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Designation: F 2113 – 01

Standard Guide for Analysis and Reporting the Impurity Content and Grade of High Purity Metallic Sputtering Targets for Electronic Thin Film Applications[1]

This standard is issued under the fixed designation F 2113; 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 guide covers sputtering targets used as thin film source material in fabricating semiconductor electronic devices. It should be used to develop target specifications for specific materials and should be referenced therein.

1.2 This standard sets purity grade levels, analytical methods and impurity content reporting method and format.

1.2.1 The grade designation is a measure of total metallic impurity content. The grade designation does not necessarily indicate suitability for a particular application because factors other than total metallic impurity may influence performance.

2. Referenced Documents

2.1 *ASTM Standards:*

F 1593 Test Method for Trace Metallic Impurities in Electronic Grade Aluminum by High Mass-Resolution Glow-Discharge Mass Spectrometer[2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *finished product*, *n—for the purpose of this standard*, a "finished product" is a manufactured sputtering target, ready for use.

3.1.2 *material lot*, *n—for the purpose of this standard*, a "lot" is material consolidated into one ingot, and processed as one continuous batch in subsequent thermal-mechanical treatments.

3.1.3 *target specification*, *n—for the purpose of this standard*, a specification for a sputtering target source material for electronic thin film applications.

3.2 *Abbreviations:*

3.2.1 *mdl*—minimum detection limit

4. Impurities

4.1 The minimum set of metallic impurity elements to be analyzed shall be developed and listed in the target specification or agreed upon by the purchaser and supplier.

4.2 Acceptable analysis methods and detection limits are to be specified in the target specification. Elements not detected will be counted and reported as present at the minimum detection limit ("mdl") for the method used. Additional elements may be analyzed and reported as agreed upon between the purchaser and the supplier, but these elements shall not be counted in defining the grade designation.

4.3 Certain elements may present particular analysis problems, such as interferences. The limits, analysis method, and mdl may, in such cases, be as agreed upon between the purchaser and the supplier.

4.4 Nonmetallic elements, which shall be analyzed and reported, are carbon, hydrogen, nitrogen, oxygen, and sulfur. Maximum limits for nonmetallic impurities shall be agreed upon between the purchaser and the supplier.

4.5 Acceptable limits and analytical techniques for particular elements in critical applications may be agreed upon between the purchaser and the supplier.

5. Classification

5.1 Grades of metallic sputtering targets are defined in Table 1, based upon total metallic impurity content of the set of elements as specified in 4.1. Impurity contents are reported in parts per million by weight (wt ppm).

5.2 Purity grade and total metallic impurity levels are based upon the set of elements as specified in 4.1.

6. Sampling

6.1 Analysis for impurities and gases shall be performed on samples that represent the finished sputtering target.

6.1.1 Unless otherwise agreed upon between the purchaser and the supplier, impurity analyses for metallic and nonmetallic impurities shall be made by the supplier for one or more sample specimens that are representative of the production lot. If more than one sample specimen is used, the results of the analyses shall be averaged to establish conformance with the grade designation (5.1), other metallic impurity limits (4.2, 4.3, and 4.5), and the agreed upon limits for nonmetallic content (4.4).

7. Analytical Methods

7.1 Analysis for impurities listed as specified in Section 4 shall be performed using methods, techniques and mdls appropriate to the material, grade and special agreements (4.3-4.5):

[1] This guide is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.17 on Sputtered Thin Films.

Current edition approved June 10, 2001. Published August 2001.

[2] *Annual Book of ASTM Standards*, Vol 10.04.

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