CDS solutions

APPLICATIONS INFORMATION USING ADVANCED SAMPLE HANDLING TECHNOLOGY

Laser Toner Analysis by Pyrolysis-GC/MS

The toner materials used in laser printers and photocopiers are frequently a combination of organic polymers or copolymers and inorganic materials like metal oxides used as pigments. It may be of interest to analyze these toners alone, for manufacturing and qualtiy control purposes, or to analyze them after they have been printed onto paper, as in questioned document investigations. In either case, pyrolysis-GC or pyrolysis-GC/MS offers a simple and effective technique for unraveling such a complex sample.

When paper (which is essentially cellulose) is pyrolyzed, it produces CO_2, water, oxygenates like furans and aldehydes, small hydrocarbons and levoglucosan. Figure 1 shows a pyrogram of a standard white paper used with laser printers, without toner. When a piece of the same paper which contains toner is pyrolyzed, the pyrogram includes all the cellulose pyrolysate peaks plus peaks from the organic material used in the toner. In this case, the toner was made using a copolymer of styrene and butyl acrylate, and the monomer peaks are easily seen in Figure 2. In fact, the styrene monomer peak is by far the largest peak, and styrene dimer and trimer may be seen as well.

The first ten minutes of these pyrograms have been expanded for easier comparison in Figure 3. Other toner formulations may include additional monomers, such as other acrylics, which are also readily identified using pyrolysis-GC/MS.

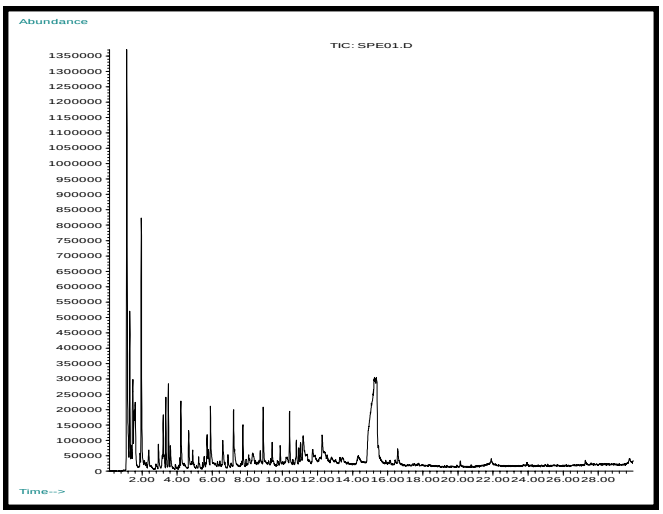

Figure 1

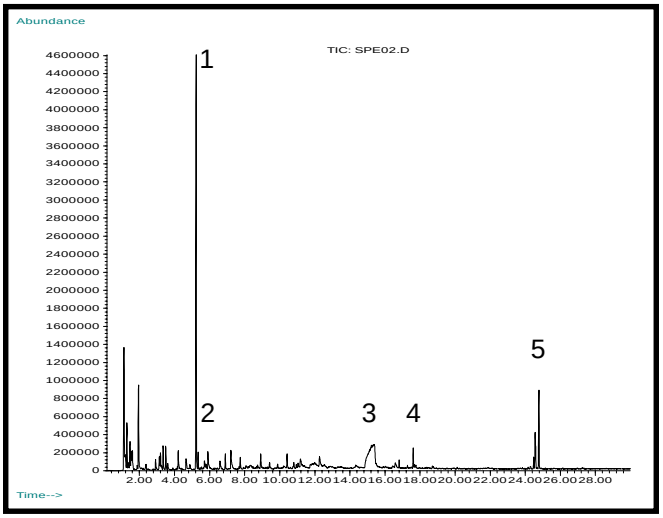

Figure 2

Peak Identification for Figures 2 and 3

1. Styrene monomer
2. Butyl acrylate monomer
3. Levoglucosan (from cellulose)
4. Styrene dimer
5. Styrene trimer

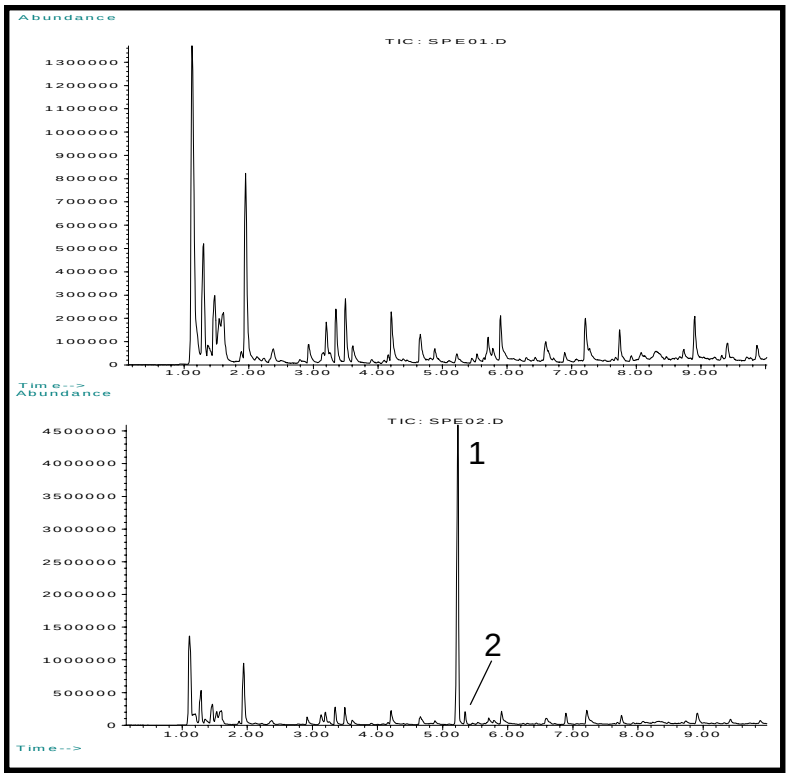

Figure 3. Upper - paper only, lower - paper with toner

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 min
Ramp:	10°C/min
Final temperature:	290°C for 10 min

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

J. Zimmerman, D. Mooney and M. Kimmett, Preliminary Examination of Machine Copier Toners by Infrared Spectrophotometry and Pyrolysis Gas Chromatography, J. Forensic Sci., 31, 2, (1986) 489.

T. Wampler and E. Levy, Applications of Pyrolysis Gas Chromatography/ Mass Spectrometry to Toner Materials from Photocopiers, J. Forensic Sci. 31, 1, (1986) 258.

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, Inc.

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