



Designation: E159 – 06

Standard Test Method for Loss of Mass in Hydrogen for Cobalt, Copper, Tungsten, and Iron Powders (Hydrogen Loss)¹

This standard is issued under the fixed designation E159; 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 test method covers the determination of the mass of hydrogen-reducible constituents in the following metal powders: cobalt, copper, iron, and tungsten.

1.2 This test method is useful for cobalt, copper, and iron powders in the range from 0.05 to 3.0 % oxygen, and for tungsten powder in the range from 0.01 to 0.50 % oxygen.

1.3 This test method does not measure the oxygen contained in oxides such as silicon oxide (SiO_2), aluminum oxide (Al_2O_3), magnesium oxide (MgO), calcium oxide (CaO), titanium dioxide (TiO_2), and so forth that are not reduced by hydrogen at the test temperatures.

1.4 For total oxygen content, vacuum or inert gas fusion methods are available (see Test Methods E1019).

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.6 *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

B215 Practices for Sampling Metal Powders

B243 Terminology of Powder Metallurgy

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E1019 Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques

¹ This test method is under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Products and is the direct responsibility of Subcommittee B09.02 on Base Metal Powders.

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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.

3. Terminology

3.1 *Definitions*—Definitions of powder metallurgy terms can be found in Terminology B243. Additional descriptive information on powder metallurgy is available in the Related Material section of Vol 02.05 of the *Annual Book of ASTM Standards*.

4. Summary of Test Method

4.1 This test method consists of subjecting a sample of powder to the action of a hydrogen-containing gas under standard conditions of temperature and time and measuring the resulting loss of mass.

5. Significance and Use

5.1 The oxygen content of a powder affects both its green and sintered properties.

5.2 Hydrogen loss is a term widely used in the powder metallurgy industry even though the measurement represents an approximate oxygen content of the powder.

5.3 Oxygen is the most common hydrogen-reducible constituent of metal powders, and this procedure may be used as a measure of oxygen, reducible under the test conditions, if other interfering elements are absent.

6. Interferences

6.1 If carbon or sulfur is present, or both, are present, they will be largely removed in the test. Their loss in mass is included in the total loss in mass measurement and must be subtracted from the total mass loss.

6.2 If metals or compounds are present that vaporize at the test temperature (such as cadmium, lead, zinc, and so forth), their effect is included in the loss of mass measurement and must be subtracted from the total mass loss.

6.3 If some components are present that are oxidized or hydrided during the test, there is a gain in mass that must be added to the total mass loss.

7. Apparatus

7.1 *Furnace*, capable of operating at the prescribed temperature.

7.2 *Temperature Control*, capable of maintaining temperatures to $\pm 15^\circ\text{C}$ ($\pm 27^\circ\text{F}$).

*A Summary of Changes section appears at the end of this standard.