



Standard Guide for Characterizing Properties of Metal Powders Used for Additive Manufacturing Processes¹

This standard is issued under the fixed designation F3049; 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 guide introduces the reader to techniques for metal powder characterization that may be useful for powder-based additive manufacturing processes including binder jetting, directed energy deposition, and powder bed fusion. It refers the reader to other, existing standards that may be applicable for the characterization of virgin and used metal powders processed in additive manufacturing systems.²

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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:³

- B212 Test Method for Apparent Density of Free-Flowing Metal Powders Using the Hall Flowmeter Funnel
- B213 Test Methods for Flow Rate of Metal Powders Using the Hall Flowmeter Funnel
- B214 Test Method for Sieve Analysis of Metal Powders
- B215 Practices for Sampling Metal Powders
- B243 Terminology of Powder Metallurgy
- B329 Test Method for Apparent Density of Metal Powders and Compounds Using the Scott Volumeter
- B417 Test Method for Apparent Density of Non-Free-Flowing Metal Powders Using the Carney Funnel

- B527 Test Method for Determination of Tap Density of Metallic Powders and Compounds
- B703 Test Method for Apparent Density of Metal Powders and Related Compounds Using the Arnold Meter
- B783 Specification for Materials for Ferrous Powder Metallurgy (PM) Structural Parts
- B822 Test Method for Particle Size Distribution of Metal Powders and Related Compounds by Light Scattering
- B855 Test Method for Volumetric Flow Rate of Metal Powders Using the Arnold Meter and Hall Flowmeter Funnel
- B923 Test Method for Metal Powder Skeletal Density by Helium or Nitrogen Pycnometry
- B964 Test Methods for Flow Rate of Metal Powders Using the Carney Funnel
- E539 Test Method for Analysis of Titanium Alloys by X-Ray Fluorescence Spectrometry
- E572 Test Method for Analysis of Stainless and Alloy Steels by Wavelength Dispersive X-Ray Fluorescence Spectrometry
- E1447 Test Method for Determination of Hydrogen in Titanium and Titanium Alloys by Inert Gas Fusion Thermal Conductivity/Infrared Detection Method
- E1569 Test Method for Determination of Oxygen in Tantalum Powder by Inert Gas Fusion Technique
- E1638 Terminology Relating to Sieves, Sieving Methods, and Screening Media
- E1941 Test Method for Determination of Carbon in Refractory and Reactive Metals and Their Alloys by Combustion Analysis
- E2371 Test Method for Analysis of Titanium and Titanium Alloys by Direct Current Plasma and Inductively Coupled Plasma Atomic Emission Spectrometry (Performance-Based Test Methodology)
- E2465 Test Method for Analysis of Ni-Base Alloys by Wavelength Dispersive X-Ray Fluorescence Spectrometry
- E2594 Test Method for Analysis of Nickel Alloys by Inductively Coupled Plasma Atomic Emission Spectrometry (Performance-Based Method)
- E2626 Guide for Spectrometric Analysis of Reactive and Refractory Metals

¹ This test method is under the jurisdiction of ASTM Committee F42 on Additive Manufacturing Technologies and is the direct responsibility of Subcommittee F42.05 on Materials and Processes.

Current edition approved June 1, 2014. Published July 2014. DOI: 10.1520/F3049-14

² Cooke, A. L., Slotwinski, J. A., "Properties of Metal Powders for Additive Manufacturing: A Review of the State of the Art of Metal Powder Property Testing," NIST IR 7873, July, 2012. Available at http://www.nist.gov/manuscript-publication-search.cfm?pub_id=911339

³ 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.