



Designation: D5235 – 18 (Reapproved 2024)

Standard Test Method for Microscopic Measurement of Dry Film Thickness of Coatings on Wood Products¹

This standard is issued under the fixed designation D5235; 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 test method covers the measurement of dry film thickness of coatings applied to a smooth, textured or curved rigid substrate of wood or a wood-based product.

1.2 This test method covers the preparation of wood or wood-based specimens for the purpose of microscopic measurement of dry film thickness.

1.3 This test method suggests an analysis of dry film thickness of coatings on wood or wood-based products using a microscopic measurement.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

¹ This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.52 on Factory Coated Wood Products.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *dry film thickness or DFT, n*—the thickness of dried, cured coating film on the substrate surface which may include attached fibers but excludes free fibers that are encapsulated in the layer itself.

3.1.2 *edge face, n*—that part of the specimen that is a plane perpendicular to the surface showing a cross section of the coating and substrate.

3.1.3 *soak in, n*—refers to a coating on a porous (wood) where the coating does not lie essentially on the surface of the wood or wood-based product, but has penetrated into the fiber structure of the wood or wood-based material.

3.1.3.1 *Discussion*—Wood or wood-based products are generally of a porous nature; sometimes exhibiting uniform absorption of coatings. Frequently absorption of coatings is of a non-uniform nature and influenced by localized surface density differences or wood pore size. These conditions of coating absorption are commonly referred to as soak in.

4. Summary of Test Method

4.1 A specimen of coated wood or wood-based product is cut to convenient size and edge face with the coating film cross-section is prepared by polishing or cutting with a sharp blade.

4.2 The prepared edge of the specimen is imaged by a calibrated imaging system with known magnification in order to measure the dry film thickness using an image analysis computer program.

4.3 Suggestions regarding interpretation of dry film thickness on porous wood or wood-based material are offered.

5. Significance and Use

5.1 As a base for calibration adjustment or accuracy verification of dry film coating thickness measuring instruments.

5.2 The dry film thickness of coatings on wood or wood-based products is specified in written product warranties for

proper decorative and protective performance of coatings on wood or wood-based products.

5.3 The minimum and maximum dry film thickness of coatings is recommended by coating companies for satisfactory decorative and protective performance on wood or wood-based products.

5.4 The average dry film thickness of coatings on wood or wood-based material may be used by manufacturing companies to estimate the theoretical cost of applied coatings.

5.5 The ratio of minimum to maximum dry film thickness on textured products is used as an indication of coating uniformity.

5.6 Specific coated product requirements may dictate certain film thickness determinations to be made. Agreement between buyer and seller may be advisable to accommodate product needs relative to dry film thickness.

6. Apparatus

6.1 *Microscope with Attached Digital Camera* (see [Note 1](#)), providing sufficient magnification and image quality in the field of view; generally 100× to 200× magnification is sufficient.

NOTE 1—Certain digital cameras can provide sufficient magnification and image quality of the coating cross-section without a microscope.

6.2 *Source of Oblique Illumination*, for the microscope.

6.3 *Image Analysis Program*, with capabilities for lines to be drawn along the coating/substrate interface and the coating surface and for calculation of the average distance between these lines on the specimen image.

6.4 *Microscope Image Calibration Tool*.

6.5 *Cutoff Saw*.

6.6 *Belt or Disc Sander*.

6.7 *C-Type Clamp*.

6.8 *Sharp Utility Knife or Razor Blade*.

7. Materials

7.1 *200 and 600-Grit Sand Paper*.

7.2 *Mould*, such as a paper cup, aluminum weighing dish, or a 50.8 mm [2 in.] or larger diameter plastic pipe that is at least 25.4 mm [1 in.] high.

7.3 *Source of Sanding Adhesive*, which is used as encapsulating medium such as:

7.3.1 *Hot Melt Glue*,

7.3.2 *Fast-Cure Acrylic Mounting Kit*, or

7.3.3 *Epoxy*.

7.4 *Solvent-borne Tint Dispersion*, which is compatible with the sanding adhesive.

7.5 *Mineral Oil*.

7.6 *Automotive Red Transmission Oil*.

7.7 *Zinc Stearate Powder*.

8. Procedure

8.1 *Specimen Preparation*—Select the area to be measured for coating thickness and remove it from the coated wood or wood-based material by a suitable method. Methods of sawing, core drilling, chiseling etc., can be used. Avoid collection of samples near the edges of sheeting material or the ends of boards, particularly those coated in vacuum coaters, unless defective coating application is being investigated. For textured surfaces, areas representative of varying degrees of texture (average, extreme, minimal or non-existent) should be selected. Take care that areas of interest are not damaged. Cutting across wood grains is preferable in exposure of area of the interest and must be conducted when a coated rough wood surface is being tested. Inspection of the surface of interest for excessive damage, as well as preliminary assessment of coating conditions and uniformity of application should be conducted under a microscope. Appropriate areas for coating dry film thickness measurements should be selected based on testing purpose.

8.1.1 Frequently the purpose of testing is the measurement of the average coating dry film thickness for coating spread assessment or identification of areas with excessively thick or thin coating dry film thickness.

8.2 *Specimen Surface Preparation*—Two methods are described for specimen surface preparation due to the variability in the properties of wood coatings. Method A is recommended to be used for hard coatings, for example, melamine furniture coating or polyester coating, which are brittle at room temperature and could shatter in contact with a sharp blade. Method B is recommended for flexible, exterior finishes, which would smear in contact with sandpaper. Such smearing may mask the appearance of voids or fracture lines in the coating and substrate and may eliminate coating/wood substrate interface details, thereby increasing measurement error.

8.3 *Method A:*

8.3.1 Select the desired coated area of a wood or wood-based material that is to be measured for dry film thickness. With the cutoff saw, cut off a sample at least 38.1 mm [1½ in.] wide from this area for mounting and encapsulation in casting resin ([Note 2](#)).

NOTE 2—Some specimens could be satisfactorily prepared and tested without mounting. Mounting may be omitted, if careful microscopic inspection of the sanded specimen does not show any damage to the area of interest or coating edge distortion.

8.3.2 Cut this specimen to a length that is at least 12.7 mm [½ in.] less than the inside diameter of the mold to be used.

8.3.3 Place the specimen, with the sample edge to be measured, face down and approximately centered in the mold.

8.3.4 Prepare the sanding adhesive according to the manufacturer's directions for use. A dispersed pigment may be added to the adhesive for better microscopic contrast between the dry film and the adhesive.

8.3.5 Pour the sanding adhesive around the sample in the mold and allow to harden according to the manufacturer's directions.

8.3.6 Remove the mold from the hardened and encapsulated specimen edge.