Designation: D5043 – 04 (Reapproved 2009)

Standard Practice for Field Identification of Coatings[1]

This standard is issued under the fixed designation D5043; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes procedures and portable apparatus for determining the generic type of coating films most likely to be encountered on structures. The coating can either be weathered from exposure or be freshly applied.

1.2 Most commonly used coatings can be divided into the broad categories and subgroups shown in Table 1 on the basis of the nonvolatile component (generic types) of their vehicle (film forming resin, binder). Although the curing of some coatings involves more than one process and coatings may contain more than one type of resin, they can usually be assigned to one of the basic classes and generic types listed in Table 1.

1.3 For field exposed coatings, it is suggested that these test methods be used as part of a complete evaluation of a coated surface as it is frequently helpful to consider the environment of exposure and how the coating has performed in the environment when drawing conclusions from these tests.

1.4 These procedures will not result in the identification of components of a coating beyond general classification of the coating by generic type and are not appropriate if more detailed analysis is required, for example, as a part of failure analysis or to identify between different manufacturers of the same type of coating. They also may not be definitive enough to identify complex systems that include multiple layers of different generic types of coatings.

1.5 The evaluation of results is quite subjective. Practice and experience are required to minimize misinterpretation. Repeat tests may be required.

1.6 None of the test is to be taken alone as grounds for identifying the generic type. Only the combination of results from several or all of the tests is to be used in conclusions regarding generic types.

1.7 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for in formation only.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements see 5.3.4, 6.3.1, 6.3.3, 7.4, and 8.4.

2. Summary of Practice

2.1 Samples of coatings films are tested with solvents and chemicals and subjected to pyrolysis to provide evidence of their generic type. Fig. 1 shows a flow chart for suggested order of tests and classification of results.

3. Significance and Use

3.1 Information about the generic type of coating on a surface is required to select compatible coatings for repainting and can be used when evaluating the performance of a coating in an environment in decisions on upgrading or replacing a coating system. This guide provides a systematic procedure for identifying the generic type of a coating. The procedure can be performed in the field by personnel with limited laboratory experience, and requires a minimum of equipment and materials.

4. Sampling

4.1 The sample of coating is obtained by chipping or scraping with a knife or by sanding and then brushing the material into a specimen container or clean envelope. Care should be taken not to cut into substrates, such as plastic or asphalt, that contain polymeric or bituminous materials. Small portions of untreated wood, masonry, or steel do not ordinarily interfere with the tests. Some tests can be conducted directly on the coating surface. If a liquid sample of coating is to be evaluated, a film of the coating should first be cast on a glass plate or similar surface from which it can conveniently be removed after drying.

NOTE 1—To develop familiarity with the subjective evaluations that follow, it is good practice to make films of known resin composition by applying control paints to glass plates or similar surfaces from which they can be readily removed after drying.

5. Pyrolysis

5.1 *Summary of Test Procedure*—A sample of coating placed in a small glass test tube is burned over a hot flame. The

[1] This practice is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.46 on Industrial Protective Coatings.

Current edition approved Dec. 1, 2009. Published December 2009. Originally approved in 1990. Last previous edition approved in 2004 as D5043 – 04. DOI: 10.1520/D5043-04R09.

TABLE 1 Classification of Coatings Frequently Used

Basic Class	Examples
Air-drying or baking (oxidizing) paint and enamel	Unmodified drying oil Oleoresinous (oil-modified, alkyd, epoxy ester, phenolic and other resins)
Lacquer (drying by evaporation of water)	Vinyl (poly[vinyl chloride-vinyl acetate]) Poly(vinyl butyral) Chlorinated rubber Styrene-butadiene rubber and similar rubbers Bituminous (coal, tar, asphalt) Cellulose nitrate
Latex (drying by evaporation of water)	Poly(vinyl acetate) Acrylic Styrenated acrylic
Chemically curing single package and multi-component coating	Epoxy Bituminous epoxy Urethane Polyester
Inorganic	Silicates and cement
Miscellaneous	Flame-sprayed Silicones

way the coating burns, its odor, and other characteristics of the fume generated are recorded. The Beilstein test identifies the presence of chlorinated and other halogens. In coatings, chlorine-containing material is most often encountered. For coatings not containing halogens, the odor is recorded.

5.2 *Apparatus:*

5.2.1 *Flame Source,* including butane or propane utility torch. (Lighters do not provide a hot enough flame.)

5.2.2 *Glass Test Tubes*—A suitable size is 10 by 75 mm (disposable culture tubes).

5.2.3 *Copper Wire,* a length of single-strand 16 to 18 gage. AWG copper electrical wire, stripped of insulation sufficiently far that melted insulation cannot interfere with the test, is satisfactory. Leave about 6 in. of insulation as a heat insulator or provide a wrapping or handle for protection from heat.

