

SEMI P20-0703

GUIDELINE FOR CATALOG PUBLICATION OF EB RESIST PARAMETERS (PROPOSAL)

This guideline was technically approved by the Global Micropatterning Committee and is the direct responsibility of the Japanese Micropatterning Committee. Current edition approved by the Japanese Regional Standards Committee on April 28, 2003. Initially available at www.semi.org June 2003; to be published July 2003. Originally published in 1992.

NOTICE: This Standard or Safety Guideline has an Inactive Status because the conditions to maintain Current Status have not been met. Inactive Standards or Safety Guidelines are available from SEMI and continue to be valid for use.

1 Purpose

- 1.1 The purpose of this guideline is to provide a baseline for publications of EB resist parameters. It can also be used as a guide to evaluate resist process parameters. This guideline is intended to be applicable for electron beam processes.
- 1.2 The parameters for EB Resist publication are discussed below.

2 Scope

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 Resist Commercial Name

- 3.1 Describe resist commercial name.

4 Resist Properties

4.1 Polymer Properties

- 4.1.1 *Components* — Describe resist components. Chemical structure is not necessarily required.
- 4.1.2 *Molecular Weight* — Describe M_w , M_n and M_w/M_n if known.
- 4.1.3 *Thermal Characteristics* — Describe T_g and T_m .

4.2 Resist Solution Properties

- 4.2.1 *Solvent* — Specify chemical names.
- 4.2.2 *Viscosity* — Solution viscosity, $\text{mPa}\cdot\text{s}$, 25°C .
- 4.2.3 *Solid Content* — Weight %.

5 Film Forming Properties

- 5.1 *Thickness Curves* — Plot film thickness T (μm or nm) after prebake versus spinning speed R (rpm). Here, x axis is $\log(R)$ and y axis is $\log(T)$.
- 5.2 *Conditions* — Specify following conditions.
 - 5.2.1 *Substrate* — Silicon wafer or chrome mask blank. Specify its structure.
 - 5.2.2 *Spinning Conditions* — Specify spinning conditions including coating sequence.
 - 5.2.3 *Environmental Conditions* — Temperature ($^\circ\text{C}$), relative humidity (%).
 - 5.2.4 *Prebake Conditions* — Prebaking temperature ($^\circ\text{C}$), time (sec), heating and cooling method and apparatus. Specify heating rate and cooling rate if monitored.

5.2.5 *Thickness Measurement Methods* — Thickness measurement instruments and measurement method. In case of a light interference thickness measurement apparatus, specify the refractive index as a parameter used in the measurement.

6 Film Thicknesses

6.1 Defines resist thicknesses and measurement conditions for resist parameter descriptions in and after § 10. Unit is μm or nm .

6.1.1 Film Thickness Definitions

6.1.1.1 *Ti* — Initial thickness after prebake prior to exposure.

6.1.1.2 *Te* — Exposed region thickness after development.

6.1.1.3 *Tu* — Unexposed region thickness after development, and after postbake if required.

6.1.1.4 *N_{Te}* — T_e/T_i . Normalized exposed region thickness.

6.1.1.5 *N_{Tu}* — T_u/T_i . Normalized unexposed region thickness.

6.1.2 *Thickness Measurement Conditions* — Thickness measurement conditions should be the same as described in ¶ 5.2.5. In case of measurements of exposed region thickness, exposed region area should be larger than $20\ \mu\text{m}$ on all sides.

7 Sample Preparation

7.1 Defines sample preparation methods for resist parameter descriptions in and after § 10.

7.1.1 *Film Thickness* — *Ti*. $0.50 \pm 0.02\ \mu\text{m}$ ($500 \pm 20\ \text{nm}$) is recommended for a standard thickness.

7.1.2 *Conditions* — Specify conditions described in ¶ 5.2.1 to 5.2.4.

8 Exposure

8.1 Defines exposure condition description methods for resist parameter descriptions in and after § 10.

8.1.1 *Exposure Dosage Definition* — Quantity of electrical charge per unit area, $\mu\text{C}/\text{cm}^2$. Describe as *D*.

8.1.2 *Exposure Dosage Calculation* — Calculate as follows.

$$D = I \times t / S \times 10^6$$

Here, *I* is current (A), *t* is exposure time (s), *S* is exposure area (cm^2).

Specify these parameters.

8.1.3 *Acceleration Voltage* — In a range from 10 to 50 kV.

8.1.4 *Exposure System* — Specify exposure methods.

8.1.4.1 *Beam Scanning Methods* — For example, raster scanning or vector scanning. Specify beam scanning pitch if defined.

8.1.4.2 *Beam Shape* — Describe beam shape.

8.1.4.3 *Beam Conditions* — Specify beam size (μm or nm) and current density (A/cm^2), if possible.

8.1.4.4 *Exposure Tool Manufacturer and System Name* — Specify exposure tool manufacturer and system name, if possible.

9 Processing and Developing Parameters

9.1 This section defines process condition descriptions in and after § 10.

9.1.1 *Post Exposure Treatments* — Describe if any treatment is processed after exposure before development.

9.1.1.1 *Methods* — For example, post exposure bake.