



Designation: C1031 – 11 (Reapproved 2022)

Standard Specification for Nuclear-Grade Aluminum Oxide Powder¹

This standard is issued under the fixed designation C1031; 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 specification provides the chemical and physical requirements for nuclear-grade aluminum oxide powder intended for fabrication into shapes for nuclear applications. Two specific uses for which this powder is intended are Al_2O_3 pellets and $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$ composite pellets for use as thermal insulator or burnable neutron absorbers, respectively.

1.2 The material described herein shall be particulate in nature.

1.3 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[C809 Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Aluminum Oxide and Aluminum Oxide-Boron Carbide Composite Pellets](#)

[C859 Terminology Relating to Nuclear Materials](#)

[E105 Guide for Probability Sampling of Materials](#)

2.2 *ANSI Standard:*

[ANSI/ASME NQA-1 Quality Assurance Requirements for Nuclear Facility Applications](#)³

¹ This specification is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.03 on Neutron Absorber Materials Specifications.

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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 Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

2.3 *U.S. Government Document:*

[Code of Federal Regulations, Title 10, Part 50—Energy \(10CFR 50\), Domestic Licensing of Production and Utilization Facilities](#)⁴

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 Terms shall be defined in accordance with Terminology C859 except for the following:

3.1.2 *buyer*—organization issuing the purchase order.

3.1.3 *powder lot*—that quantity of aluminum oxide powder made up of powder from one or more sources, blended together and homogenized such that samples taken in accordance with the procedures in Section 8 can be considered as representative of the entire quantity.

3.1.4 *seller*—aluminum oxide manufacturer.

4. Ordering Information

4.1 The buyer shall specify the following information on the order:

4.1.1 Quantity (weight of delivered product),

4.1.2 Lot size (allowable range),

4.1.3 Sample requirements, and

4.1.4 Additional requirements.

5. Chemical Composition

5.1 The powder shall conform to the following chemical requirements (see Methods C809):

Element	Weight %, max
Silicon	2.0
Iron-Chromium-Nickel	0.6
Magnesium	1.0
Sodium	0.2
Calcium	0.3
Hafnium	200 $\mu\text{g/g Al}_2\text{O}_3$
Fluorine	50 $\mu\text{g/g Al}_2\text{O}_3$
Fluorine-Chlorine-Iodine-Bromine	100 $\mu\text{g/g Al}_2\text{O}_3$
Gadolinium	100 $\mu\text{g/g Al}_2\text{O}_3$
Samarium	100 $\mu\text{g/g Al}_2\text{O}_3$
Europium	100 $\mu\text{g/g Al}_2\text{O}_3$
Dysprosium	200 $\mu\text{g/g Al}_2\text{O}_3$

5.2 The impurities listed in 5.1, and any other identified impurity exceeding 1.0 weight % and the total concentration of

⁴ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, D.C., 20401.