

General Approach to Paint, Tape, and Polymer Casework

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1 INTRODUCTION

The most common types of forensic paint evidence are automotive and architectural (e.g., house, do-it-yourself (DIY)) coatings. Cosmetic nail polish, tool, industrial, and non-automotive vehicle paints are also encountered.

The most common types of forensic pressure sensitive adhesive (PSA) tape evidence are duct tape, vinyl electrical tape, and packaging tape. Masking tape and clear office tape are usually analyzed by the Questioned Documents Unit (QDU).

Examples of general polymer evidence include automotive parts, plastics, or consumer products (e.g., glues, sealants).

Examination requests for any of these polymer-based materials involve either (1) characterizing a sample (e.g., determining whether a material is a polymer and what type, chemical composition, sourcing or end use), or (2) comparing samples to determine if they can be differentiated.

2 SCOPE

This procedure describes general guidelines for Chemistry Unit caseworking personnel who analyze paint, tape, or other polymeric evidence submitted to the FBI Laboratory. Separate, detailed technical procedures exist that cover sample processing and acquisition of both physical and chemical compositional data on each of these types of evidence.

3 SAMPLING

Due to the wide variety of examination requests, numbers of samples submitted, and conditions of the samples submitted, Paints & Polymers (P&P) examiner discretion will determine the appropriate sample(s) to examine on a case-by-case basis. For indistinguishable samples, as determined by a discretionary number of analytical examinations, an option is to take an individual sample, assign a new item identifier (e.g., Item 1-1), specifically list the item in the inventory, and discuss it independently in the *Laboratory Report*. Record the decision criteria used for determining the sample(s) selected in the case notes. If the complexity of the case warrants discussion of the sample(s) selection with another P&P examiner, also record this discussion in the case notes.

4 EVIDENCE CONSIDERATIONS

4.1 Physical Fit Evaluations

4.1.1 Paints/Polymers

The proper selection, collection, preservation, and packaging of any of the polymeric evidence received are of paramount importance in a forensic examination. The potential for a physical fit between the broken edges of a known and questioned sample should be considered before selecting a collection method. Care must be taken to keep the edges intact.

4.1.2 Tapes

When tape is used, pieces are torn or cut from the source roll; a physical reconstruction (i.e., physical fit) is possible between pieces and/or with the free end of the source roll of tape. Therefore, the potential for a physical fit between torn or cut tape specimens should be considered before collection in order to preserve all tape ends.

4.2 Processing

4.2.1 Paints/Polymers

Whenever possible, items with potential paint or polymer transfer (i.e., intact or present as a smear) should be submitted for examination in their entirety. Items of clothing should be processed with respect to how they are received (i.e., separately or collectively). If the investigation involves a motor vehicle, the recommended practice is to place brown kraft paper under the area where paint or automotive polymer transfer is suspected and then section, scrape, or cut the area of interest from the vehicle. Therefore, determine if this paper was submitted for P&P examination along with the collected paint and/or polymer samples.

4.2.2 Tapes

Whenever feasible, tape should be submitted still adhered to the original substrate. If this is not feasible, advise the contributor to manually remove the tape and place it adhesive side down on a clean, colorless piece of plastic sheeting (e.g., transparency film, Kapak® tubular rollstock). The tape should not be distorted or torn during this removal process. Once adhered to plastic sheeting, tape specimens can be packaged in cardboard boxes, paper bags, manila envelopes, or sealable plastic bags.

Partially-consumed rolls of tape should be packaged separately.

