

## Characterization of Paint Chips

### References

- Saferstein, Richard. *Criminalistics: An Introduction to Forensic Science*, 6th edition, Prentice Hall: Englewood Cliffs, 1998; pp 239-249. {paint analysis}
- Skoog, D.A.; Holler, F.J.; Nieman, T.A. *Principles of Instrumental Analysis*, 5<sup>th</sup> ed.; Saunders: Philadelphia, 1998; Chapters 16 & 17. {Infrared spectrophotometry}

### Goal

To determine the layer structure, top-coat color, and top-coat composition of automotive paint or paint from a work of art.

### Suggested Methods of Analysis

Microscopy, reflectance visible spectrophotometry, FT-Raman spectrophotometry

### Materials

Paint chips from automobiles stored in sealed plastic bags

### Microscopy

Prepare a small amount of epoxy cement, and transfer a drop to a microscope slide. Use tweezers to place a small paint chip edge on into the drop of epoxy. The paint surface should be perpendicular to the slide. Up to six paint samples will fit on one microscope slide. Illuminate the sample from above and observe the edge of the paint chip with a microscope at the highest possible magnification. Record the number, color, and thickness of the layers.

### Infrared Diffuse Reflectance

A diffuse reflectance accessory in the FT-IR spectrophotometer is used to determine the composition of the clearcoat in the paint. Follow the operating instructions for the instrument. Use some dry, ground KBr as reference material to optimize the optics to give maximal reflected energy and to obtain a background (100% T) spectrum. Take 16 scans at a resolution of  $4\text{ cm}^{-1}$  from  $550\text{ cm}^{-1}$  to  $4200\text{ cm}^{-1}$ .

Cut with a razor blade a paint chip to fit the sample holder containing the KBr solid. Gently place the paint chip on top of the KBr. Ensure that the sample lies flat and that the alignment laser passes through the middle of the sample. Obtain a spectrum of the paint sample versus the KBr background using the same parameters as above.

Compare the wavelength characteristics of the sample spectra to decide whether two of the paint chips could have the same origin.

### Visible Diffuse Reflectance

A diffuse reflectance (integrating sphere) accessory in the UV-Vis spectrophotometer is used to determine the exact color of a paint sample. Follow the operating instructions for the instrument. First, set the 100% reflectance background with a reference (Teflon) disk covering

the sample port of the integrating sphere. Record the visible spectrum from 350 nm to 800 nm. Next, position the paint sample over the sample port using non-stick tape and record its visible spectrum. Repeat for all of the samples.

Compare the wavelength characteristics of the sample spectra to decide whether two of the paint chips could have the same origin.