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Standard Specification for Chromium Diffusion Coating Applied by Pack Cementation Process¹

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1. Scope

1.1 This specification covers the requirements for chromium diffusion of metals by the pack cementation method. Pack diffusion employs the chemical vapor deposition of a metal which is subsequently diffused into the surface of a substrate at high temperature. The material to be coated (substrate) is immersed or suspended in a powder containing chromium (source), a halide salt (activator), and an inert diluent such as alumina (filler). When the mixture is heated, the activator reacts to produce an atmosphere of chromium halides which transfers chromium to the substrate for subsequent diffusion. The chromium-rich surface enhances corrosion, thermal stability, and wear-resistant properties.

1.2 *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

- [B374 Terminology Relating to Electroplating](#)
- [B487 Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section](#)
- [B602 Test Method for Attribute Sampling of Metallic and Inorganic Coatings](#)
- [B697 Guide for Selection of Sampling Plans for Inspection of Electrodeposited Metallic and Inorganic Coatings](#)
- [B762 Test Method of Variables Sampling of Metallic and Inorganic Coatings](#)
- [C664 Test Methods for Thickness of Diffusion Coating](#)

¹ This specification is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.03 on Engineering Coatings.

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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.

- [D3951 Practice for Commercial Packaging](#)
- [E766 Practice for Calibrating the Magnification of a Scanning Electron Microscope](#)
- [E1077 Test Methods for Estimating the Depth of Decarburization of Steel Specimens](#)
- [F1330 Guide for Metallic Abrasive Blasting to Descale the Interior of Pipe](#)

3. Terminology

3.1 Definitions used in this specification are in accordance with Terminology B374.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *diffusion coating*—a diffusion coating is one produced by causing an element to react with or diffuse into, or both, the surface of a metallic substrate, thus, chemically altering the surface of the substrate.

3.2.2 *retorts*—containers in which powder and parts are packed for processing. They can be constructed of carbon, stainless, or high alloys and fabricated in all shapes and sizes to accommodate parts being processed.

3.2.3 *significant surface*—areas that are essential to the serviceability or function of the article. These surfaces must be identified on a drawing or marked-up sample of product. Areas can fall into one of three categories as follows:

3.2.4 *coating required*—these surfaces must be in accordance with all quality requirements of this specification.

3.2.5 *no coating required*—these surfaces are areas where no coating is allowed due to a number of reasons including dimensional, fabrication, and welding, as well as others. Materials used for masking are commercially available.

3.2.6 *optional*—these surfaces do not require coating, but at the same time do not require masking.

4. Classification

4.1 There are four classes of chromium diffusion defined by base (basis) metal category.

- 4.1.1 *Class I*—Carbon steel.
- 4.1.2 *Class II*—Low-alloy steels.
- 4.1.3 *Class III*—Stainless steels.
- 4.1.4 *Class IV*—Nickel-based alloys.