5.2.4 *Lead Acetate Paper.*

5.2.5 *Test Tube Clamp.*

5.3 *Procedure:*

5.3.1 Put a small specimen of coating, preferably of one type, in the test tube. Hold the tube briefly in the hot flame. Limit flame contact to the end of the test tube immediately around the specimen. As the specimen is heated, observe the nature of deterioration and identify coating type as follows:

Observation	Identification
No change in shape; possible change in color; continued heating causes sample to glow red	Inorganic
Rapid deterioration, almost explosive in nature	Cellulose nitrate or similar
Swelling	Some vinyl-type coatings

NOTE 2—Melting, bubbling, and charring are common with most generic types and not definitive.

5.3.2 Continue heating until fume (smoke) fills the test tube. Most fumes are white or near-white; slight condensation of a clear liquid on the upper test tube wall is sometimes observed. Other observations and identifications include:

Observation	Identification
Dark fume; clear brown liquid condensate	Possibly epoxy
Very dark, possibly sooty fume; dark condensate	Bituminous

NOTE 3—Bituminous coatings may be asphalt, coal tar, or combinations. The test is not definitive.

NOTE 4—Silicone coatings will form an ash upon pyrolysis at 800°C. Such temperatures are outside the scope of this test.

5.3.3 *Beilstein Test*—Conduct the Beilstein test by first heating the bare copper wire in the flame until no color is imparted to the flame. Insert the heated wire into hot fume in the test tube briefly (1 to 2 s). Withdraw the copper wire from the test tube and immediately hold it in the flame again. Observe the flame over the copper wire for color and make identifications as follows:

Observation	Identification
No color	No chloride (or other halogen) content
Traces of green color	Chloride contaminants from environment or minor component of coating
Strong green color	Chlorinated resin or chlorinated resin modifier

With practice the intensity of the green flame can be used to determine whether the chlorine containing component is major or minor.

5.3.3.1 *Example 1*—A very intense, relatively long-lasting repeatable green flame indicates chlorinated rubber or vinyl coating.

5.3.3.2 *Example 2*—An intense or moderately intense relatively short-lived green flame, which may or may not be repeated, indicates chlorinated plasticizer in a nonchlorinated resin binder.

NOTE 5—Although fluorinated resins also give a positive Beilstein test, they are less likely to be encountered in the industrial applications than chlorinated resins.

NOTE 6—If the sample includes hydrated material, for example, concrete or plaster, water will be liberated by burning and will condense on the wall of the test tube. Halogen liberated from the paint will be absorbed into the condensate. The copper wire must be brought into contact with the condensate to avoid a false negative.

NOTE 7—Those experienced with the Beilstein test may prefer to run it on a specimen not subjected to pyrolysis.

5.3.4 *Odor Test*—Conduct the odor test only if the Beilstein test is negative (no green flame). Tip the test tube so that the fumes flow toward the open end of the tube. Gently wave a hand over the mouth of the test tube and carefully smell the odor of the fumes as they dissipate from the mouth of the test tube. (**Warning**—Hot chlorine or fluorine-containing vapors and gases are extremely irritating and potentially hazardous. In addition, coatings may contain lead or other toxic metals that volatilize and form metal fumes during this test procedure. Care must be taken to avoid inhalation of the vapors, gases and fumes.)

5.3.4.1 Indications are subjective, but the following classes can be assigned:

Observation	Identification
Oily	Oleoresinous
Very sweet	Acrylic latex
Vinegary; acetic acid	Poly (vinyl acetate)
Burning hair	Epoxy, epoxy ester, bituminous epoxy
Burning rubber	Polysulfide
No strong odor	Inorganic, cementitous
Acrid (biting) odor with sooty or tarry smoke	Bituminous

5.3.5 Use the lead acetate paper to verify the presence of a sulfide component by holding a piece of moistened lead acetate paper over or in the mouth of the test tube. A sulfur-containing component is present if the paper rapidly darkens.

