

SEMI M70-1015

TEST METHOD FOR DETERMINING WAFER-NEAR-EDGE GEOMETRY USING PARTIAL WAFER SITE FLATNESS

This Standard was technically approved by the Silicon Wafer Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on August 31, 2015. Available at www.semiviews.org and www.semi.org in October 2015; originally published March 2007; previously published November 2009.

1 Purpose

1.1 Wafer near edge geometry can significantly affect the yield of semiconductor device processing.

1.2 Knowledge of near edge geometrical properties can help the producer and consumer to determine if the dimensional characteristics of a wafer satisfy given geometrical requirements.

1.3 This Test Method is suitable for quantifying the near edge geometry of wafers used in semiconductor device processing.

1.4 The PSFQR or PSFQD metric is suitable for quantifying near edge geometry when applying a site pattern that appropriately covers large parts of the wafer edge.

NOTE 1: Acronyms beginning with P are the same as those in Appendix 1 of SEMI M1 except that they relate to the partial sites covering the near edge region.

1.5 Flatness metric is well-established therefore partial site flatness can be used as a process control tool as well as a material exchange specification for edge geometry.

1.6 There are other metrics; that is, ZDD, ESFQR, ROA, some of which quantify more specific aspects of edge geometry.

NOTE 2: ERO is frequently employed as a more general term for describing near edge geometry, but as of the approval date of this standard there are no standardized conditions or test procedures for it. As such a general term, ERO is included in the keywords for this standard, even though it is outside the scope of the standard.

2 Scope

2.1 This Test Method covers calculation of the near edge geometry metrics PSFQR and PSFQD.

2.2 SFQR and SFQD are well known parameters and described in detailed in SEMI MF1530. In contrast to SEMI MF1530 the present Test Method is dealing exclusively with the non-full sites (i.e., the partial sites). The Test Method is focused only and specifically on near edge geometry applications.

2.3 The metrics calculated by this Test Method are based on a thickness data array (see also SEMI MF1530). This array represents the front surface of the wafer when the back surface of the wafer is ideally flat, as when pulled down onto an ideally clean flat chuck.

2.4 This Test Method is suitable for polished, epitaxial, SOI, or other layer condition.

2.5 The Test Method is applicable to categories of wafers specified in SEMI M1 used in advanced IC manufacturing.

2.6 This Test Method does not cover acquisition of the thickness data array. However, it gives the required characteristics of the thickness data array.

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.

3 Limitations

3.1 Deficiencies of data such as inadequate spatial resolution, mispositioning, noise, etc. in the thickness data array used to calculate the metrics may lead to erroneous results.

3.2 The calculations of this Test Method do not remove wafer shape and therefore are not applicable to data obtained from unclamped wafer single-surface data.

3.3 The reference plane used in the calculation is dependent on the x - and y -length of the sites and the x - and y -offset of the site pattern.

4 Referenced Standards and Documents

4.1 SEMI Standards and Safety Guidelines

SEMI M1 — Specifications for Polished Single Crystal Silicon Wafers

SEMI M20 — Practice for Establishing a Wafer Coordinate System

SEMI M49 — Guide for Specifying Geometry Measurement Systems for Silicon Wafers for the 130 nm to 22 nm Technology Generations

SEMI M59 — Terminology for Silicon Technology

SEMI M67 — Test Method for Determining Wafer Near-Edge Geometry from a Measured Thickness Data Array Using the ESFQR and ESFQD Metrics

SEMI M68 — Test Method for Determining Wafer Near-Edge Geometry from a Measured Height Data Array Using a Curvature Metric, ZDD

SEMI M77 — Test Method for Determining Wafer Near-Edge Geometry Using Roll-Off Amount, ROA

SEMI MF1530 — Test Method for Measuring Flatness, Thickness, and Total Thickness Variation on Silicon Wafers by Automated Noncontact Scanning

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

5 Terminology

5.1 Acronyms, terms, and symbols used in silicon wafer technology, including those in this Test Method, are given in SEMI M59.

6 Summary of Test Method

6.1 All partial sites are used for metric calculation. Partial sites are defined by FQA, the site size and offset. Required exclusions are defined.

6.2 A thickness data array is acquired.

6.3 The data array is used to construct a reference plane in each site.

6.4 PSFQR for each site is calculated as the range of the reference plane deviation within the site.

6.5 PSFQD for each site is calculated as the reference plane deviation within the site having the largest absolute value within the site while retaining the sign.

6.6 Recipe parameters are reported.

6.7 PSFQR and PSFQD are reported for each site. Statistical quantities for these parameters are also calculated and reported for each wafer.

7 Apparatus

7.1 *Measuring Equipment* — Suitable for acquiring the thickness data array and transferring it to the calculation software.

NOTE 3: A test method for acquiring a suitable thickness data array is being considered for development by the Silicon Wafer Committee.

7.1.1 The equipment shall perform all necessary calculations and corrections needed to produce the thickness data array internally and automatically, including instrument-dependent exclusion areas. The equipment shall be equipped with a means of detecting and either deleting or identifying invalid data (over-range signal).