATION USING ADVANCED SAMPLE HANDLING TECHNOLOGY

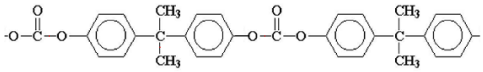
Pyrolysis of the Bisphenol A Polymers Epoxy and Polycarbonate

Bispehnol 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.



EPOXY



POLYCARBONATE

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 CO2, 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.

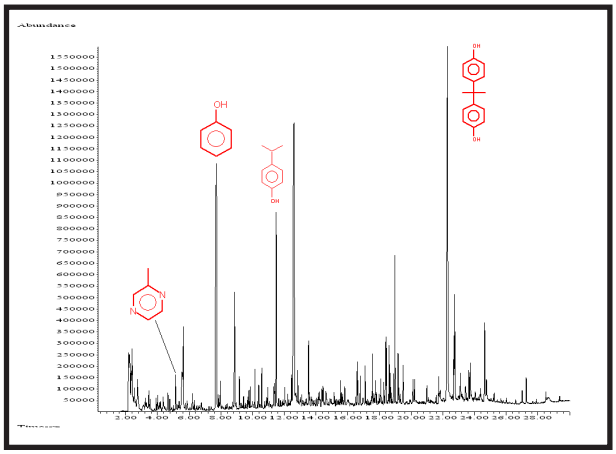


Figure 1. Pyrolysis of epoxy.

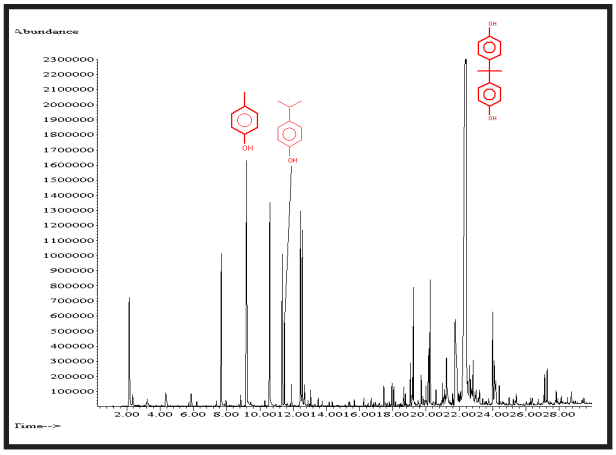


Figure 2. Pyrolysis of polycarbonate

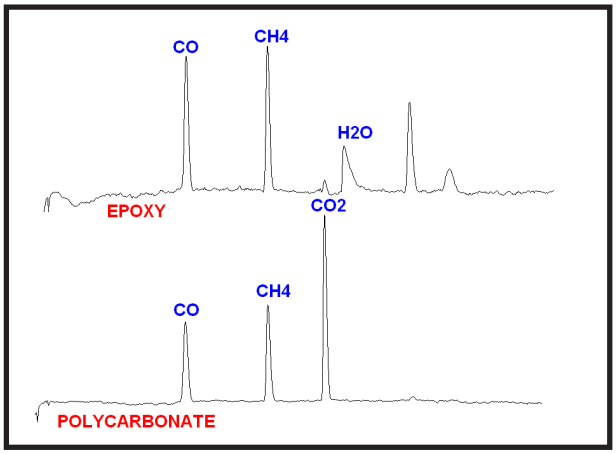


Figure 3. Fixed gas analysis.

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.

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