Forensic Paint Analysis

Forensic Science
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Importance of Paint in Forensic Science

• Painted surfaces are everywhere!
• Paint is one of the most prevalent types of evidence received by crime labs
• Most frequently encountered in hit-and-run and burglary cases:
  – Paint from car transferred to victim
  – Paint from house transferred to tool during burglary
Importance of Paint in Forensic Science

• Forensic scientist can compare paint from house to paint stuck on burglar’s tool
• Forensic scientist can also analyze paint from a hit-and-run to determine color, make, and model of car!
Automobile Paint

• Cars paint have several layers:
  – Electrocoat primer—electrically bonded to the steel of the car
  – Primer surface—smooths out the surface of the car, highly colored
  – Basecoat—“eye appeal” layer
  – Clearcoat—clear, glossy, improves durability
Comparison of Paint (continued)

• Layers of automobile paint
  – Electrocoat primer – applied to the steel body of a car for corrosion resistance; colors range from black to grey
  – Primer surfacer – applied to the primer to completely smooth it out and hide any seams or imperfections; highly pigmented (light grey for lighter colored cars and red oxide for darker cars)
Comparison of Paint (continued)

• Layers of automobile paint (continued)
  – Basecoat – the actual color of the vehicle
  – Clearcoat – unpigmented; improves gloss, durability, and appearance
Microscopic examination of Paint

• **Color is the most distinguishing characteristic of paint**

• **Stereomicroscopes can compare surface texture and color layer sequence**
  – Layer Structure is very important
  – If two samples with several layers match up, then they MOST LIKELY came from the same source

*Stereomicroscope picture of layers of automotive paint*
Microscopic Examination of Paint

• The microscope is the most important instrument for locating and comparing paint specimens
• Color is the most distinctive forensic characteristic of paint
• An examiner observes color layers and tries to match the number and sequence of colors. This process can connect paints to a common origin
• Unfortunately, most paint specimens do not have layers that can be individualized to a single source, so a chemical analysis must be done
Techniques Used in Paint Comparisons

• Characterization of paint binders
  – Pyrolysis gas chromatography
    • Many solids cannot be injected into a gas chromatograph, so items must be heated, or pyrolyzed, to high temperatures so they will decompose into gaseous products
    • Then they are put into a chromatograph, and a pyrogram is produced showing the chemical makeup of the binder
    • Even the smallest of paint chips can be pyrolyzed and sent through the gas chromatograph
    • Pyrograms can distinguish one polymer from another
Techniques Used in Paint Comparisons (continued)

• Characterization of paint binders (continued)
  – Infrared spectrophotometry
    • Binders absorb infrared radiation to yield a spectrum that is characteristic to that specimen
IR Spectrophotometry

• Did these two paint samples come from the same source? Why or why not?
Techniques Used in Paint Comparisons (continued)

• Characteristics of paint pigments
  – Emission spectrograph
    • Can detect 15 – 20 elements in auto paint simultaneously
    • Some are common to all paints, but others have significant forensic uniqueness
Identification by Emission Spectroscopy

• **Unique elements produce a unique line pattern (like a barcode) when “excited” (for example, by an electric arc)**
Significance of Paint Evidence

• How to tell if two similar paints come from the same surface
  – Paint layers beneath the surface layer offer valuable points of comparison
  – Color charts for automobile finishes are available from manufacturers
  – Paint Data Query (PDQ)
    • A database that provides information on paints based on make, model, and year
    • Maintained by the Royal Canadian Mounted Police
Collection and Preservation of Paint Evidence

• Paint evidence is mostly involved in burglaries and hit-and-run incidents

• Paint chips should be picked up with forceps and placed in a paper druggist fold or a glass or plastic container
Collection and Preservation of Paint Evidence (continued)

• If paint is smeared on or embedded into something, package the entire item
• With hit-and-run cases, collect uncontaminated paint from an undamaged area as a reference for comparison
• ¼-inch square samples are sufficient, but you must go all the way to bare metal
Collection and Preservation of Paint Evidence

• Collect sample from undamaged area of vehicle for comparison

• Scrape paint with clean scalpel or knife blade

• Tools used to break into building may contain paint and other trace evidence—package the WHOLE tool

• Collect reference samples from the area around the break-in for comparison
Resources


