Designation: F 1594 – 95 (Reapproved 1999)

Standard Specification for Pure Aluminum (Unalloyed) Source Material for Vacuum Coating Applications [1]

This standard is issued under the fixed designation F 1594; 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 pure aluminum metal (unalloyed) for use as raw material for making evaporation sources, sputtering targets, and superconducting wires.

1.2 This specification sets purity grade levels, physical attributes, analytical methods, and packaging requirements.

2. Referenced Documents

2.1 *ASTM Standards:*

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[2]

E 112 Test Method for Determining the Average Grain Size of Metals[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *raw material lot*—a quantity of material that is melted, consolidated, or purified, or both, in one equipment run as a nominally uniform batch of metal.

4. Classification

4.1 Grades of aluminum are defined in Table 1.

4.2 Purity and total metallic impurity levels are based upon elements listed in Table 2.

5. Ordering Information

5.1 Orders for these products shall include the following:

5.1.1 Grade (see 4.1).

5.1.2 Configuration (see 8.1).

5.1.3 Whether or not certification is required (see 12.1).

5.1.4 Whether or not a sample representative of the finished product is required to be provided by the supplier to the purchaser.

6. Impurities

6.1 The suite of metallic elements to be assayed for is defined in Table 2. Acceptable analysis methods are specified in Section 12. Elements not detected will be counted and reported as present at the detection limit. Additional elements may be analyzed and reported, as agreed upon between supplier and purchaser, but these shall not be counted in defining the grade designation.

6.2 Acceptable concentration limits for individual elements and analytical techniques shall be agreed upon between the supplier and the purchaser.

TABLE 1 Aluminum Grades

Grade	Purity, %	Maximum Total Metallic Impurity Level (by weight), ppm
4N5	99.995	50
4N	99.99	100
3N8	99.98	200
3N5	99.95	500

7. Physical Properties

7.1 Grain size and measurement method for grain size shall be agreed upon between the supplier and the purchaser. When the grain morphology is equiaxied, refer to Practice E 112.

8. Dimensions

8.1 Each product shall conform to an appropriate engineering drawing.

8.2 Nominal dimensions, tolerances, and other attributes shall be agreed upon between the supplier and the purchaser.

9. Workmanship, Finish, and Appearance

9.1 Workmanship, finish, and appearance shall be agreed upon between the supplier and the purchaser.

9.2 Surface must be free of any contaminates such as mold release, dirt, or oils that could adversely affect the purity of the material when remelted, unless otherwise agreed upon between supplier and purchaser.

10. Sampling

10.1 Analyses for impurities shall be performed on a sample that is representative of the finished material lot provided by the supplier.

11. Analytical Methods

11.1 Analysis for impurities in Table 2 and 6.2 shall be

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[2] *Annual Book of ASTM Standards*, Vol 14.02

[3] *Annual Book of ASTM Standards*, Vol 03.01.

TABLE 2 Minimum Metallic Elements to be Assayed

boron	beryllium	bismuth	calcium	cadmium	cobalt	chromium	copper	iron	gallium	vanadium
lithium	magnesium	manganese	sodium	nickel	lead	silicon	tin	strontium	titanium	zinc
zirconium										

performed using optical emission spectroscopy, atomic absorption, or any other technique that meets the purchaser-required detection limits.

11.2 Impurity levels shall be reported using Practice E 29.

12. Certification

12.1 When required by the purchaser, a certificate of analysis/compliance that represents the finished material lot shall be provided for each lot by the supplier.

12.2 The certificate of analysis/compliance shall state the manufacturer's or supplier's name, the supplier's lot number, impurity levels, method of analysis, and any other information agreed upon between the supplier and the purchaser.

12.3 Impurity levels may be reported in the certificate of analysis/compliance using actual analytical results for the material lot, or by a certificate of analysis/compliance using typical analytical results based upon historical statistical data for the same process. Certification and the manner of reporting impurity levels shall be agreed upon between the supplier and the purchaser.

13. Packaging

13.1 Each piece shall be enclosed in a shipping carton that ensures product integrity during shipment.

14. Keywords

14.1 aluminum source; evaporation; thin films; vacuum coating