



Designation: ~~B652/B652M-04~~ Designation: B652/B652M – 10

Standard Specification for Niobium-Hafnium Alloy Ingots¹

This standard is issued under the fixed designation B652/B652M; 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 covers hafnium alloyed niobium ingots prepared by vacuum- or plasma- arc melting or electron-beam furnace melting, or a combination of these methods, to produce consolidated metal for processing to various mill shapes.

1.2 The material covered by this specification is Grade R04295, niobium-base alloy containing approximately 10 % hafnium and 1 % titanium.

~~1.3 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.~~

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

2. Referenced Documents

2.1 *ASTM Standards:*²

E29 ~~Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications~~ Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E2626 Guide for Spectrometric Analysis of Reactive and Refractory Metals

3. Terminology

3.1 *Lot Definitions:*

3.1.1 ingot, n—a quantity of metal cast into a shape suitable for subsequent processing to various mill products.

4. Ordering Information

~~3.1~~ Orders for material under this specification shall include the following information as applicable:

~~3.1.1~~ General alloy description (see 1.2) and ASTM designation and year of issue,

~~3.1.2~~ Quantity in weight or pieces,

~~3.1.3~~ Size: diameter and length,

~~3.1.4~~ Chemistry (Section 5)

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~~4.1.3~~ Size: diameter and length,

~~4.1.4~~ Chemistry (Section 6),

~~3.1.5~~ Quality and finish (see 7.2

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~~3.1.6~~ Certifications and Reports (Section 13

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~~3.1.7~~ Packaging (Section 15

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~~3.1.8~~ Disposition of rejected material (Section 11

~~4.1.8~~ Disposition of rejected material (Section 12).

¹ This specification is under the jurisdiction of ASTM Committee B10 on Reactive and Refractory Metals and Alloys and is the direct responsibility of Subcommittee B10.03 on Niobium and Tantalum.

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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.

4. Materials and Manufacture

4.1 The ingot metal for this material may be vacuum- or plasma-arc melted, electron-beam melted, or a combination of these methods.

5. Chemical Composition

5.1 The material shall conform to the requirements as to chemical composition prescribed in Materials and Manufacture

5.1 The ingot metal for this material may be vacuum- or plasma-arc melted, electron-beam melted, or a combination of these methods.

6. Chemical Composition

6.1 The material shall conform to the requirements as to chemical composition prescribed in Table 1. Analysis for elements, not listed in Table 1 and not normally expected in niobium-hafnium alloy, shall not be required unless specified at time of purchase.

6. Permissible Variations in Quantity

6.1 For orders requiring up to 100 lb [45 kg] of ingots, the manufacturer may overship up to a maximum of 20%. For orders up to 1000 lb [450 kg], the manufacturer may overship up to a maximum of 10%. The permissible overshipment shall be negotiated for orders larger than 1000 lb [450 kg] and not normally expected in niobium-hafnium alloy, shall not be required unless specified at time of purchase. Guide E2626 may be used as a guide for chemical analysis techniques.

7. Workmanship, Finish, and Appearance

7.1 The manufacturer shall use care to have each lot of ingot material as uniform in quality as possible.

7.2 Permissible Variations in Quantity

7.1 For orders requiring up to 100 lb [45 kg] of ingots, the manufacturer may overship up to a maximum of 20%. For orders up to 1000 lb [450 kg], the manufacturer may overship up to a maximum of 10%. The permissible overshipment shall be negotiated for orders larger than 1000 lb [450 kg].

8. Workmanship, Finish and Appearance

8.1 The manufacturer shall use care to have each lot of ingot material as uniform in quality as possible.

8.2 When specified, the ingots shall be conditioned on the surface to standards agreed upon between the purchaser and the manufacturer.

7.3

8.3 In the conditioned ingot, no abrupt changes in diameter or local depressions that will impair subsequent fabrication will be permitted. The difference between maximum and minimum radius of the conditioned ingot shall not exceed 5% of the maximum radius. Lands, grooves, and local depressions shall be blended to a maximum angle of 30° to the axis of the ingot.

7.4

8.4 Each ingot should be tested for soundness by nondestructive test methods, such as dye penetrant and ultrasonic tests, as mutually agreed upon between the purchaser and the manufacturer.

8.5 Defects in ingots that exceed the acceptance standards shall be removed by cropping or surface conditioning, whichever is appropriate. The manufacturer shall be permitted to remove surface imperfections provided that after such removal, the requirements of conditioning are met (7.38.3).

7.6

8.6 The ingots shall be free of imperfections that would be deemed injurious by the standards of acceptability agreed upon between the purchaser and the manufacturer.

8. Number of Tests

8.1 Each ingot shall be tested for chemical composition in at least three positions along the length of the ingot.

TABLE 1 Chemical Requirements (Ingot)

Niobium-Hafnium Alloy Grade R04295	
Element	Content, Maximum Weight % (Except for Hf and Ti)
Carbon	0.015
Oxygen	0.025
Nitrogen	0.010
Hydrogen	0.0015
Hafnium	9–11
Titanium	0.7–1.3
Zirconium	0.700
Tungsten	0.500
Tantalum	0.500
Niobium by difference	