

SEMI M25-95 (Withdrawn 1103)

SPECIFICATION FOR SILICON WAFERS FOR CALIBRATION OF LIGHT POINT DEFECT WAFER INSPECTION SYSTEMS WITH RESPECT TO THE DIAMETER OF POLYSTYRENE LATEX SPHERES

NOTICE: This document was balloted and approved for withdrawal in 2003.

1 Purpose

1.1 This document describes the specifications to be met by bare silicon wafers used for calibrating surface inspection systems with respect to the diameter of polystyrene latex spheres. This document does not intend to establish manufacturing procedures for calibration wafers.

Note 1: This specification might be used as the basis for making calibration substrates with other materials and/or surfaces.

2 Scope

2.1 Bare silicon wafers on which latex-spheres of a known diameter are deposited are used as standards for the calibration of bare wafer inspection systems. The response curve of the systems is generated for the calibration of the systems with respect to the sizing of polystyrene latex (PSL) spheres, not for counting them.

3 Referenced Documents

3.1 SEMI Standard

SEMI M1 — Specifications for Polished Monocrystalline Silicon Wafers

4 Terminology

4.1 *Light-Point Defect (LPD)* — An isolated, localized effect on the wafer surface or in the substrate wafers resulting in increased light scattering intensity above a threshold (unit LSE).

Note 2: LPD is a general term and it includes for example latex spheres and other localized surface irregularities.

4.2 *Latex-Sphere Equivalent (LSE)* — The size unit of an LPD expressed as the diameter of a latex-sphere which scatters the same amount of light as the LPD. This is indicated by adding “LSE” to the length unit used, e.g., 0.2 μm LSE.

Note 3: Sizing may be different for other materials and shapes than PSL spheres because of the different optical designs of inspection systems.

4.3 *Response Curve (RC)* — The relation between measured scattered light intensity and latex-sphere diameters for a calibration surface inspection system.

The RC depends on the light source used and may contain non-monotonic regions.

4.4 *LPD histogram* — The distribution of the counts of LPD's per unit length over their size as expressed in LSE.

5 Requirements

5.1 *Substrates* — The wafers used as substrates for the deposition of latex-spheres must be bare silicon with a native oxide surface and they have to meet the requirements of SEMI M1. In addition to the M1 specification, the surface conditions (for example, roughness) must be in compliance with Section 5.5.2.

Note 4: The substrate wafer must be measured before latex sphere deposition with the same type of instrument to ensure that the conditions of 5.5.2 are fulfilled.

5.2 *Latex-Spheres* — The latex-spheres used must be certified with respect to their diameter and they must be traceable to the Standard Reference Materials (SRM) of the National Institute of Standards and Technology (NIST), former National Bureau of Standards (NBS). The certification methodology must be in accordance with the technologies used by NIST.

Note 5: If the PSL are not traceable to NIST, the certification method should be fully documented.

5.3 *Range of Latex-Sphere Diameters* — The diameters of the latex-spheres used for calibration must be selected so that the measurement range for the intended application is covered. Sufficient latex-sphere diameters must be used to achieve the required accuracy of the RC.

Note 6: For surface inspection systems using laser light source(s), it is recommended to avoid latex-sphere diameters corresponding approximately to the wavelength of the laser used and its multiples of the laser used.

5.4 *Density of Latex-Spheres Deposited* — The density of the deposited latex-spheres, full or partial wafer coverage, must be selected in such a way that the peak of the histogram of the latex-sphere diameters is at least 100% above the background counts. It has to be verified that the indicated (relevant) peak in the histogram is generated by single, isolated latex-spheres of the specified diameter. A density of 5–15 latex-spheres per square centimeter is recommended.

5.5 *Background Contamination*

5.5.1 Calibration wafers must be handled and stored with great care to avoid contamination and damage.

5.5.2 The bell-shaped peak in the LPD histogram of a calibration wafer which is generated by the latex-spheres must be well-defined and must be well above the background level. The bell-shaped curve has to go down to less than 50% of its peak value on both sides of the maximum within a diameter range of $\pm 15\%$ as referred to the nominal latex-sphere diameter.

5.6 *Multiple Deposition of Latex-Spheres* — Deposition of latex-spheres with different, well-defined diameters on a calibration wafer is allowed if all the conditions of this specification are met for each kind of deposited latex-sphere size.

6 Packaging

6.1 Special packing requirements shall be subject to agreement between the supplier and the purchaser. Otherwise all wafers shall be handled, inspected, and packed in such a manner as to avoid chipping, scratches, and contamination, and in accordance with the best industry practices to provide ample protection against damage during shipment.

7 Data to Accompany Calibration Wafers

7.1 Certificate for average and standard deviation of the diameter of the latex spheres used, including the production lot number of latex-spheres used.

7.2 Date of production and certification of calibration wafer.

7.3 Histogram, as defined above.

7.4 Approximate number of deposited latex-spheres in a specified area.

7.5 Wafer identification.

7.6 Name and address of the originator of the calibration wafers.

7.7 LPD's wafer map.

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