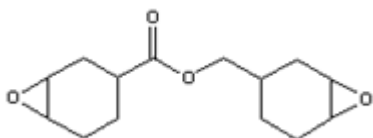


CDSolutions

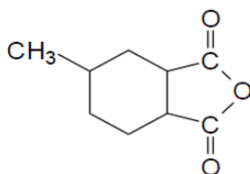
APPLICATIONS INFORMATION USING ADVANCED SAMPLE HANDLING TECHNOLOGY

Quantitation of Epoxy to Hardener Ratios in a Cycloaliphatic Epoxy

Although many common epoxy resins are formulated using Bisphenol A, aliphatic, especially cyclohexyl compounds, are also used. The epoxies shown here were formulated with varying amounts of 3,4-Epoxycyclohexylmethyl 3,4-epoxy cyclohexane carboxylate, shown below:



and hardened using methylhexahydrophthalic anhydride (MHHPA), which has the structure:



The samples used epoxy to hardener ratios of 0.50, 0.66 and 1.00. When pyrolyzed, each sample produced a pyrogram like the one shown in Figure 1, with most of the components eluting as three peaks at about 14 minutes. Figure 2 shows an expanded view of the epoxies, with epoxy to hardener ratios of 1:2 and 1:1.

Ascribing the first peak to the epoxy resin and the third peak to the hardener, peak area ratios were plotted against the relative amounts of the constituents. This produced a linear graph for the range of constituent ratios, shown in Figure 3.

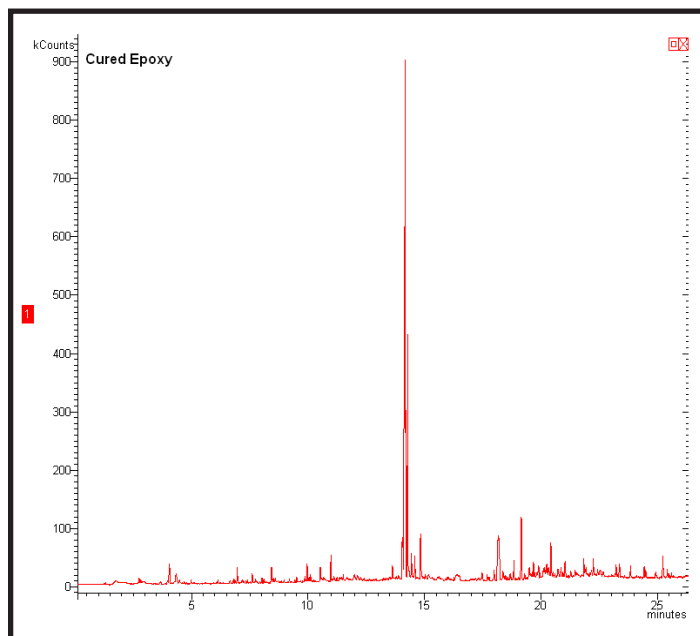


Figure 1. Pyrogram of epoxy at 750°C.

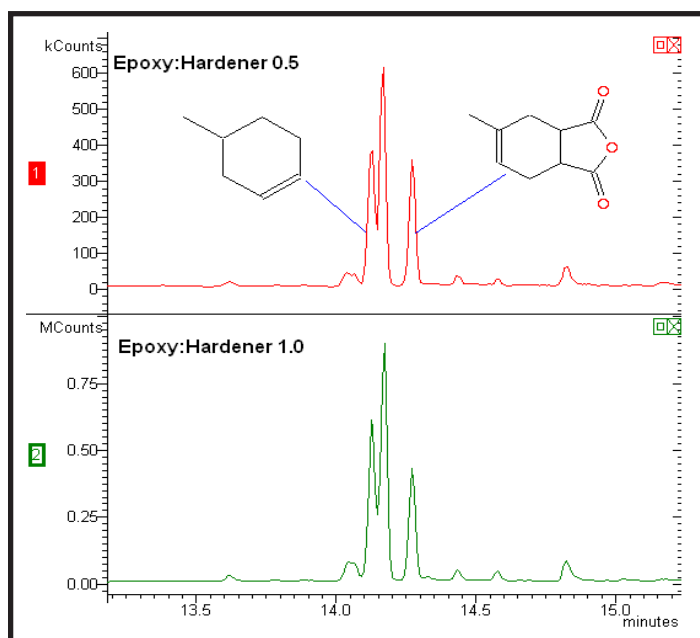


Figure 2. Expanded view of pyrogram.

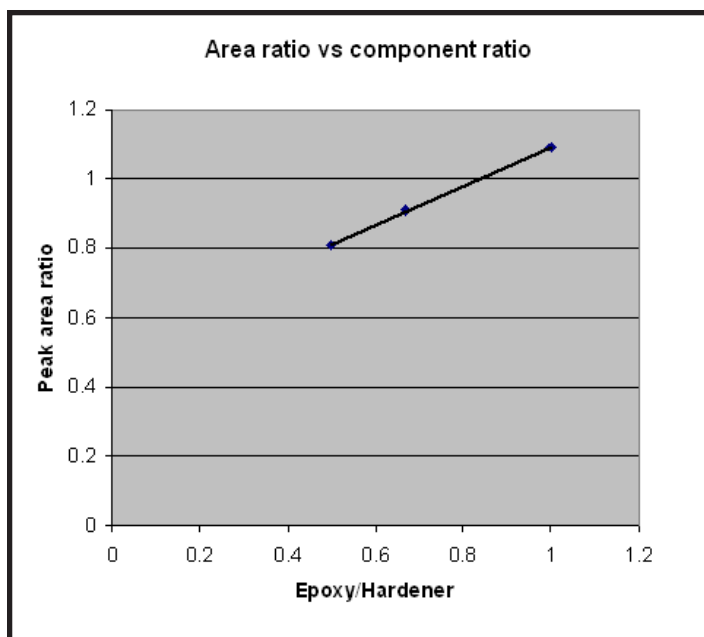


Figure 3. Graph of peak area ratio vs component ratio.

Experimental Parameters

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

Pyroprobe

Pyrolysis: 750°C for 15 seconds
 Interface: 325°C for 4 minutes
 Carrier flow: 30 ml/min

GC/MS

Column: 30 m x 0.25 mm 5% phenyl MS
 Carrier: Helium
 Split: 75:1
 Oven program:
 40°C for 2 minutes
 10°C/minute to 325°C

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

H. Nakagawa and S. Tsuge,
 Studies on Thermal Degradation of
 Epoxy Resins by High-resolution
 Pyrolysis-Gas Chromatography,
 J. Anal. Appl. Pyrolysis 7 (1987) 113.

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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