



Standard Test Method for Measurement of Coating Thickness by the Beta Backscatter Method¹

This standard is issued under the fixed designation B 567; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the beta backscatter gages for the nondestructive measurement of metallic and nonmetallic coatings on both metallic and nonmetallic substrate materials.

1.2 The test method measures the mass of coating per unit area, which can also be expressed in linear thickness units provided that the density of the coating is known.

1.3 The test method is applicable only if the atomic numbers or equivalent atomic numbers of the coating and substrate differ by an appropriate amount (see 7.2).

1.4 Beta backscatter instruments employ a number of different radioactive isotopes. Although the activities of these isotopes are normally very low, they can present a hazard if handled incorrectly. This standard does not purport to address the safety issues and the proper handling of radioactive materials. It is the responsibility of the user to comply with applicable State and Federal regulations concerning the handling and use of radioactive material. Some States require licensing and registration of the radioactive isotopes.

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

2. Referenced Documents

2.1 International standard:

ISO 3543: Metallic and Nonmetallic Coatings—Measurement of Thickness—Beta Backscatter Method

3. Terminology

3.1 Descriptions of Terms:

3.1.1 *activity*—the nuclei of all radioisotopes are unstable and tend to change into a stable condition by spontaneously emitting energy or particles, or both. This process is known as radioactive decay. The total number of disintegrations during a

suitably small interval of time divided by that interval of time is called “activity.” Therefore, in beta backscatter measurements, a higher activity corresponds to a greater emission of beta particles. The activity of a radioactive element used in beta backscatter gages is generally expressed in microcuries ($1 \mu\text{Ci} = 3.7 \times 10^4$ disintegrations per second).

3.1.2 *aperture*—the opening of the mask abutting the test specimen. It determines the size of the area on which the coating thickness is measured. This mask is also referred to as a platen, an aperture plate, a specimen support, or a specimen mask.

3.1.3 *backscatter*—when beta particles pass through matter, they collide with atoms. Among other things, this interaction will change their direction and reduce their speed. If the deflections are such that the beta particle leaves the body of matter from the same surface at which it entered, the beta particle is said to be backscattered.

3.1.4 *backscatter coefficient*—the backscatter coefficient of a body, R , is the ratio of the number of beta particles backscattered to that entering the body. R is independent of the activity of the isotope and of the measuring time.

3.1.5 backscatter count:

3.1.5.1 *absolute backscatter count*—the absolute backscatter count, X , is the number of beta particles that are backscattered during a finite interval of time and displayed by the instrument. X will, therefore, depend on the activity of the source, the measuring time, the geometric configuration of the measuring system, and the properties of the detector, as well as the coating thickness and the atomic numbers of the coating and substrate materials. X_0 is the count produced by the uncoated substrate, and X_s that of the coating material. To obtain these values, it is necessary that both these materials are available with a thickness greater than the saturation thickness (see 3.1.12).

3.1.5.2 *normalized backscatter*—the normalized backscatter, x_n , is a quantity that is independent of the activity of the source, the measuring time, and the properties of the detector. The normalized backscatter is defined by the equation:

$$x_n = \frac{X - X_0}{X_s - X_0}$$

¹ This test method is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.10 on Test Methods.

Current edition approved Oct. 1, 2003. Published October 2003. Originally approved in 1972. Last previous edition approved in 1998 as B 567 – 98.