



Designation: ~~B349/B349M-03~~ Designation: B 349/B 349M – 09

# Standard Specification for Zirconium Sponge and Other Forms of Virgin Metal for Nuclear Application<sup>1</sup>

This standard is issued under the fixed designation B 349/B 349M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

~~1.1 This specification covers one grade of virgin zirconium metal commonly designated as sponge because of its porous, sponge-like texture, but it may also take other forms such as chunklets.~~

~~1.2 The one grade described is designated as Reactor Grade R60001, suitable for use in nuclear applications. The main characteristic of the reactor grade is its low nuclear cross section as achieved by removal of hafnium. The manufacturer must use procedures to prevent contamination with other high cross-section materials.~~

~~1.3 Unless a single unit is used, for example corrosion mass gain in mg/dm~~

1.1 This specification covers one grade of virgin zirconium metal commonly designated as sponge because of its porous, sponge-like texture, but it may also take other forms such as chunklets, suitable for use in nuclear applications.

1.2 Unless a single unit is used, for example corrosion mass gain in mg/dm<sup>2</sup>, the values stated in either inch-pound or SI units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore each system must be used independently of the other. SI values cannot be mixed with inch-pound values.

~~1.4~~

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

## 2. Referenced Documents

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

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

## 3. Terminology

3.1 ~~Lot Definitions—Forms:~~

~~3.1.1 castings—a lot shall consist of all castings produced from the same pour. chunklets, *n*—zirconium metal produced from the reduction of the chloride, usually by sodium.~~

3.1.1.1 Discussion—In this process, the reduced metal is melted and dripped onto a rotating disk to form chunklets.

~~3.1.2 ingot—no definition required.~~

~~3.1.3 rounds, flats, tubes, and wrought powder metallurgical products (single definition, common to nuclear and non-nuclear standards)—a lot shall consist of a material of the same size, shape, condition, and finish produced from the same ingot or powder blend by the same reduction schedule and the same heat treatment parameters. Unless otherwise agreed between manufacturer and purchaser, a lot shall be limited to the product of an 8 h period for final continuous anneal, or to a single furnace load for final batch anneal.~~

~~3.1.4 sponge—a lot shall consist of a single blend produced at one time.~~

~~3.1.5 weld fittings—definition is to be mutually agreed upon between manufacturer and the purchaser. sponge, *n*—zirconium metal produced from the reduction of the chloride, usually by magnesium.~~

3.1.2.1 Discussion—The process is one where the metal condenses to the solid state and does not melt.

3.2 Lot Definition—a lot shall consist of a single blend produced at one time.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B10 on Reactive and Refractory Metals and Alloys and is the direct responsibility of Subcommittee B10.02 on Zirconium and Hafnium.

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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*, Vol 14.02, volume information, refer to the standard's Document Summary page on the ASTM website.

#### 4. Classification

4.1 Primary zirconium is furnished in one grade designated as Reactor Grade R60001, suitable for nuclear applications. The main characteristic of the reactor grade is its low neutron capture cross section as achieved by removal of hafnium. The manufacturer must use procedures to prevent contamination with other high cross-section materials.

#### 5. Ordering Information

4.1

5.1 Purchase orders for material under this specification shall include the following information, as required, to describe adequately the desired material:

4.1.1 Quantity;

4.1.2 Name of material;

4.1.3 Grade designation; and

4.1.4 ASTM designation and year of issue.

NOTE 1—A typical ordering description is as follows: 5000 lb (2000 kg) reactor grade zirconium, Grade R60001, ASTM Specification B349-01.

4.2 In addition to the data specified in

5.1.1 Quantity (weight),

5.1.2 Name of material (zirconium sponge or chunklets),

5.1.3 Grade designation (see 4.1),

5.1.4 ASTM designation and year of issue.

5.2 In addition to the data specified in 5.1, the following options and points of agreement between the manufacturer and the purchaser shall be specified in the purchase order, as required.

4.2.1 Sampling and duplicate samples (see 7.1 and 7.2)

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4.2.2 Certification reports (Section 13)

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4.2.3 Packaging (Section 15)

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#### 5. Materials and Manufacture

5.1 Zirconium metal is usually prepared by reduction of zirconium tetrachloride, and gets its physical characteristics from the processes involved in production. These characteristics may be expected to vary greatly with manufacturing methods. This specification, however, is not limited to material prepared by reduction of tetrachloride or to material of any specific physical form.

5.2 Only virgin zirconium metal, in identified, uniform, well-mixed blends, shall be supplied under this specification.

NOTE 1—A typical ordering description is as follows: 5000 lb (2000 kg) reactor grade zirconium, Grade R60001, ASTM Specification B 349/B 349M - 09.

#### 6. Materials and Manufacture

6.1 Zirconium metal is usually prepared by reduction of zirconium tetrachloride, and gets its physical characteristics from the processes involved in production. These characteristics may be expected to vary greatly with manufacturing methods. This specification, however, is not limited to material prepared by reduction of tetrachloride or to material of any specific physical form.

6.2 Only virgin zirconium metal, in identified, uniform, well-mixed blends, shall be supplied under this specification.

#### 7. Chemical Composition

7.1 The zirconium metal supplied under this specification shall conform to the requirements for chemical composition prescribed in Table 1.

#### 7. Sampling

7.1

#### 8. Sampling

8.1 A blend of sponge shall be sampled by running a full quantity through a proportioner or splitter to obtain a representative sample of at least 1 % of the blend weight. The samples for chemical analyses shall be made on a compacted briquette and an evaluation ingot. The method for splitting this sample and preparing an evaluation ingot and compacted briquette shall be agreed upon between the manufacturer and the purchaser.

8.1.1 The evaluation ingot shall be greater than 30 lb (14 kg).

8.1.2 The compacted briquette shall be at least 1 lb (0.5 kg).

8.2 When specified in the purchase order, a duplicate sample or portions of the briquette and evaluation ingot shall be supplied to the purchaser.