4.3 Known Samples

4.3.1 Paints/Coatings

In order to account for any possible variation in layer structure across a painted surface, “control” (i.e., known) samples should be taken from an area close to (but not within) any damaged area. If no damage is obvious, controls should be taken from several areas of the suspected substrate. In the case of motor vehicles, various layer systems and paint chemistries can be present on a single vehicle depending on factors such as different substrates (sheet metal or composite materials), horizontal versus vertical surfaces, stone chip susceptibility, and assembly plant spot repair. Aftermarket refinishes/repairs and weathering can also influence the paint system. “Control” specimens should comprise all of the layers of paint down to the parent substrate. This can be accomplished by a number of methods: sectioning an area of the painted surface, cutting a paint sample from the parent substrate using a clean blade or knife, lifting or prying loosely attached chips, or dislodging by gently impacting the opposite side of the painted surface.

4.3.2 Tapes

If tape bindings from different areas of a victim's body are submitted, there is a potential to be able to physically fit the ends together to form a continuous piece(s) of tape. This process can limit the number of tape samples that need further evaluation and provide a possible sequence of removal of the tape pieces from an open roll of tape. Unless there is a specific reason to evaluate unopened rolls of tape, only partially consumed rolls will be used for comparative examinations to pieces of tape.

4.4 Preserving Sampled Evidence

4.4.1 Paints/Coatings

Paint chips should be confined between two glass microscope slides, contained in pharmacy folded paper, or packaged in covered containers (e.g., pillboxes, glass or plastic vials). Plastic bags, cotton, and envelopes should not be used as the inner packaging for paint specimens.

Other items, such as tools or sections of automotive parts, should be safely packaged (i.e., minimize injury or compromising the packaging with sharp edges) separately and precautions taken to minimize the potential for dislodging the suspected paint transfer during transport to and from the FBI Laboratory.

4.4.2 Tapes

If the tape is cut during removal or in another unit prior to receipt in P&P, it is imperative that each cut is initialed and executed using a tool that produces a unique pattern (e.g., pinking shears).

5 PROCEDURE

5.1 Review Request

Conduct a critical review of the contributor's request and the item(s) received.

5.2 Clothing Substrates

Process clothing for paint, tape, or polymeric trace evidence transfer prior to any fabric impression or DNA examinations. Regardless of which unit receives the evidence first, P&P personnel will then visually and/or microscopically examine the items and any associated debris for paint/polymer evidence.

5.3 Paint Characterization

A paint characterization is performed using some or all of the methods outlined in Figures 1 and 2. These flowcharts have been created based on the guidance set forth in ASTM E1610 *Standard Guide for Forensic Paint Analysis and Comparison*. A P&P technical procedure also describes each analytical technique depicted. The case notes will record the techniques used. Testing is stopped when the analyst determines that there is sufficient data to report on the chemical composition or source of the paint.

5.4 Paint Comparison

In a comparison examination, establish if any differences are detected between two (or more) samples after subjecting them to the analytical testing schemes described in Figures 1 and 2. Testing is stopped when the analyst determines that there is sufficient orthogonally derived data to report whether exclusionary differences exist between compared paint evidence. As such, not all techniques may be conducive or needed for all paint examinations. The casenotes will record the techniques used. The rationale to exclude IR, SEM/EDS, or pyGC/MS will also be recorded.

