

	<b>TRACE-PM 9.1 Terminology and Introduction to Paint Analysis</b>	
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	Document Manager: Cheryl Lozen	Approved By: Ryan Larrison

## 9.1 Terminology and Introduction to Paint Analysis

### 9.1.1 Introduction

The challenge and responsibility of a Forensic Scientist performing a paint comparison is to find a significant difference, if it exists, in the paints being compared. The absence of a significant difference at the conclusion of an analysis constitutes or suggests similarity between the compared samples in all tested characteristics. The strength, or degree, of this similarity will depend on a number of factors, including the following: the type and number of matching physical characteristics; the type and relative abundance of components in the paint film; the presence or absence of studies quantifying the uniqueness of these components; and the discriminative power of the tests performed.

Limited sample size and sample preservation requirements dictate that the comparative tests must be selected and applied in a reasonable sequence in order to maximize the discriminating power of the test results.

### 9.1.2 Paint Terminology

For definitions of terms used in these guidelines other than those listed, see ASTM D16 Terminology Relating to Paint, Varnish, Lacquer, and Related Products.

**Additive (modifier):** Any substance added in a small quantity to improve properties. Additives may include substances such as dryers, corrosion inhibitors, catalysts, ultraviolet absorbers, and plasticizers.

**Binder:** A nonvolatile portion of a paint which serves to bind or cement the pigment particles together.

**Coating:** A generic term for paint, lacquer, enamel, or other liquid or liquefiable material that is converted to a solid, protective, or decorative film or a combination of these types of films after application.

**Discriminate:** To distinguish between two samples on the basis of significant differences; to differentiate.

**Discriminating Power:** The ability of an analytical procedure to distinguish between two items of different origin.

**Known Sample:** A coating sample of established origin.

**Paint:** Commonly known as a pigmented coating.

**Pigment:** A finely ground, inorganic or organic, insoluble, and dispersed particle. Besides color, a pigment may provide many of the essential properties of paint such as opacity, hardness, durability, and corrosion resistance. The term pigment includes extenders.

**Questioned Sample:** A coating sample whose original source is unknown.

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**Significant Difference:** A difference between two samples that indicates that the two samples do not have a common origin.

## 9.1.3 Minimum Standards & Controls

### 9.1.3.1 Minimum Standards of Analysis with Adequate Samples

Microscopic examination of color, texture, layer sequence and thickness, infrared spectroscopy binder analysis and elemental analysis (e.g., SEM-EDS, u-XRF). Other tests that can be used in conjunction with the above examinations are chemical reactivity tests, pyrolysis gas chromatography, and microspectrophotometry.

### 9.1.3.2 Making a Conclusion

A conclusion regarding a paint comparison can be rendered if one or more of the following exists.

- A physical match.
- Comparison of the physical characteristics, organic and inorganic components.
- A comparison of any physical or chemical property that results in an elimination.
- The observation or determination of an unusual quality possessed by the comparison samples.

### 9.1.3.3 Documentation

- All instrument hard copies generated from case exhibits must contain the case number, exhibit number, analyst's initials and date.
- Pertinent instrument parameters used for an analysis must be documented in the procedures manual or in the case record.
- All calibration data shall be retained and dated.
- Worksheets will include the tests performed and the results obtained.
- Identification or classification made by comparison to other than in-house standards must be noted in the case record.
- Identification or classification made via computer search must be confirmed by visual comparison to computer's standard and noted in the case record.

### 9.1.3.4 Analytical Techniques

#### 9.1.3.4.1 Chemical Reactivity Tests

- Control: Nitrocellulose or a known nitrocellulosic paint sample will be used as the control for the diphenylamine reagent and noted in the case record or reagent log.
- All reagents will be properly labeled, initialed by the preparer and dated.

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- The reaction of the comparison samples will be noted on the worksheet.

#### **9.1.3.4.2 Pyrolysis Gas Chromatography**

- Blank of the cleaned sample boat or tube will be run immediately prior to each sample. The blank can be done using a five-minute isothermal run at the program maximum temperature.
- The instrument parameters used for an analysis must be documented in the procedures manual or in the case record.

#### **9.1.3.4.3 Fourier Transform Infrared Spectrometer (FTIR) - Also see 7.2 FTIR Minimum Standards and Controls**

- Check that the ATR, salt plate or slide is clean before using
- Background scans should be run in conjunction with the sample(s)
- IR Spectra shall include case number, exhibit number(s) and analyst's initials. Date, resolution, number of scans, frequency range and mode (absorbance or %T) must be recorded within the case record, such as on the spectra or in the worksheet notes.
- IR Spectra must be preserved in the case record object repository.

#### **9.1.3.4.4 Scanning Electron Microscope with Energy Dispersive X-Ray System - Also see 7.4 SEM-EDS Minimum Standards and Controls**

- A copper-aluminum calibration standard will be run each day a case sample is run.
- Data from the EDS will include accelerating voltage, date, peaks identified, case number and analyst's initials. Method of generation must be included in the case record.
- Data from the EDS must be preserved in the case record object repository.

#### **9.1.3.4.5 Micro-Xray Fluorescence Spectrometry (u-XRF) - Also see 7.5 EDAX Micro X-ray Fluorescence Minimum Standards and Controls**

- The u-XRF must be calibrated each day it is used for casework analysis.
- Data from the XRF will include date, peaks identified, case number and analyst's initials.
- Data from the XRF must be preserved in the case record object repository.
- The case record must include the instrument parameters.

#### **9.1.3.4.6 Microspectrophotometry (MSP) – Also see 7.1 Microspectrophotometer**

- Verification with NIST Traceable Standards shall be performed each day samples are run, prior to use of the instrument for any casework
- Data from the MSP will include date, case number, item number(s) and analyst's initials
- Data from the MSP must be preserved in the case record object repository.
- The case record must include the instrument parameters.

### **9.1.4 Sample Handling**

Some examples of how to recover/collect paint samples are manual removal with scalpels, forceps or by gentle scraping.

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Care should be taken when handling known and questioned samples.

- The examiner shall change gloves and clean their tools between examining/handling the evidence from the known source and the questioned evidence.
- Ideally, different tools should be used for the known and questioned samples, but at a minimum, the tool should be examined for cleanliness with a stereoscope before use on an evidence item.
- The examiner shall change the examination paper between questioned paint and known paint exhibits. The examiner may change the paper between multiple victim, suspect or scene items, as necessary.
- Care should be taken to prohibit debris that may be adhering to the exterior surfaces of evidence containers, from being introduced into any sampling or collection of debris/samples from items inside those containers. Ensure that the sampling technique utilized prevents such an occurrence.

### 9.1.5 Safety Considerations

See FSD Health & Safety Manual

This protocol involves the use of dangerous chemicals, temperatures, or radiation sources. This protocol does not purport to address all the possible safety hazards or precautions associated with their application. It is the responsibility of the analyst prior to use to review and implement appropriate safety and health practices.

The MSDS must be consulted unless the analyst is already aware of the hazards associated with the chemicals to be used.

### 9.1.6 References

[ASTM E1610-18 - Standard Guide for Forensic Paint Analysis and Comparison](#)

[ASTM E2808-19 - Standard Guide for Microspectrophotometry in Forensic Paint Analysis](#)

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ASTM D16 Terminology Relating to Paint, Varnish, Lacquer, and Related Products.