



Standard Specification for Nuclear-Grade Aluminum Oxide Powder¹

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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.

2. Referenced Documents

2.1 *ASTM Standards*:²

C 809 Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Aluminum Oxide and Aluminum Oxide-Boron Carbide Composite Pellets

C 859 Terminology Relating to Nuclear Materials

E 105 Practice for Probability Sampling of Materials

2.2 *ANSI Standard*:

ANSI/ASME NQA-1 Quality Assurance Requirements for Nuclear Facility Applications³

2.3 *U.S. Government Document*:

Code of Federal Regulations, Title 10, Part 50—Energy (10CFR 50), Domestic Licensing of Production and Utilization Facilities⁴

3. Terminology

3.1 *Descriptions of Terms Specific to This Standard*—Terms shall be defined in accordance with Terminology **C 859** except for the following:

3.1.1 *buyer*—organization issuing the purchase order.

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

3.1.3 *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 Particle size distribution.

5. Chemical Composition

5.1 The powder shall conform to the following chemical requirements (see Methods **C 809**):

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 total concentration of all impurities, the impurities listed in 5.1, and any other identified impurity exceeding 1.0 weight % shall be reported. The total of all measured impurities shall not exceed 4.0 weight %.

5.3 *Loss-on-Ignition*—The test method and acceptance limits for loss-on-ignition shall be agreed upon between the buyer and the seller.

NOTE 1—The buyer may specify limits for any other elements (for example, neutron absorbing materials, such as boron) not listed in 5.1.

6. Physical Requirements

6.1 The particle size distribution shall have a mean value of 6 μm or less. The particle size distribution will be determined utilizing a method approved by the buyer.

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.

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