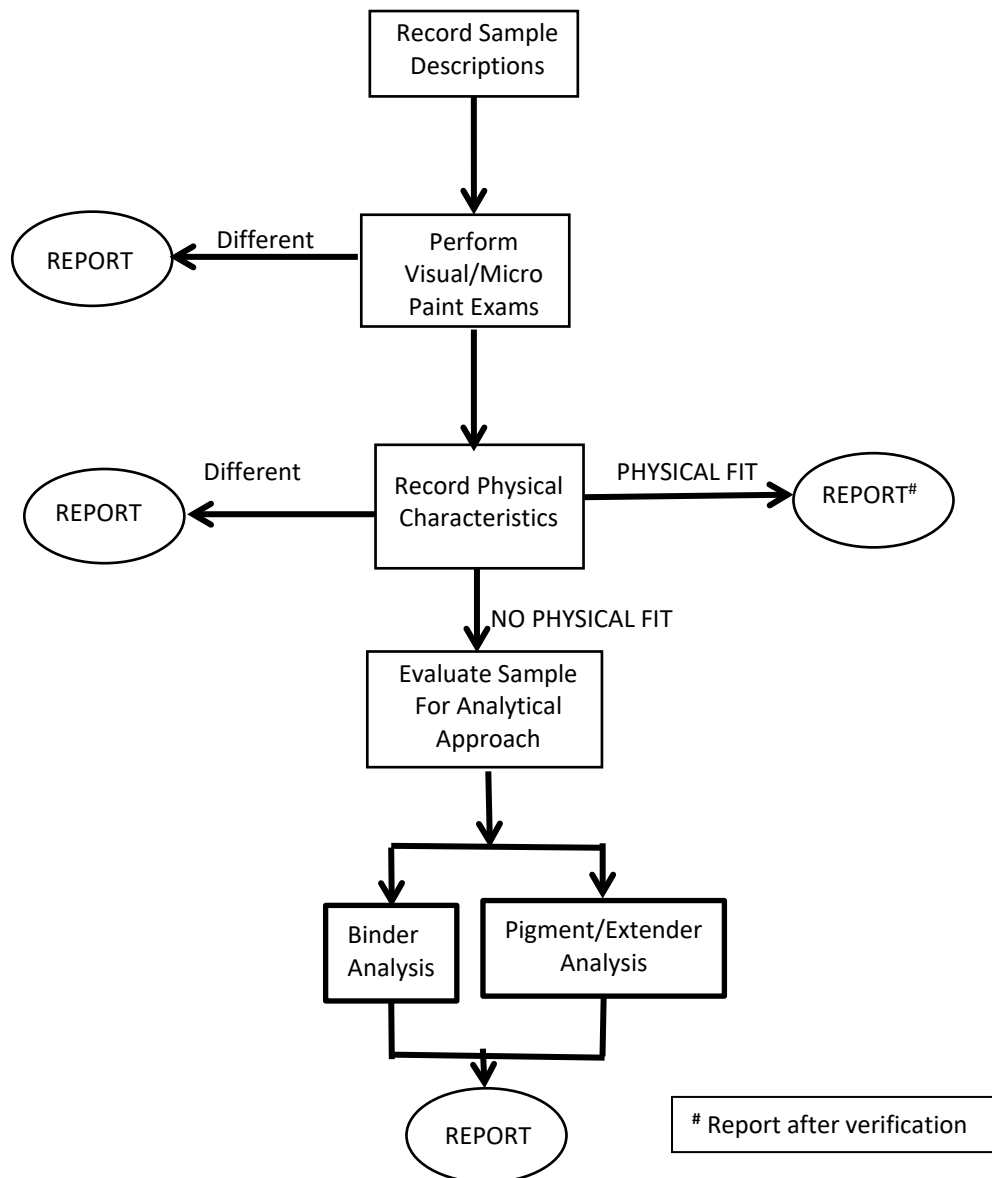


Figure 1. Paint Analysis Scheme

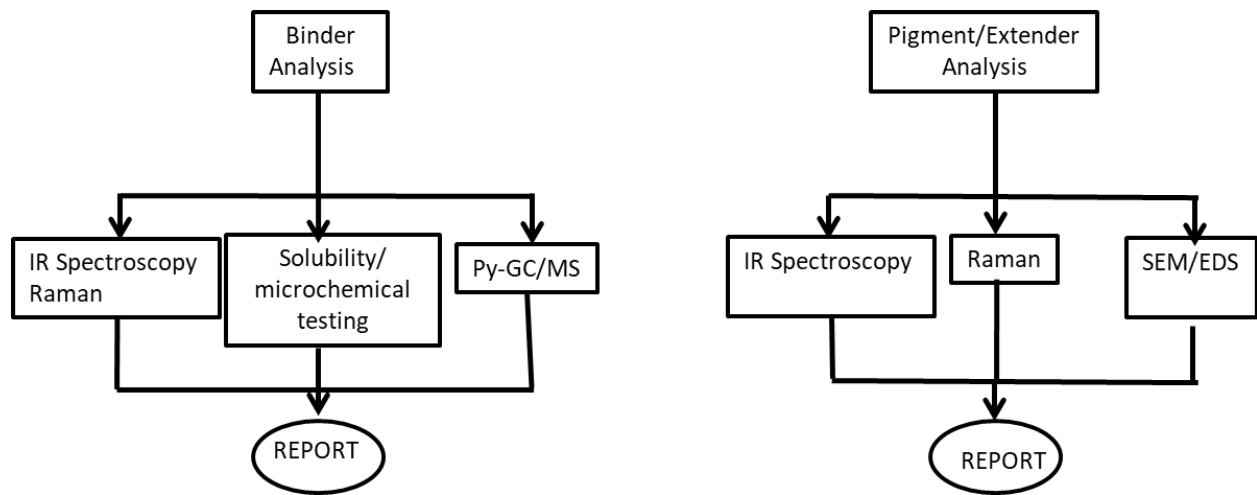


Figure 1. Binder and Pigment Analysis

5.5 OEM Paint Sourcing

If the paint sample is a factory-applied, original equipment manufacturer’s (OEM) automotive finish, several reference collections and databases exist to aid in developing possible make, model, and model year information about the source vehicle. Figure 3 is a flowchart that outlines a suggested analytical scheme for an automotive make-model-year search. Some processes may not be needed or possible depending upon the evidence received or the information obtained at a previous step in the flowchart. A P&P technical procedure describes each analytical technique depicted in Figure 3.

