Designation: C664 – 10

StandardTest Methods for Thickness of Diffusion Coating[1]

This standard is issued under the fixed designation C664; 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.

INTRODUCTION

Diffusion coating is a thermally activated means of protecting certain iron, nickel, and cobalt based alloys against severe operating conditions. It creates a chemically bonded, tenacious coating that acts as a diffusion barrier against oxygen and other elements into the substrate to provide superior oxidation, corrosion and erosion resistance up to 2100°F (1150°C). It is commonly used for gas turbine components, power generation components, and diesel engines. This test procedure provides a mean of determining the thickness of a diffusion coating.

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:*[2]

D374 Test Methods for Thickness of Solid Electrical Insulation

E3 Guide for Preparation of Metallographic Specimens

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.

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

Current edition approved April 1, 2010. Published May 2010. Originally approved in 1970. Last previous edition approved in 2005 as C664 – 87(2005). DOI: 10.1520/C0664-10.

[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.