Visual and Microscopical Examination of Polymeric Evidence

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1 INTRODUCTION

This procedure describes the general approach used to characterize and compare a variety of polymeric materials received for analysis.

2 SCOPE

This procedure applies to Chemistry Unit caseworking personnel who perform visual and microscopical examinations on polymeric evidence.

3 EQUIPMENT

- Stereo microscope (~6X to ~100X) with appropriate lighting (such as an annular ring light or fiber optic lights)
- General Laboratory Supplies (e.g., tweezers, glass microscope and well slides, pillboxes, scalpel handle and blades, large flat blade spatula, probes: steel, tungsten, wood)
- Large sheets of untreated kraft paper (or equivalent)
- Micrometer, 0-1" range, accurate to 0.0001", or equivalent
- Ruler with a minimum of 1/16" gradations
- Digital camera or equivalent

4 SAMPLING

Refer to the current version of PP-800 for guidance in selecting samples for analysis and comparison. Record the samples selected in the case notes.

5 PROCEDURE

5.1 Visual and Microscopical Examination

Use written descriptions, sketches, photography, or other imaging methods to capture both visual and microscopical characteristics and observations. If the items are suitable for further examination, record a detailed description of each item to include comparative features or any unusual conditions (e.g., commingled material).

A. Process each item separately to prevent cross-contamination.

B. Transfer the item from its original container to a suitable substrate (e.g., paper, glass microscope slide, pillbox) to examine both visually and microscopically. Evidence

that is too large or bulky to fit under a conventional stereomicroscope for examination can be handled as follows.

1. Use a modified base for the stereomicroscope.

2. Alternatively, section and examine an area of interest from the bulk material.

C. Some specimens require processing or preparation prior to examination.

1. Clothing: Examine each article of clothing visually and microscopically for evidence of a polymeric material transfer.

i. If a potential polymer transfer is embedded or abraded onto the fabric, take a cutting which includes a sample of the transferred substance and preserve it for future examination. See C.2. for further instructions regarding smears.

ii. Process each article of clothing as it was received (i.e., individually or collectively packaged) and isolate the debris in the same manner (i.e., one pillbox per package).

iii. Suspend the item from a rack over a large sheet of paper and carefully scrape all surfaces in a downward motion with the edge of a large flat-bladed spatula or similar tool to dislodge any remaining polymeric evidence.

iv. Collect the deposited debris and transfer it to an appropriately labeled pillbox or other container for microscopical examination. See C.3. for further instructions regarding debris.

2. Smears: Oftentimes, the amount of energy imparted in a transfer of polymeric material will cause it to melt or soften and resolidify, fusing the polymer to the substrate.

i. If fused or embedded onto a surface, remove particles and fragments using a clean suitable tool (e.g., tweezers, scalpel) while observing under a microscope. If the item will be subsequently examined for toolmark comparisons, relatively soft, pliable materials such as wood or Teflon™ should be used in place of a metal blade to dislodge the suspected polymeric material from the surface.

ii. The fabric weave of an article of clothing can be stretched in order to facilitate removal/dislodging polymeric particles.

iii. Transfer isolated particles/fragments to an appropriately labeled well slide or pillbox for future examination.

iv. Smeared samples can be contaminated with material from the surface upon which it is impacted (e.g., soil, fibers, paint, wood) thereby affecting the chemistry and/or color of the sample. If appropriate, take a control sample of the substrate close to but not within the area containing the smear.

3. Debris: Polymeric evidence can be mixed in with other materials that are not probative for examination by Paints & Polymers (PP) personnel (e.g., fibers, glass, soil).

i. Examine the contents of the debris microscopically, manipulating it with the appropriate tools (e.g., tweezers, scalpel, probe) and isolate any plastic-like materials.

ii. Transfer these materials to an appropriately labeled well slide or pillbox for future examination.

iii. To decrease the likelihood that polymeric evidence has been overlooked, another qualified PP analyst can examine the debris. Alternatively, the primary analyst should re-examine the debris on a different day. Record the results of these subsequent analyses in the case notes.

D. Once isolated, observe the surface of the specimen(s) and record color, morphology, degree of gloss, texture, the presence of manufacturer markings, the presence of surface striae, defects, or any other characteristics that help to describe the item.

E. Record the overall shape and nominal dimensions of the item such as length, width, and thickness. Nominal measurements can be taken with a ruler.

F. View the specimen(s) at ~6X to ~100X magnification and determine if it is multi-layered. Record all observations in the case notes.

1. Obvious layers can be exposed/observed by a number of techniques which include, but are not limited to, viewing the sample on edge, cross-sectioning by hand, cross-sectioning by encapsulation and microtomy or polishing, making an oblique (bias) cut through the sample, or taking a series of thin peels through each layer.

2. A combination of techniques can be used to fully characterize the layer structure. The extent of sample manipulation and preparation will depend on the amount of sample available, its complexity, and its characteristics.

5.2 Sourcing Examination

A. Record any observed manufacturer markings found on a sample with descriptive notes to include any letters, numbers, or symbols observed on the item as well as the relative location of the marking. If imaging techniques such as photography are used, include a scale or notation of the magnification in the image.

B. Employ resources within and outside the FBI Laboratory as applicable (e.g., industry contacts) to develop additional information about the potential source(s) of the item. Record these communications in the case notes and communication log according to the Quality Assurance Manual.

5.3 Physical Fit Evaluations

A. Observe the specimens for possible physical fits (i.e., fracture matches). A physical fit can be recognized by the alignment of broken edges, manufacturer markings, and/or surface anomalies (e.g., striae, texture).

1. Physical fit determinations are the most conclusive type of examination and must be recorded with descriptive notes and imaging techniques.

2. Include a measuring scale in any collected images when practicable. If not practicable, annotate the image with the magnification used.

B. A second PP examiner must observe and record concurrence with suspected physical fit results between known and question specimens.

6 ACCEPTANCE CRITERIA

- If physical characteristics of two (or more) specimens being compared differ, cease examinations and report that the specimens differ.

- Acceptance criteria for a physical fit are described in section 5.3.

7 LIMITATIONS

- Sample size and condition can preclude conducting certain examinations, including color assessment.

- Sourcing capabilities of common synthetic polymeric materials is limited. This is directly related to the abundance of such materials in the marketplace and the number of end uses for a particular polymeric material.

- Reporting a potential source for automotive parts (i.e., vehicle make/model/year) is limited to the manufacturer's part numbers. For automotive parts, the SAE (Society of Automotive Engineers) numbers can only provide information as to the function of the part on the automobile.

8 REFERENCES

PP-800, FBI Laboratory, Chemistry Unit – Paints and Polymers

9 REVISION HISTORY

Revision	Issued	Changes
05	06/15/2022	Revised according to new QAM requirements and made general editorial changes throughout.