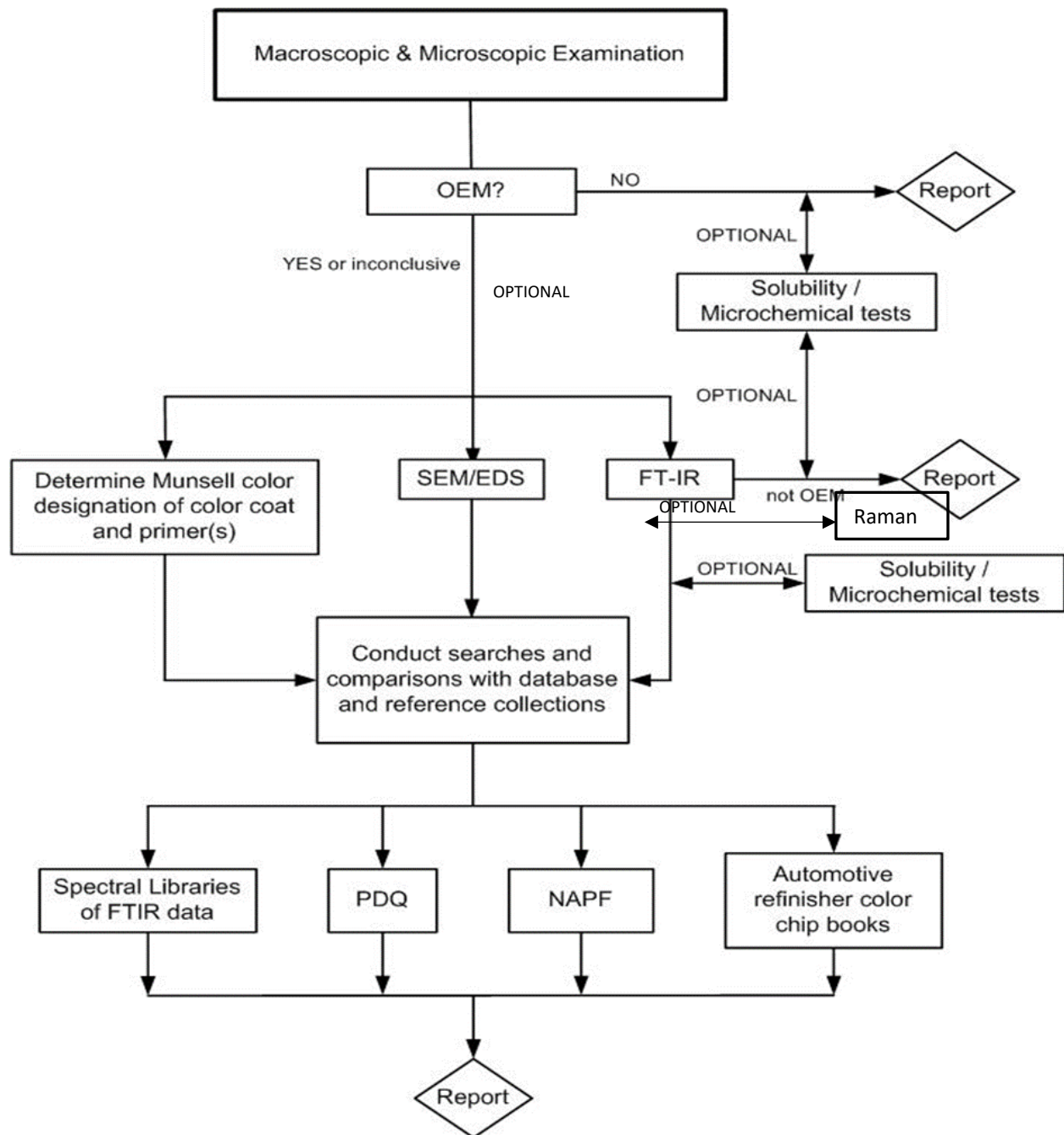


Figure 2. Analytical Scheme for Make-Model-Year Automotive Paint Searches

5.6 Polymers

5.6.1 Characterization

For a characterization request, first examine the material in question for manufacturer markings (e.g., part numbers, descriptors) that could provide useful information. If no such markings are found, analyze the material using some or all of the methods outlined in Figure 4. Testing is stopped when the analyst determines that there is sufficient data to report on the chemical composition or source of the polymer. Commercially available source materials and instrumental reference libraries maintained in the FBI Laboratory can be used to obtain compositional information. The case notes will record the techniques used. Testing is stopped when the analyst determines that there is sufficient data to report on the chemical composition or source of the polymer.

5.6.2 Comparison

In a comparison examination, establish if any exclusionary differences are detected between two (or more) samples after subjecting them to the analytical testing scheme described in Figure 4. Testing is stopped when the analyst determines that there is sufficient data to report whether exclusionary differences exist between compared polymer evidence. As such, not all techniques may be conducive or needed for all polymer examinations. The casenotes will record the techniques used. The rationale to exclude IR, SEM/EDS, pyGC/MS will also be recorded.

