

Application Note Paints & Coatings

Author:

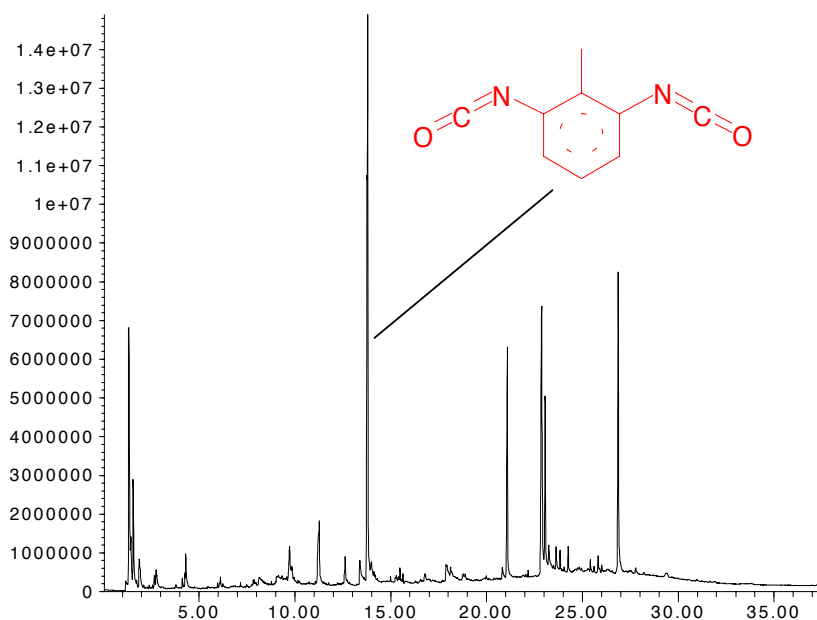
T. Wampler

Polyurethanes are a versatile group of polymers found in a wide array of manufactured products ranging from packaging foams, through elastics, paints and molded goods. All polyurethanes are produced from a polyol and a diisocyanate, and when pyrolyzed, polyurethanes regenerate the diisocyanate, which may be used as a marker for this family of polymers. This is true whether the material is a pure polyurethane or a blend or composite with only a small amount of polyurethane in the composition.

Figure 1 shows the pyrogram of a typical clear-gloss exterior polyurethane finish for wood. About 100 μg of the dried finish was heated to 750°C for 15 seconds to produce the pyrolysis compounds. The diisocyanate in this product is toluene diisocyanate (TDI) which elutes at about 14 minutes and is the largest peak in the chromatogram. The later eluting peaks are long-chain unsaturated fatty acids, including oleic acid.

A polyurethane material used for shoe soles was pyrolyzed to produce the pyrogram in Figure 2. In this case, the diisocyanate was 1,1'-methylenebis(4-isocyanato-benzene) (MDI), which is also regenerated from the polymer and in this case is again a major peak in the chromatogram, eluting at about 22 minutes. The peak at 4 minutes is cyclopentanone, which is produced from adipic acid containing polymers, and indicates that the polyurethane used a polyester-type polyol in its formulation.

Abundance



Time-->

Figure 1. Clear polyurethane finish.

Instrument Conditions

Pyroprobe

Valve Oven: 300°C
Temperature: 750°
Time: 15 seconds
Clean temp.: 1000°C
Time: 10 seconds
Purge flow: 20 ml/min

GC/MS

Column: 5% phenyl (30m x 0.25mm x .25µm)
Carrier: Helium, 75:1 split
Injector: 300°C
Oven: 40°C for 2 minutes
10°C/min to 300°C hold 5 min
Scan Range: 35-500 amu

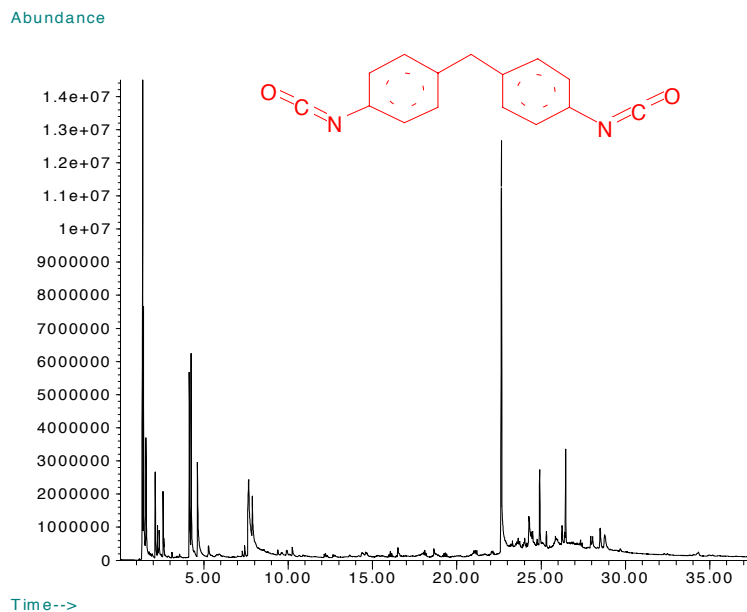


Figure 2. Polyurethane shoe sole.

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

H. Ohtani et al., Characterization of Polyurethanes by High-Resolution Pyrolysis-Capillary Gas Chromatography, JAAP, 12 (1987) 115-133.