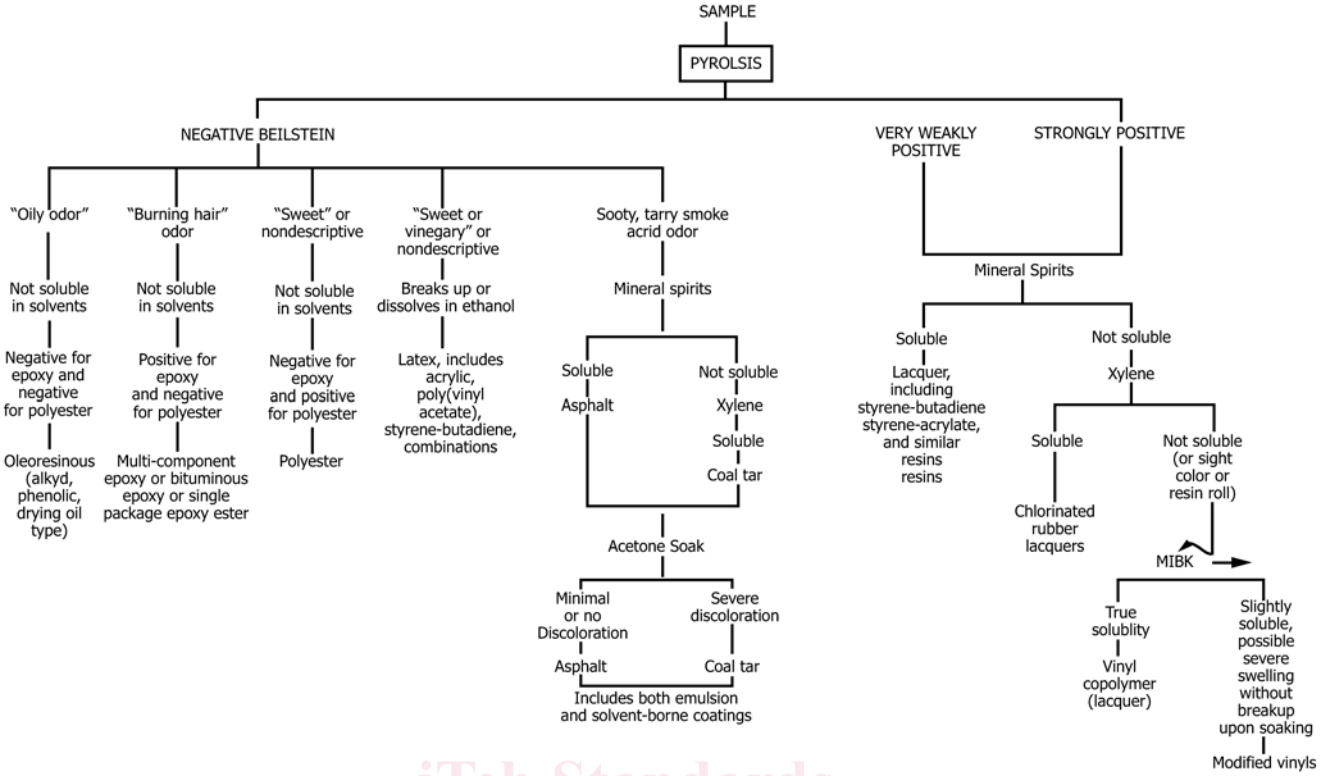

FIG. 1 Suggested Test Flow Chart for Coatings Identification

6. Solubility Tests

6.1 Chemically cured, inorganic, and aged oleoresinous coatings are not resoluble in the solvents originally used in producing the coatings. Lacquers and some latex coatings are resoluble and the strength of the solvent required to cause the coating to dissolve can be used to classify the coating.

6.2 *Reagents*—Solvents used, listed in order of increasing power of solvency (that is, ability to dissolve a resin), are as follows:

6.2.1 *Denatured Alcohol (Ethyl Alcohol).*

6.2.2 *Mineral Spirits (Petroleum Spirits),* aliphatic hydrocarbon solvent with typical Kauri-Butanol value (KB) of 25 to 45.

6.2.3 *Xylene (Xylol),* aromatic hydrocarbon solvent with typical KB of 98.

6.2.4 *Methyl Isobutyl Ketone (MIBK, 4-Methyl-2-Pentanone).*

6.2.5 *Acetone (Dimethyl Ketone, 2-Propanone).*

6.3 *Procedure:*

6.3.1 Use a stirring rod or a gloved fingertip to conduct the rub test. The test is perhaps best done by a finger-rub technique on the coating film itself because the sensations perceptible by touch are valuable in interpreting results. Alternatively, the solubility tests may be done by soaking portions of the film in solvents, in which case porcelain spot plates and glass stirring rods can be used. (**Warning**—These solvents can cause skin irritation and dermatitis. Minimize time of contact of solvents with skin and discontinue use if irritation occurs.)

6.3.2 *Rub Test*—Beginning with ethanol, dampen a fingertip or glass rod and rub the surface of the film briskly in a circular motion 5 to 10 mm (¼ to ½ in.) in diameter. Renew the test solvent frequently as required. Continue rubbing at least 30 s or until definite effects are observed. Continue with each solvent in increasing power of solvency. Cleaning the fingertip or glass rod in each succeeding solvent before using that test solvent. Select a new spot on the film or an untested chip of paint for each solvent used.

NOTE 8—If the coating film on the test surface is chalky, the first finger-rub test done with ethanol will liberate much of the chalk, which will dry quickly as a powder. Repeating the test will reveal much less or no color and the test surface will appear unchanged. If chalk is liberated, use ethanol to clean the test spot for subsequent solvent tests.

6.3.3 *Solvent-Soak Test*—The full series of solvents can be run concurrently. Place five chips in a spot plate dish and pour a small amount of each solvent over one of the chips. Periodically stir the solvent and rub the chip with a glass stirring rod until definite changes occur. Add additional solvent, if necessary due to evaporation, and observe extent of discoloration of the solvent and whether the chip softens, breaks apart, swells, dissolves, or a combination thereof. Note whether a color different from the color of the topcoat is imparted to the solvent, indicating dissolution of an intermediate or primer coat. If portions of the chip dissolve or discolor the solvent, soak up the solvent with a paper towel and add fresh solvent if undissolved chip remains. If no further effect occurs, wash the remainder of the chip by gentle swirling, soak up the solvent, allow the chip to dry, and proceed with