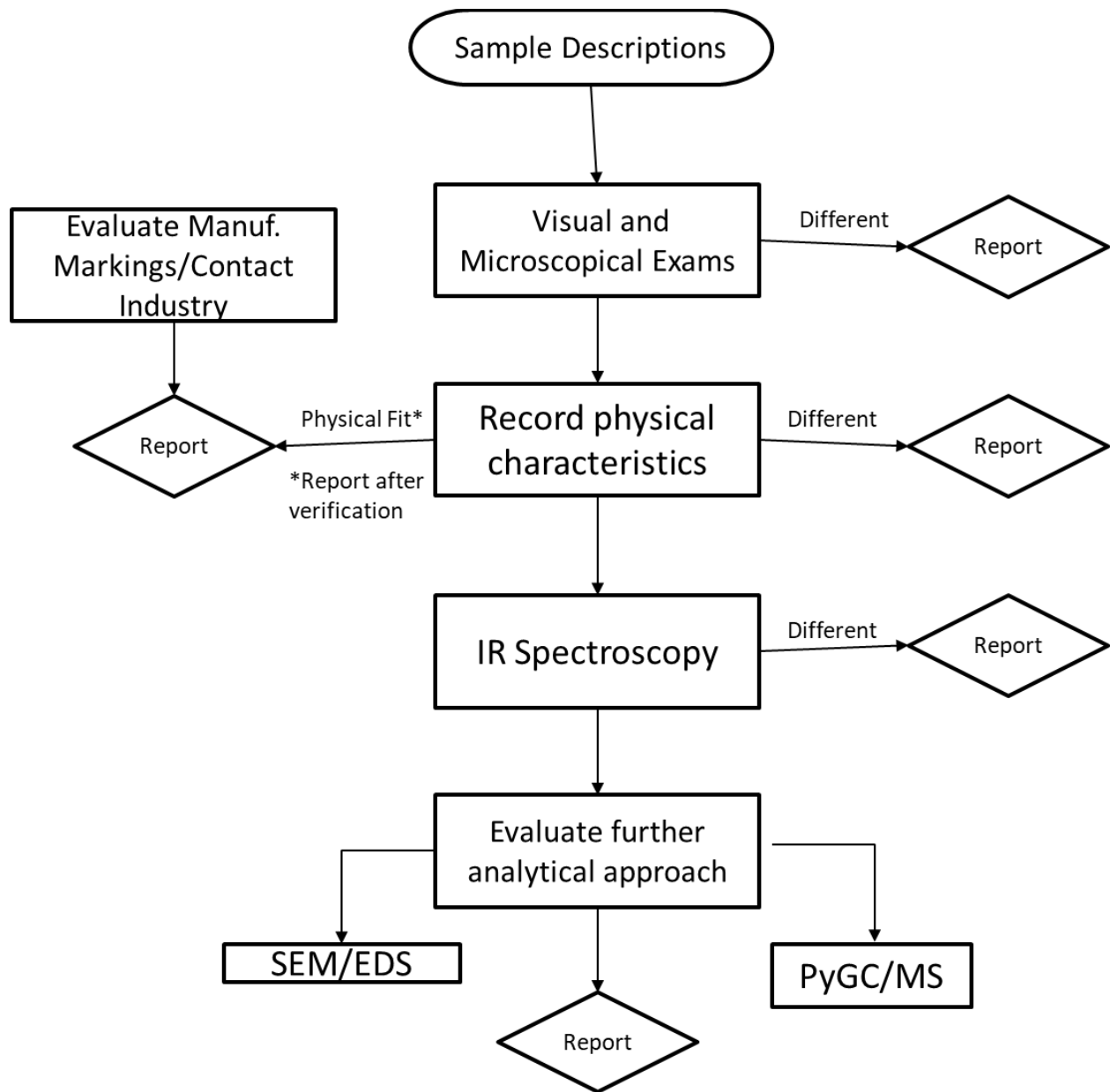


Figure 4. Polymer Analysis Scheme

5.7 Tape/Adhesive Characterization

A tape characterization is performed using the methods outlined in Figures 5 and 6. These flowcharts have been created based on the guidance set forth in ASTM E3260 *Standard Guide for Forensic Examination and Comparison of Pressure Sensitive Tapes*. A P&P technical procedure also describes each analytical technique depicted. Testing is stopped when the analyst determines that there is sufficient data to report on the chemical composition or source of the tape or adhesive material. The case notes will record the techniques used.

5.8 Tape/Adhesive Comparison

In a comparison examination, establish if any differences are detected between two (or more) samples after subjecting them to the analytical testing schemes described in Figures 5 and 6. When a fabric, fiber, or glass filament reinforcement is present within the tape construction, these analyses can only be conducted by personnel who are qualified to examine these types of materials. Testing is stopped when the analyst determines that there is sufficient data to report whether exclusionary differences exist between compared tapes or adhesive evidence. As such, not all techniques may be conducive or needed for all PSA examinations. The casenotes should record the techniques used. The rationale to exclude any expected techniques IR, SEM/EDS, pyGC/MS will also be recorded.

