



## Standard Specification for Nuclear-Grade Aluminum Oxide Powder<sup>1</sup>

This standard is issued under the fixed designation C 1031; 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  $\text{Al}_2\text{O}_3$  pellets and  $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$  composite pellets for use as thermal insulator or burnable neutron absorbers.

1.2 The material described herein shall be particulate in nature.

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

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 Program Requirements for Nuclear Facility Applications<sup>3</sup>

#### 2.3 U.S. Government Document:

Code of Federal Regulations, Title 10, Part 50—Energy (10CFR 50), Domestic Licensing of Production and Utilization Facilities<sup>4</sup>

### 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), and

4.1.3 Sample requirements.

4.2 The particle size distribution will be determined utilizing a method agreed upon between buyer and seller.

### 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 µg/g $\text{Al}_2\text{O}_3$ |
| Fluorine                         | 50 µg/g $\text{Al}_2\text{O}_3$  |
| Fluorine-Chlorine-Iodine-Bromine | 100 µg/g $\text{Al}_2\text{O}_3$ |
| Gadolinium                       | 100 µg/g $\text{Al}_2\text{O}_3$ |
| Samarium                         | 100 µg/g $\text{Al}_2\text{O}_3$ |
| Europium                         | 100 µg/g $\text{Al}_2\text{O}_3$ |
| Dysprosium                       | 200 µg/g $\text{Al}_2\text{O}_3$ |

5.2 Any identified impurity exceeding 1.0 weight % shall be reported. The total of all measured impurities shall not exceed 4.0 weight %.

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 submitted by the seller for approval by the buyer.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C-26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.03 on Neutron Absorber Materials Specifications.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from the American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

<sup>4</sup> Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.