SEMI MF928-0305 (Reapproved 0211)
TEST METHODS FOR EDGE CONTOUR OF CIRCULAR SEMICONDUCTOR WAFERS AND RIGID DISK SUBSTRATES

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1 Purpose

1.1 The edges of circular wafers of electronic materials are frequently required to be shaped after cutting the wafers from the ingot. Contouring the wafer edge reduces the incidence of chipping and minimizes epitaxial edge crown and photoresist edge bead during subsequent processing of the wafer. Similarly, edges of rigid disk substrates are frequently edge shaped.

1.2 The test methods described here provide means to determine that the wafer edge contour is appropriate to meet specifications, such as SEMI M1 or SEMI M9, which are intended to provide wafers avoiding the difficulties enumerated above.

2 Scope

2.1 These test methods provide means for examining the edge contour of circular wafers of silicon, gallium arsenide, and other electronic materials, and determining fit to limits of contour specified by a template that defines a permitted zone through which the contour must pass. Principal application of such a template is intended for, but not limited to, wafers that have been deliberately edge shaped.

NOTE 1: DIN 50441-2 is equivalent to Method B of this standard. It is the responsibility of DIN Committee NMP 221. DIN 50441-2, Measurement of the Geometric Dimensions of Semiconductor Slices; Testing of Edge Rounding, is available from Beuth Verlag GmbH, Burggrafenstrasse 6, 10787 Berlin, Germany, Telephone: 49.30.2601.0, Fax: 49.30.2601.1263, http://www.beuth.de.

2.2 Two test methods are described:

2.2.1 Method A is destructive and is limited to inspection of discrete points on the periphery, including flats. The contour of deliberately edge-shaped wafers may not be uniform around the entire periphery, and thus the discrete location(s) may or may not be representative of the entire periphery.

2.2.2 Method A is recommended for examining the edge profile of flatted regions of the wafer.

2.2.3 Method A is best suited for referee purposes.

2.3 Method B is nondestructive and suitable for inspection of all points on the wafer periphery except flats.

2.3.1 Method B is appropriate for routine process monitoring such as alignment of wafer edge grinders, routine quality control and incoming/outgoing inspection purposes. In view of the uncertainty of precisely locating the intersection of the contour and the wafer surface when carrying out Method B, use of this method for commercial transactions is not recommended unless the parties to the test establish the degree of correlation that can be obtained.

2.3.2 Method B may also be applied to the examination of the edge contour of the outer periphery of substrates for rigid disks used for magnetic storage of data; metallic rigid disk substrates cannot conveniently be cleaved.

NOTE 2: Reference to wafers in the remainder of this standard shall be interpreted to include substrates for rigid disks unless the phrase “of electronic materials” is also included in the context.

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

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

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3 Limitations

3.1 In Method B, the profile of the parallel surfaces of the wafer may not be sharply focused at distances exceeding approximately 0.5 mm (0.020 in.) from the extreme wafer edge toward the wafer center. This uncertainty in the wafer surface location may cause inaccuracy in positioning the wafer with respect to template lines. It may also make it difficult to determine whether the wafer edge profile lies within the permitted zone at point B of the template (see Figure 1). These difficulties can be overcome by aligning a straight edge to the wafer surface by direct contact, observing the shadow extension in the sharply focused region, and extrapolating the straight line edge of the template reference. In applying this technique, exercise care to avoid damaging or contaminating the wafer surface.

3.1.1 This limitation renders Method B unsuitable for determining the distance between the front and back wafer surfaces. The edge contours near the front and back surfaces of the wafer must be inspected separately.

3.2 In Method B, attempting to view the complete wafer periphery, except flats, through wafer rotation may necessitate frequent focus adjustment due to variations in wafer roundness and fixturing precision, including wafer centering.

3.3 By either test method, any foreign material such as large particles or high spots on the wafer surface in the light path will present a false edge contour by masking the true contour shape.

3.4 It is not always feasible to provide a uniform radius or bevel to the edges of wafers because silicon, gallium arsenide, and many other electronic materials as well as glass disk substrates are both hard and brittle. Wear of grinding tools, process variations, and the presence of flats on the circumference of wafers cause practical contours to have varying shapes. For this reason, templates are used that define an allowed range.

3.5 If a television system is used, the user is cautioned that distortions in the horizontal and vertical deflections may occur (see ¶ 9.2).

4 Referenced Standards and Documents

4.1 *SEMI Standards*

SEMI M1 — Specifications for Polished Single Crystal Silicon Wafers

SEMI M9 — Specifications for Polished Monocrystalline Gallium Arsenide Slices

4.2 *ANSI Standard*[1]

ANSI/ASQ Z1.4 — Sampling Procedures and Tables for Inspection by Attributes

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Summary of Test Methods

5.1 Both test methods employ optical means to project a shadow of the edge contour at substantial magnification on a screen.

5.1.1 In applying Method A (destructive) the sample wafer is cleaved or broken along a diameter. A sharply focused image of the cross section of the wafer is obtained over a sufficiently large region near the edge with the aid of an optical comparator or projection microscope.

5.1.2 In Method B (nondestructive) the unbroken wafer is back lighted with collimated (parallel) light such that a sharply defined shadow of the wafer edge is projected on a screen. In this test method the wafer is not altered in any way.

5.2 By either test method, the contour of the wafer edge profile image is compared to a template that has been mounted or projected on the screen. The template defines a permitted zone through which the edge contour must pass.

[1] American National Standards Institute, Headquarters: 1819 L Street, NW, Washington, DC 20036, USA. Telephone: 202.293.8020; Fax: 202.293.9287. New York Office: 11 West 42nd Street, New York, NY 10036, USA. Telephone: 212.642.4900; Fax: 212.398.0023; http://www.ansi.org.

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