NOTICE: This standard has either been superceded and replaced by a new version or discontinued.
Contact ASTM International (www.astm.org) for the latest information.

Designation: F 1513 – 99

Standard Specification for Pure Aluminum (Unalloyed) Source Material for Electronic Thin Film Applications [1]

This standard is issued under the fixed designation F 1513; 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 in evaporation sources and sputtering targets. This material is intended as a raw material for electronic applications. The material is used as-supplied in some cases (for example, as *e*-beam evaporation sources). In other instances it may be remelted, alloyed, cast and processed by the purchaser to make finished products (for example, sputtering targets).

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

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards:*

D 1971 Practices for Digestion of Samples for Determination of Metals by Flame Atomic Absorption or Plasma Emission Spectroscopy [2]

3. Terminology

3.1 *material lot*—material melted and cast from one crucible charge.

4. Classification

4.1 Grades of aluminum are defined in Table 1. Impurity contents are reported in parts per million by weight (wt ppm).

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

5. Ordering Information

5.1 Orders for pure aluminum source material shall include the following:

5.1.1 Grade (4.1),

5.1.2 Configuration (8.1 and 8.2),

5.1.3 Whether or not certification is required (12.1), and

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

TABLE 1 Aluminum Grades

Grade	Purity, %	Maximum Metallic Impurity Content (by weight), ppm
6N	99.9999	1
5N5	99.9995	5
5N	99.999	10

6. Impurities

6.1 The minimum suite of metallic impurity elements to be analyzed is defined in Table 2. Acceptable analysis methods and detection limits are specified in Section 11. 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 the supplier and the purchaser, but these shall not be counted in defining the grade designation.

6.2 Nonmetalic elements to be analyzed and reported are *C*, *H*, *O*, *N*, and *S*.

6.3 Acceptable limits and analytical techniques for particular elements in critical applications shall be as agreed upon between the supplier and the purchaser.

6.4 Fluorine and chlorine may be important impurities in some applications. Acceptable limits and analytical techniques shall be agreed upon between the supplier and the purchaser.

7. Grain Size

7.1 Grain size and measurement method for grain size shall be agreed upon between the supplier and the purchaser.

TABLE 2 Minimum Suite of Metallic Elements to be Analyzed

Antimony	Gold	Silver
Arsenic	Iron	Sodium
Beryllium	Lithium	Thorium
Boron	Magnesium	Tin
Calcium	Manganese	Titanium
Cerium	Nickel	Uranium
Cesium	Phosphorus	Vanadium
Chromium	Potassium	Zinc
Copper	Silicon	Zirconium

[1] This specification is under the jurisdiction of ASTM Committee F-1 on Electronics and is the direct responsibility of Subcommittee F01.17 on Sputter Metallization.

Current edition approved Dec. 10, 1999. Published February 2000. Originally published as F 1513–94. Last previous edition F 1513–94.

[2] *Annual Book of ASTM Standards*, Vol 11.01.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States.

NOTICE: This standard has either been superceded and replaced by a new version or discontinued.
Contact ASTM International (www.astm.org) for the latest information.

8. Dimensions

8.1 Each product shall conform to an appropriate engineering drawing, as agreed upon between the supplier and the purchaser.

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 effect 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 samples that are representative of the supplier's finished material lots.

11. Analytical Methods

11.1 Analysis for impurities in 6.2 and Table 2 shall be performed as follows:

11.1.1 *Alkalies (Potassium, Lithium, Sodium)*—Atomic absorption (AA), glow discharge mass spectrometer (GDMS) or any other technique with a minimum detection limit (mdl) of 0.05 wt. ppm. Use Practices D 1971, as applicable, for sample preparation.

11.1.2 *Carbon, Oxygen, and Sulfur*—Fusion and gas extraction/infrared spectroscopy or GDMS; mdl 10 wt. ppm.

11.1.3 *Nitrogen*—Fusion and gas extraction/thermal conductivity analysis; mdl 5 wt. ppm.

11.1.4 *Hydrogen*—Fusion and gas extraction/thermal conductivity; mdl 0.3 wt. ppm.

11.1.5 *All Others*—AA, inductively coupled plasma (ICP) emission spectroscopy, spark source mass spectroscopy (SSMS), or GDMS; mdl 0.01 wt. ppm for 6N grade, 0.1 wt. ppm for 5N5 and 5N grade. Use Practices D 1971, as applicable, for sample preparation.

11.1.6 Other analytical techniques may be used provided they can be proved equivalent to the methods specified, and have minimum detection limits of the specified methods.

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, the grade level (Section 4), impurity levels (Section 6), method of analysis (Section 11), and any other information as agreed upon between the supplier and the purchaser.

12.3 Impurity levels are to be reported in the certificate of analysis/compliance using actual analytical (not "typical") results for the material lot. All impurity levels, except uranium and thorium, shall be reported in wt. ppm. Uranium and thorium are ordinarily controlled at very low levels in this material and may be reported in parts per billion by weight (wt. ppb). Nondetected trace impurities shall be reported as present at the mdl concentrations (6.1).

13. Packaging and Package Marking

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

14. Keywords

14.1 aluminum; coating; evaporation; sputtering; targets; thin films; vacuum coating

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).