



Standard Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Boron Carbide¹

This standard is issued under the fixed designation C791; 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 These test methods cover procedures for the chemical, mass spectrometric, and spectrochemical analysis of nuclear-grade boron carbide powder and pellets to determine compliance with specifications.

1.2 The analytical procedures appear in the following order:

	Sections
Total Carbon by Combustion in an Inductive Furnace and Infrared Measurement	7 – 16
Total Boron by Titrimetry and ICP OES	17 – 27
Isotopic Composition by Mass Spectrometry	28 – 32
Pyrohydrolysis	33 – 40
Chloride by Constant-Current Coulometry	41 – 49
Chloride and Fluoride by Ion-Selective Electrode	50 – 58
Water by Constant-Voltage Coulometry and Weight Loss on Drying	59 – 62
Metallic Impurities	63 and 64
Soluble Boron by Titrimetry and ICP OES	65 – 79
Free Carbon by a Coulometric Method	80 – 89

2. Referenced Documents

2.1 *ASTM Standards*:²

C750 Specification for Nuclear-Grade Boron Carbide Powder

C751 Specification for Nuclear-Grade Boron Carbide Pellets

D1193 Specification for Reagent Water

3. Significance and Use

3.1 Boron carbide is used as a control material in nuclear reactors. In order to be suitable for this purpose, the material must meet certain criteria for assay, isotopic composition, and impurity content. These methods are designed to show whether or not a given material meets the specifications for these items as described in Specifications C750 and C751.

3.1.1 An assay is performed to determine whether the material has the specified boron content.

¹ These test methods are under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and are the direct responsibility of Subcommittee C26.03 on Neutron Absorber Materials Specifications.

Current edition approved June 1, 2012. Published July 2012. Originally approved in 1975. Last previous edition approved in 2011 as C791 – 11. DOI: 10.1520/C0791-12.

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.

3.1.2 Determination of the isotopic content of the boron is made to establish whether the content is in compliance with the purchaser's specifications.

3.1.3 Impurity content is determined to ensure that the maximum concentration limit of certain impurity elements is not exceeded.

4. Reagents

4.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.³ Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

4.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Specification D1193.

5. Safety Precautions

5.1 Many laboratories have established safety regulations governing the use of hazardous chemicals and equipment. The users of these methods should be familiar with such safety practices.

6. Sampling

6.1 Criteria for sampling this material are given in Specifications C750 and C751.

TOTAL CARBON BY COMBUSTION IN AN INDUCTIVE FURNACE AND INFRARED MEASUREMENT

7. Scope

7.1 This method covers the determination of total carbon in nuclear-grade boron carbide in either powder or pellet form.

³ *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K. and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.