

SEMI M38-1104

SPECIFICATION FOR POLISHED RECLAIMED SILICON WAFERS

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NOTICE: This document was completely rewritten in 2004.

1 Purpose

1.1 Silicon wafers are often subjected to reclaim processes in order to improve manufacturing efficiency in device production. A reclaimed wafer is one that has been re-conditioned for subsequent utilization.

1.2 This specification covers requirements for reclaimed silicon wafers to be used for testing and process monitoring in semiconductor manufacturing.

1.3 In some instances for 300 mm wafers with supplier marked back surfaces, it is necessary to re-inscribe the mark after one or more reclaim cycles. Consequently, this specification also includes an appendix that covers the re-inscription of such wafers.

NOTE 1: Issues related to the re-inscription of such 300 mm wafers are discussed in Related Information 1.

2 Scope

2.1 This specification divides reclaimed wafers into four application categories: Mechanical, Furnace, Particle, and Lithography and provides tables of the specification requirements for each category. Thus, a prospective purchaser of reclaimed silicon wafers needs to know which application matches his or her requirements.

2.2 Only requirements for some attributes are specified in Tables 1 and 2. Other requirements are indicated to be “customer specified” which means that the customer may specify a requirement for that particular attribute, “as-supplied” which means that the attribute has whatever value was supplied in the wafer delivered (or used) for reclaim, and “unspecified” which means that the attribute is not specified and for which the wafer does not need to be tested.

2.3 In addition to the general categories listed in Section 2.1, this specification provides requirements for reclaimed wafers intended for use in advanced device production, including devices in the 180 and 130 nm technology generations in a third table.

2.4 This specification is directed specifically to silicon wafers with one or both polished surfaces. If the wafers

have epitaxial deposits, the attributes of the epitaxial layer are not included the specification requirements.

2.5 This specification covers reclaim wafers that are either customer-supplied or third party-sourced. The user should exercise caution when sourcing materials with unknown thermal histories, unknown bulk contamination, or unknown deposits, such as gold (Au) films.

2.6 For applications placing higher demands on silicon wafers such as particle counting, measuring pattern resolution in a photolithography process, or surface ion contamination monitoring, the customer may want to reference SEMI M1, SEMI M8, or SEMI M24.

2.7 For referee purposes, U.S. customary units shall be used for wafers of 2- and 3-inch nominal diameter and SI (System International), commonly called metric, units for 100 mm and larger diameter wafers.

NOTICE: This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.

3 Referenced Standards

3.1 SEMI Standards

SEMI M1 — Specifications for Polished Monocrystalline Silicon Wafers

SEMI M8 — Specification for Polished Monocrystalline Silicon Test Wafers

SEMI M18 — Format for Silicon Wafer Specification Form for Order Entry

SEMI M24 — Specification for Polished Monocrystalline Silicon Premium Wafers

SEMI M31 — Provisional Mechanical Specification for Front Opening Shipping Box Used to Transport and Ship 300 mm Wafers

SEMI M45 — Provisional Shipping System for 300 mm Wafer Shipping System

SEMI MF1241 — Terminology of Silicon Technology

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

4 Terminology

4.1 Definitions of terms related to silicon wafer technology are given in SEMI M1 and in SEMI MF1241.

4.2 The following definitions apply in the context of this specification:

4.2.1 *furnace wafer* — a silicon wafer suitable for monitoring thermal processes or as an implant monitor, usually used only in a cleanroom environment.

4.2.2 *lithography wafer* — a silicon wafer used specifically for testing lithography equipment wherein surface flatness is the key attribute, usually used only in a cleanroom environment.

4.2.3 *mechanical wafer* — a silicon wafer suitable for equipment or process testing, usually outside of a cleanroom environment.

4.2.4 *particle wafer* — a silicon wafer suitable for monitoring area or process cleanliness, used only in a cleanroom environment.

4.2.5 *reclaimed wafer* — a silicon wafer that has been reconditioned for subsequent utilization.

5 Ordering Information

5.1 Purchase orders for reclaimed silicon wafers furnished to this specification shall minimally include the following items:

5.1.1 Nominal diameter,

5.1.2 Type of application (mechanical, furnace, particle, lithography, 180 nm, or 130 nm),

5.1.3 A statement that the wafers are customer-supplied or third-party sourced,

5.1.4 Resistivity,

5.1.5 Any other requirement specified by the customer (indicated as “customer specified” in the tables),

5.1.6 Any requirements that differ from the tables, and

5.1.7 Methods of testing specified attributes for which either no or multiple test methods exist (see Sections 7.2 and 7.3).

5.2 Customer specified requirements other than resistivity may include:

5.2.1 Nominal edge exclusion for FQA,

5.2.2 Wafer ID marking,

5.2.2.1 For 300 mm wafers, whether the wafers are to be re-inscribed as specified in Appendix 1 or not,

5.2.3 Pits, haze, and/or back surface roughness (particle or lithography wafers),

5.2.4 Localized light scatterers, and

5.2.5 Edge condition (for 200 and 300 mm wafers only),

5.3 In addition the following optional criteria may be included in a purchase order:

5.3.1 Minimum removal requirements (if any),

5.3.2 Lot traceability and lot integrity maintenance requirements,

5.3.3 Lot acceptance criteria,

5.3.4 Certification, and

5.3.5 Packing and Marking.

5.3.5.1 Note that for packing and marking of 300 mm wafers, the requirements of SEMI M31 and SEMI M45 shall be observed.

6 Requirements

6.1 The wafers shall conform to the parameters as specified in the appropriate column of Table 1, Table 2, or Table 3, as augmented and amended by the purchase order.

