Designation: C 1065 – 93

Standard Specification for Nuclear-Grade Zirconium Oxide Powder[1]

This standard is issued under the fixed designation C 1065; 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 defines the physical and chemical requirements for zirconium oxide powder intended for fabrication into shapes, either entirely or partially of zirconia, for use in a nuclear reactor core.

1.2 The material described herein shall be particulate in nature.

1.3 The values stated in SI units are to be regarded as the standard.

2. Referenced Documents

2.1 *ASTM Standards:*

C 859 Terminology Relating to Nuclear Materials[2]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[3]

E 105 Practice for Probability Sampling of Materials[3]

2.2 *ANSI Standard:*

ANSI/ASME NQA-1 Quality Assurance Program Requirements for Nuclear Facilities[4]

2.3 *U.S. Government Standard:*

Code of Federal Regulations, Title 10, Part 50, Energy (10 CFR 50) Domestic Licensing of Production and Utilization Facilities[5]

3. Terminology

3.1 Terms shall be defined in accordance with Terminology C 859 except for the following:

3.2 *buyer*—the organization issuing the purchase order.

3.3 *phase transformation*—the rearrangement of the atomic ordering of a crystalline lattice as a material is cycled through a critical transformation or inversion temperature. The change from one crystalline phase to another may be accompanied by a volume change that could lead to cracks or defects in products fabricated from such materials.

3.4 *powder lot*—a specified quantity of zirconium oxide powder (with stabilizing additive, if applicable) blended together such that samples taken in accordance with the procedures of Section 8 can be considered as representative of the entire specified quantity.

3.5 *seller*—the zirconium oxide processor.

3.6 *stabilizing additive*—a material which, when added in sufficient quantity to the subject material exhibiting the phase transformation, produces a stabilized crystalline phase that does not undergo a transformation at any temperature within the expected fabrication or usage regime of the manufactured product; the potentially deleterious volume change is therefore avoided.

4. Ordering Information

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

4.1.1 Quantity (weight of delivered product).

4.1.2 Nominal particle size range and applicable tolerances in accordance with U.S. Standard Sieve Series (Specification E 11). For particle sizes less than 280 mesh, the particle size distribution will be determined using a method agreed upon between the buyer and the seller.

4.1.3 *Stabilizing Additive*—The amount and types of stabilizing additives (if any, including limits).

4.1.4 Lot size.

4.1.5 Sampling requirements.

5. Chemical Composition

5.1 A stabilizing additive may be used with the zirconium oxide. The recommended stabilizing additive is either calcium oxide (CaO) or yttrium oxide (Y_2O_3). The recommended additive concentration in the case of CaO stabilization is 4 to 8 weight %. In the case of Y_2O_3 stabilization, the recommended additive concentration is 14 to 20 weight %.

5.2 Use analytical chemistry methods as agreed upon between the buyer and the seller.

5.3 *Impurity Concentration*—The impurity concentration excluding the stabilizing additives shall not exceed 0.5 weight %. Individual element limits are specified in Table 1. The buyer may specify additional limits for any other elements not listed in Table 1.

[1] This specification is under the jurisdiction of ASTM Committee C-26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C 26.03 on Neutron Absorber Materials Specifications.

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[2] *Annual Book of ASTM Standards*, Vol 12.01.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] Available from the American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[5] Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.