

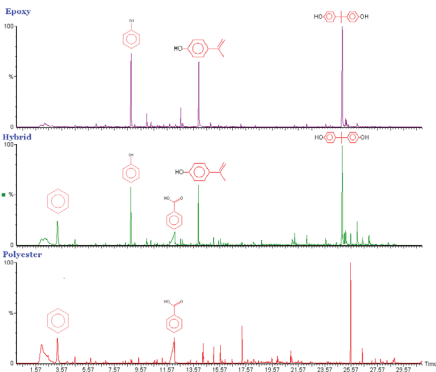
# A Practical Applications Guide for Analytical Pyrolysis – GC/MS

Forensic



# Powder-Coat Paints

Placing a suspect at the scene of a crime is crucial when solving crimes. This is achievable through the identity of trace evidence. Evidence such as paints, fibers, toner, ink and cosmetics can easily be characterized. In this example, powder-coat paints are differentiated from each other. Epoxy (top pyrogram) is identified by bisphenol A, and isopropenyl phenol, while benzoic acid is indicative of polyester (bottom pyrogram). A blend or hybrid (center pyrogram) has pyrolysis products of each.



Typical powder coatings. Epoxy (top), Polyester (bottom) and Hybrid (center).

## Pyroprobe Setting

Set-point: 750°C for 15 s

Valve Oven: 325°C

Transfer Line: 325°C

## GC/MS Setting

Column: 35% Phenyl

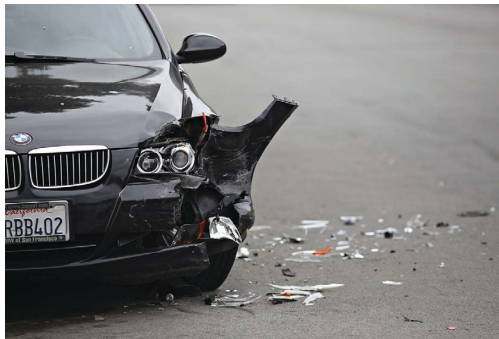
Carrier: Helium, 50:1 split

Injector: 325°C

Oven: 40°C for 2 min

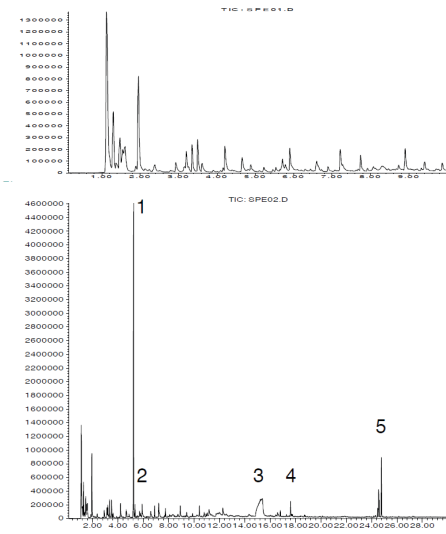
10°C/min to 300°C

Scan Range: 35-550 amu



# Toner Inks

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. Toners can be analyzed printed onto paper, important for questioned document investigations. The following pyrograms are toners printed on paper. Pyrolysis products of the toner, peaks 1,2,4, and 5, are acrylate monomer and styrene oligomers are easily recognizable from the paper itself.



Upper - paper only, lower - paper with toner

## Peak Identification

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

**Pyroprobe Setting**

Set-point: 750°C for 15 s

Valve Oven: 300°C

Transfer Line: 325°C

**GC/MS Setting**

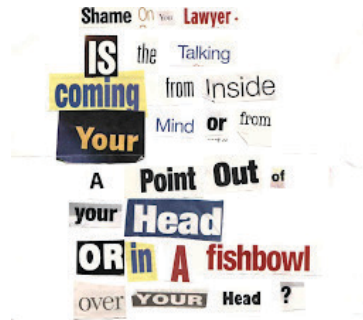
Column: 5% phenyl

Carrier: Helium, 50:1 split

Injector: 300°C

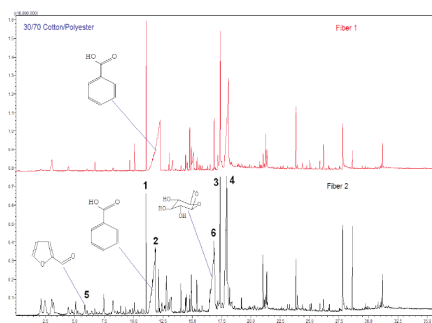
Oven: 40°C for 2 min  
6°C/min to 295°C  
hold 10 min

Scan Range: 35-550 amu



# Textile Fibers

Fibers transferred to a crime scene can be strong evidence. Often, one fiber is plenty of sample to identify its polymer type. Fiber blends are like other polymer blends or mixtures when analyzed; the individual polymers pyrolyze independently, and the resulting pyrogram contains pyrolysates from each of the constituents. In the following example, trace fibers both contained in a fabric listed as 30% cotton. When pyrolyzed, Fiber 1 has only pyrolysis products for PET polyester, but Fiber 2 has peaks from cellulose in cotton (specifically furfural and levoglucosan) as well as the benzoic and terephthalic acid products from PET.



Cotton/polyester fiber blends. Fiber 1 is pure polyethylene terephthalate (PET). Fiber 2 is a blend of PET and cotton.

## Pyroprobe Setting

Set-point: 750°C for 15 s

Valve Oven: 300°C

Transfer Line: 325°C

## GC/MS Setting

Column: 5% phenyl

Carrier: Helium, 75:1 split

Injector: 300°C

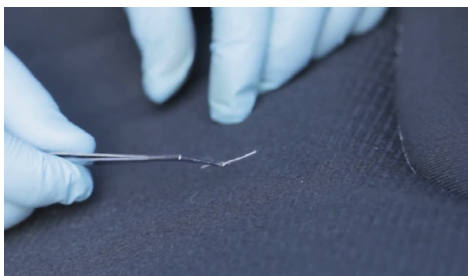
Oven: 40°C for 2 min

10°C/min to 325°C

Scan Range: 35-550 amu

## Peak # Compound

- 1 Vinyl benzoate
- 2 Benzoic acid
- 3 Divinyl terephthalate
- 4 Terephthalic acid monovinyl ester
- 5 Furfural
- 6 Levoglucosan
- 7 Acrylonitrile
- 8 Hexene dinitrile



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