6.2 The wafers shall be capable of being reconditioned for use.

7 Test Methods

7.1 Values of attributes specified in the tables or purchase order shall be tested in accordance with the test methods indicated for the attribute in SEMI M1 or SEMI M18. Sampling for the test shall be done in accordance with the requirements of SEMI M1.

7.2 If multiple tests are described for any attribute, the purchase order shall indicate which test shall be used, unless the supplier of the reclaimed wafers can make the choice.

7.3 If no standardized test is available for any attribute, the test method to be used shall be agreed upon between purchaser and supplier.

8 Certification

8.1 Upon request of the purchaser in the contract or order, a manufacturer's or supplier's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

8.2 In the interest of controlling inspection costs, the supplier and the purchaser may agree that the material shall be certified as “capable of meeting” certain requirements. In this context, “capable of meeting” shall signify that the supplier is not required to perform the appropriate tests in Section 9. However, if the purchaser performs the test and the material fails to meet the requirement, the material may be subject to rejection.

9 Packing and Marking

9.1 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.

9.2 The wafers supplied under this specification shall be identified by appropriately labeling the outside of each box or other container and each subdivision thereof in which it may reasonably be expected that the wafers will be stored prior to further processing.

9.3 For 300 mm wafers, the packing and marking requirements of SEMI M31 and SEMI M45 shall be met.

Table 1 Specifications for 150 mm, 200 mm, and 300 mm Silicon Reclaim Wafers

	Item	Mechanical	Furnace	Particle	Lithography
1.0	General Characteristics				
1.1	Growth Method		As-supplied		
1.2	Crystal Orientation		As-supplied		
1.3	Conductivity Type		As-supplied		
1.4	Dopant		As-supplied		
1.5	Nominal Edge Exclusion for FQA	Unspecified	Customer specified		
2.0	Electrical Characteristics				
2.1	Resistivity		Customer specified		
2.2	Radial Resistivity Variation (RRG)		Unspecified		
2.3	Resistivity Striations		Unspecified		
2.4	Minority Carrier Lifetime		Unspecified		
3.0	Chemical Characteristics				
3.1	Oxygen Concentration	Unspecified	As-supplied	Unspecified	
3.2	Radial Oxygen Variation	Unspecified	As-supplied	Unspecified	
3.3	Carbon Concentration	Unspecified	As-supplied	Unspecified	
4.0	Structural Characteristics				
4.1	Dislocation Etch Pit Density		Unspecified		None
4.2	Slip	Unspecified	None		
4.3	Lineage	Unspecified	None		
4.4	Twins	Unspecified	None		
4.5	Swirl		Unspecified		
4.6	Shallow Pits		Unspecified		
4.7	OISF		Unspecified		
4.8	Oxide Precipitates		Unspecified		
5.0	Wafer Preparation Characteristics				
5.1	Wafer ID Marking		Customer specified		
5.2	Front Surface Thin Films	Unspecified	None	Unspecified	None
5.3	Denuded Zone		Unspecified		
5.4	Extrinsic Gettering	Unspecified	None	Unspecified	None
5.5	Backseal	Unspecified	None	Unspecified	None
5.6	Annealing		Unspecified		

	Item	Mechanical	Furnace	Particle	Lithography
6.0	Mechanical Characteristics				
6.1	Diameter				
	150 mm ±	0.50 mm			
	200 mm ±	0.50 mm			
	300 mm ±	0.50 mm			
6.2	Primary Flat/Notch Dimension	As-supplied			
6.3	Primary Flat/Notch Orientation	As-supplied			
6.4	Secondary Flat Dimension (if Applicable)	As-supplied			
6.5	Secondary Flat Location (if Applicable)	As-supplied			
6.6	Edge Profile	Unspecified			
6.7	Thickness				
	150 mm (SEMI M1.8)	533–675 μm			
	150 mm (SEMI M1.13)	585–725 μm			
	200 mm	600–775 μm			
	300 mm	650–800 μm			
6.8	Thickness Variation (TTV)	Unspecified			
6.9	Surface Orientation	As-supplied			
6.10	Bow	Unspecified			
6.11	Warp (for diameters other than 300 mm)	Unspecified			
	Warp (for 300 mm only)	Unspecified			
6.12	Sori	Unspecified			Customer specified
6.13	Flatness/Global	Unspecified			Customer specified
6.14	Flatness/Site	Unspecified			Customer specified
7.0	Front Surface Chemistry				
7.1	Surface Metal Contamination				
	Sodium	Unspecified	Customer specified	Unspecified	
	Aluminum	Unspecified	Customer specified	Unspecified	
	Potassium	Unspecified	Customer specified	Unspecified	
	Chromium	Unspecified	Customer specified	Unspecified	
	Iron	Unspecified	Customer specified	Unspecified	
	Nickel	Unspecified	Customer specified	Unspecified	
	Copper	Unspecified	Customer specified	Unspecified	
	Zinc	Unspecified	Customer specified	Unspecified	
7.2	Surface Organics	Unspecified			
8.0	Front Surface Visual Characteristics				
8.1A	Scratches (macro) – total length	Unspecified	None		
8.1B	Scratches (micro) – total length	Unspecified	≤0.10 × Diameter		
8.2	Pits	Unspecified		Customer specified	
8.3	Haze	Unspecified		Customer specified	