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Standard Test Methods for Thickness of Diffusion Coating¹

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1. Scope

1.1 These test methods cover two procedures for measuring the thickness of diffusion coatings.

1.2 Test Method A is the determination of the dimensional-change thickness, defined as the difference in the thickness of the part before and after coating. (The terms micrometer thickness and part growth are considered synonymous with dimensional change thickness.)

1.3 Test Method B is the determination of total coating thickness, defined as the distance between the observably unaffected substrate and the exterior surface of the coating. This includes the total of all included phases, zones and layers. (The term case depth is considered to be synonymous with total coating thickness.) The total coating thickness is determined by cross-sectioning the coating, preparing a metallurgical mount and microscopically measuring the coating thickness.

1.4 The total coating thickness as determined microscopically from a cross-section will usually be greater than, or equal to, the dimensional change thickness determined by part growth. When the coating is produced primarily by reaction with the substrate, the substrate-coating interface recedes as the substrate is consumed in the reaction. In such cases the difference between the total coating thickness and the dimensional change thickness is the thickness of the substrate consumed.

1.5 Diffusion coatings are usually formed at elevated temperatures for service at elevated temperatures. This means that diffusion coatings are dynamic systems which are continually undergoing changes while in an elevated-temperature environment. It is necessary to know that certain phases are growing at the expense of others and to know the previous history of a coating to understand the significance of coating thickness data.

1.6 Values in SI units are to be regarded as the standard. Inch-pound units are provided 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:*

D 374 Test Methods for Thickness of Solid Electrical Insulation²

E 3 Methods of Preparation of Metallographic Specimens³

3. Significance and Use

3.1 A diffusion coating is one produced by causing an element or elements to react with or diffuse into, or both, the surface of a metallic substrate, thus chemically altering the substrate adjacent to the surface. To appreciate the significance of coating thickness measurements one must understand the contributions to a particular coating of solid-solution zones in the substrate and reaction products such as intermetallic compounds.

4. Test Method A

4.1 *Apparatus*—The instrument shall be a machinist's type micrometer without a locking device. If calibrated in inches, it shall be constructed with a vernier reading to 0.0001 in. (0.1 mil). If calibrated in metric units, it shall be capable of reading to 0.01 mm. It shall have a ratchet or similar mechanism, such as a friction thimble, for controlling measuring pressure and shall have anvil and spindle surfaces 6.00 ± 0.03 mm (0.250 ± 0.001 in.) in diameter. It shall meet all other requirements and calibration procedure for Method A of Test Method D 374.

4.2 *Procedure:*

4.2.1 Clean the area selected for coating-thickness measurement of dust or other powdery materials prior to coating. Record the precise area to be measured, so that the same area can be remeasured after coating.

¹ These test methods are under the jurisdiction of ASTM Committee B-8 on Metallic and Inorganic Coatings and are the direct responsibility of Subcommittee B08.12 on Materials for Porcelain Enamel and Ceramic-Metal Systems.

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² *Annual Book of ASTM Standards*, Vol 10.02.

³ *Annual Book of ASTM Standards*, Vol 03.01.