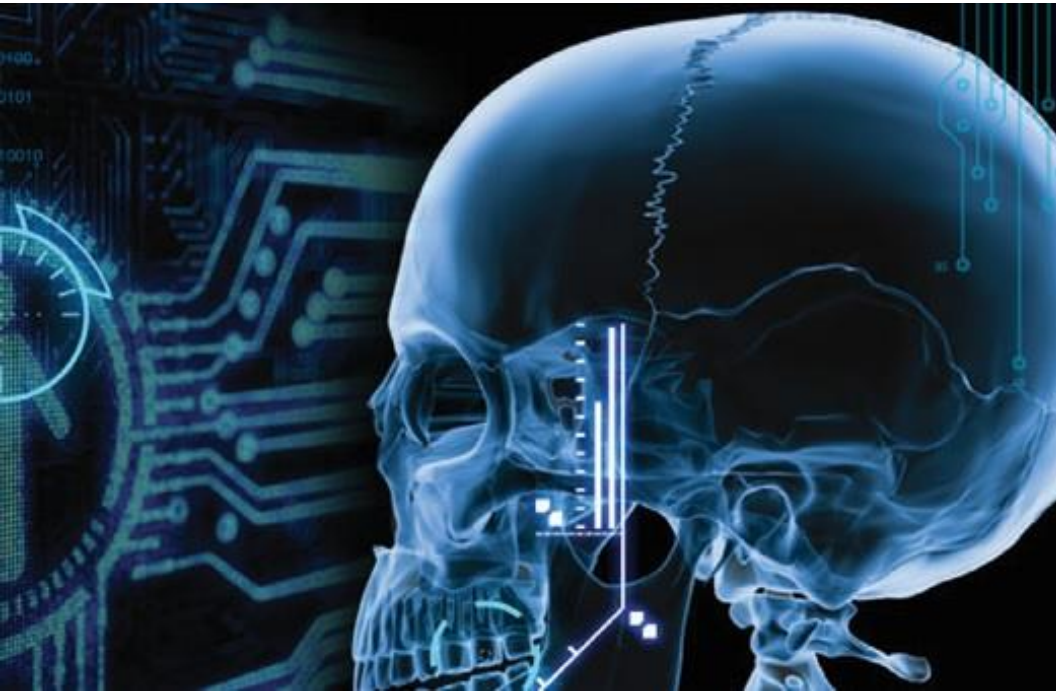


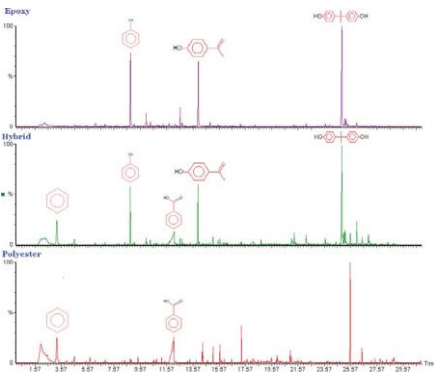
A Practical Applications Guide for Analytical Pyrolysis -GC/MS

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.



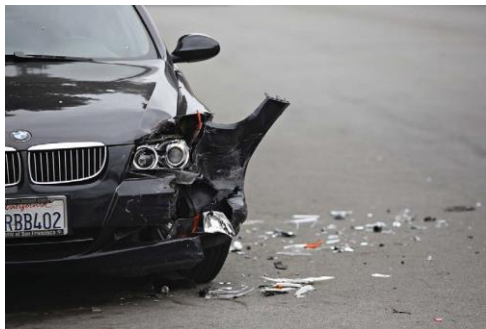
Typical powder coatings. Epoxy (top), Polyester (bottom) and Hybrid (center).

Pyroprobe Setting

Set-point: 750°C for 15 s
Valve Oven: 325°C
Transfer Line: 325°C

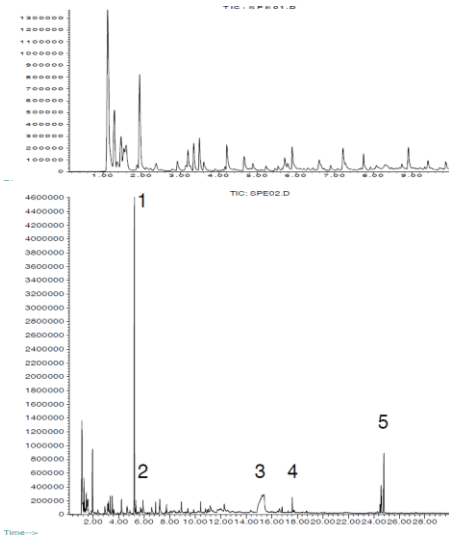
GC/MS Setting

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 analysed 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 recognisable 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

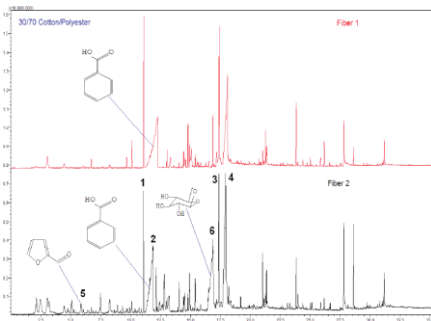
GC/MS Setting

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 Fibres

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



Cotton/polyester fibre blends. Fibre 1 is pure polyethylene terephthalate (PET). Fibre 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