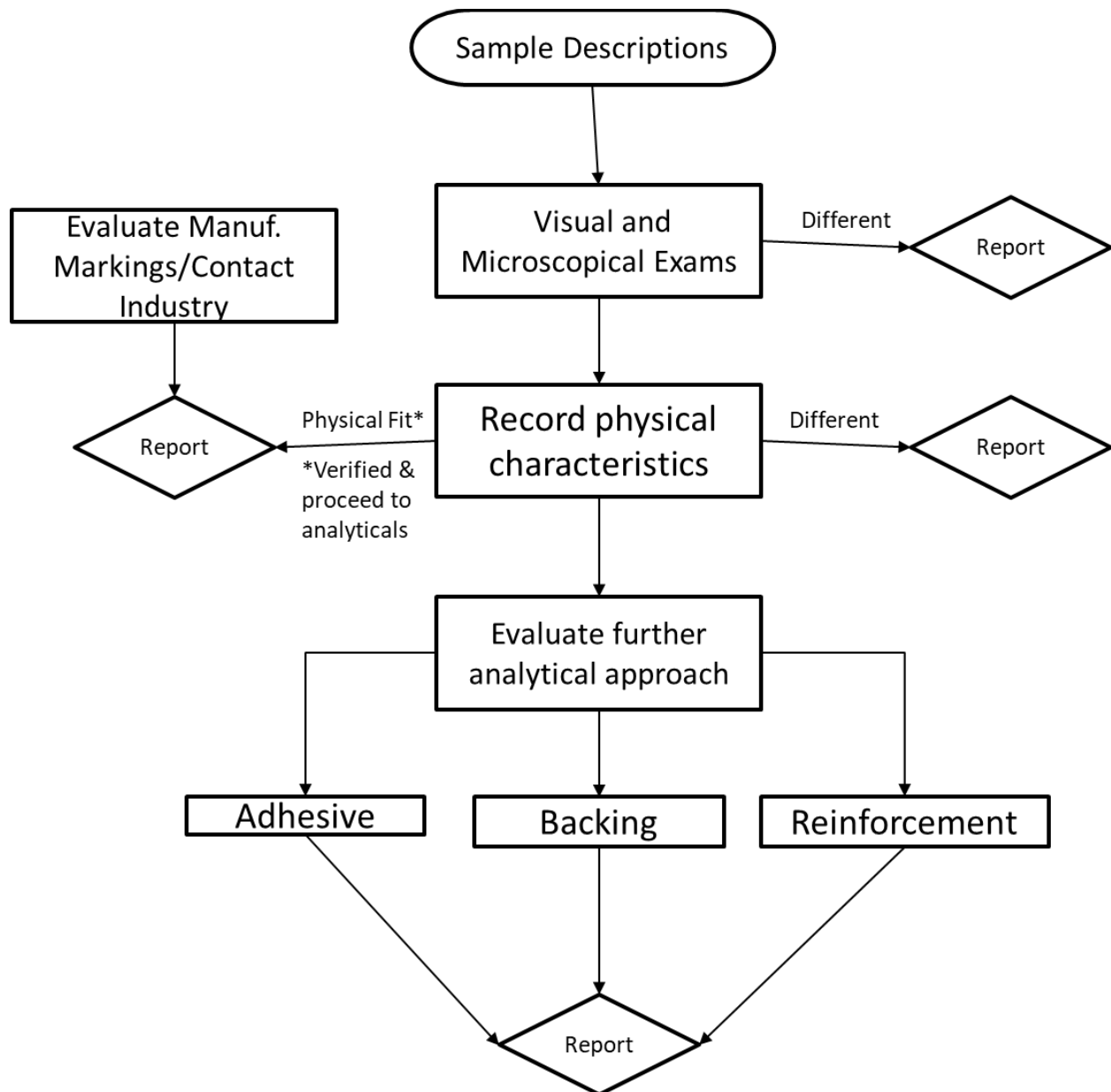


Figure 5. Tape Analysis Scheme

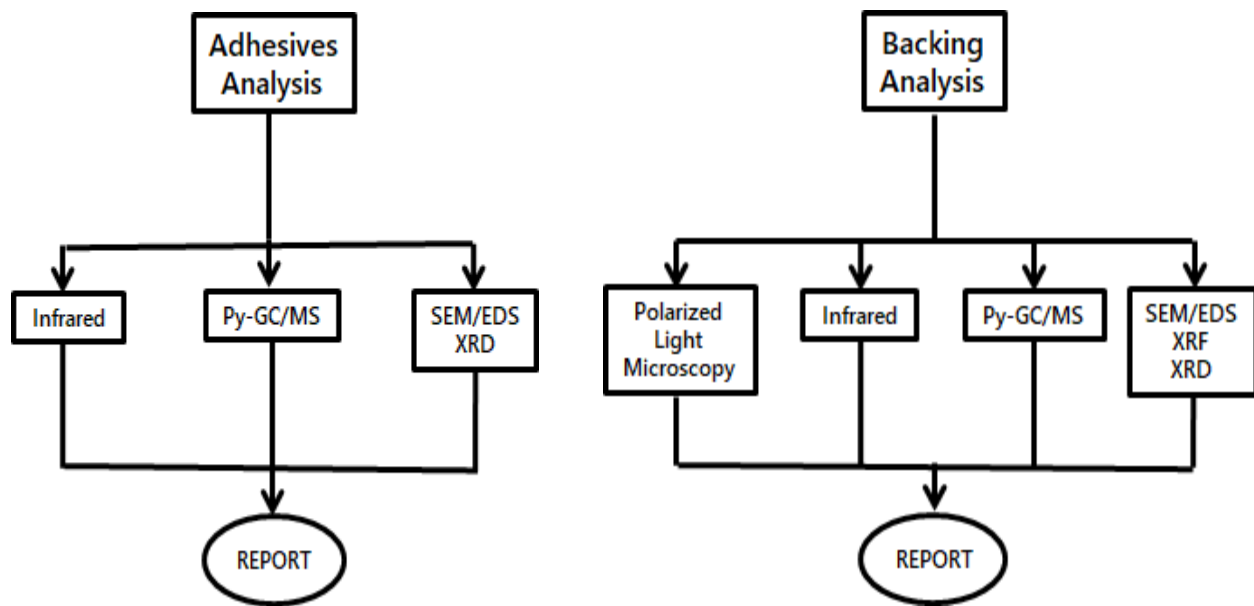


Figure 6. Adhesive and Backing Analysis Scheme

6 LIMITATIONS

- A. Sample size and condition can preclude conducting certain examinations, including color assessment and layer structure for paints.
- B. If the sample is a paint smear, layers can commingle and hinder attempts to isolate each for analysis.
- C. A factory-applied, OEM automotive coating finish is required for make-model-year determinations.
- D. Sourcing an evidentiary paint specimen to a single make, model, and year may not be feasible because several different vehicles can be manufactured at a single assembly plant and/or the same color of paint can be utilized on different vehicle models over a period of time.
- E. 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 many types of polymeric material.
- F. Sourcing capabilities of certain types of tape is limited. This is directly related to the number of manufacturers and distributors of a particular type of tape.

7 REFERENCES

ASTM E1610, Standard Guide for Forensic Paint Analysis and Comparison. ASTM International, West Conshohocken, PA.

ASTM E3260, Standard Guide for Forensic Examination and Comparison of Pressure Sensitive Tapes. ASTM International, West Conshohocken, PA.

8 REVISION HISTORY

Revision	Issued	Changes
05	07/01/2022	New document combining revisions and editorial changes to General Approach procedures for Paint, Polymers, and Tapes into a single document and discontinuation of PP-801 and PP-802.