Designation: D7378 – 16

Standard Practice for Measurement of Thickness of Applied Coating Powders to Predict Cured Thickness[1]

This standard is issued under the fixed designation D7378; 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 the thickness measurement of dry coating powders applied to a variety of rigid substrates. Use of some of these procedures may require repair of the coating powder. This practice covers the use of portable instruments. It is intended to supplement the manufacturers' instructions for their operation of the gages and is not intended to replace them. It includes definitions of key terms, reference documents, the significance and use of the practice, and the advantages and limitations of the instruments.

1.2 Three procedures are provided for measuring dry coating powder thickness:

1.2.1 *Procedure A*—Using rigid metal notched (comb) gages.

1.2.2 *Procedure B*—Using magnetic or eddy current coating thickness gages.

1.2.3 *Procedure C*—Using non-contact ultrasonic powder thickness instruments.

1.3 Coating powders generally diminish in thickness during the curing process. Some of these procedures therefore require a reduction factor be established to predict cured film thickness of powder coatings.

1.4 *Procedure A and Procedure B* measure the thickness (height or depth) of the applied coating powders in the pre-cured, pre-gelled state. By comparing results to the measured cured powder thickness in the same location, a reduction factor can be determined and applied to future thickness measurements of the same coating powder.

1.5 *Procedure C* results in a predicted thickness value of the cured state based on a calibration for typical coating powders. If the powder in question is not typical then an adjustment can be made to align gage readings with the actual cured values as determined by other measurement methods.

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

1.7 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4138 Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means

D6132 Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Coating Thickness Gage

D7091 Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *accuracy, n*—the measure of the magnitude of error between the result of a measurement and the true thickness of the item being measured.

3.1.2 *adjustment, n*—the physical act of aligning a gage's thickness readings to match those of a known thickness sample (reduction of bias) in order to improve the accuracy of the gage on a specific surface, within a specific portion of its measurement range or to specific operating conditions.

3.1.2.1 *Discussion*—An adjustment will affect the outcome of subsequent readings.

3.1.3 *coating powders, n*—finely divided particles of resin, either thermoplastic or thermosetting, generally incorporating pigments, fillers, and additives and remaining finely divided

[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 D01.51 on Powder Coatings.

Current edition approved Dec. 1, 2016. Published March 2017. Originally approved in 2007. Last previous edition approved in 2010 as D7378 – 10. DOI: 10.1520/D7378-16.

[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.

during storage under suitable conditions, which, after fusing and possibly curing, give a continuous film.

3.1.4 *calibration, n*—the high-level, controlled and documented process of obtaining measurements on traceable calibration standards over the full operating range of the gage, then making the necessary gage adjustments (as required) to correct any out-of-tolerance conditions.

3.1.4.1 *Discussion*—Calibration of coating thickness gages is performed in a controlled environment using a documented process by the equipment manufacturer, their authorized agent, or by an accredited calibration laboratory. The outcome of the calibration process is to restore/realign the gage to meet/exceed the manufacturer's stated accuracy and may result in the creation of a calibration certificate recording the results of the process at the time of testing.

3.1.5 *powder coatings, n*—coatings which are protective or decorative, or both, formed by the application of a coating powder to a substrate and fused in a continuous film by the application of heat or radiant energy.

3.1.6 *dry film thickness, n*—the thickness of a cured coating (or coating layers) as measured from the surface of the substrate.

3.1.7 *micrometer (micron), n*—one one-thousandth of a millimeter (0.001 mm); 25.4 microns = 1 mil.

3.1.8 *mil, n*—an imperial unit of measure; one one-thousandth of an inch (0.001 in.); 1 mil = 25.4 microns.

3.1.9 *substrate, n*—the base material, type of surface or component that is being coated.

3.1.10 *uncured, adj*—the physical state of coating powder when particles are electrostatically held to a substrate.

3.1.11 *verification of accuracy, n*—comparing predicted thickness values with actual cured thickness values and ensuring both are within their combined measurement tolerances.

4. Summary of Practice

4.1 The three procedures take measurements of applied coating powders in the pre-cured, pre-gelled state. Each procedure employs different devices to measure the dry powder.

4.2 *Procedure A*—Uses a metal notched gage to manually determine the thickness of the coating powder. The gage is dragged through the powder a short distance. Powder thickness is determined as being between the highest numbered tooth that made a mark and has powder clinging to it, and the next highest tooth that left no mark and has no powder clinging to it. Measurements can be made on a suitable rigid surface, metal or non-metal but marks will be made in the powder that may not be covered when the powder flows in the cure process.

4.3 *Procedure B*—Uses a conventional magnetic or eddy current coating thickness gage with a specially designed powder probe to measure the thickness of the coating powder. Micro pins, which are integrated into the probe, penetrate the coating powder down to the substrate. The probe is manually pressed down to the surface of the powder to effect a thickness measurement. This procedure is applicable to flat, metal substrates only. Marks may be made in the powder that may not be covered when the powder flows in the cure process.

4.4 *Procedure C*—Uses a non-contact ultrasonic powder thickness instrument to take a measurement of the applied coating powder to calculate and display a predicted cured thickness. Measurements can be made on any rigid surface.

4.5 The thickness of dry coating powder diminishes during the curing process. To predict the cured powder coating thickness, a correlation must be made between pre-cured and post-cured thicknesses.

4.5.1 *Procedure A and Procedure B* result in a thickness measurement of the uncured coating powder only. A reduction factor must then be used to predict the cured powder thickness for each particular coating powder. This reduction factor is

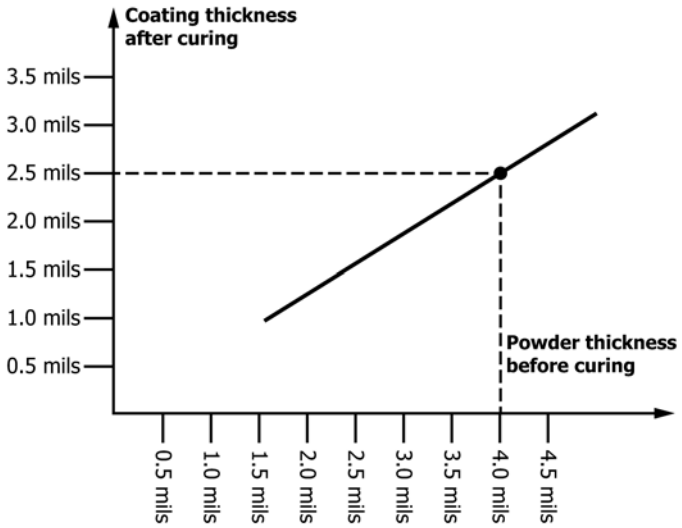

FIG. 1 Typical Correlation Between Pre- and Post-cured Powder