SEMI P9-0298
GUIDELINE FOR FUNCTIONAL TESTING OF MICROELECTRONIC RESISTS

SUPERSEDED

1 Purpose

1.1 The purpose of this guideline is to provide a baseline program of test procedures needed to functionally test liquid-developed resists, resist developers, and rinses for microelectronic applications. It can also be used as a guide to evaluate process modifications to such systems. This guideline is intended to be applicable for photo, DUV, X-ray, and electron beam processes.

2 Background

2.1 Release of the information in this document was approved by the SEMI Photolithographic Chemicals Committee (Resist Committee) in May 1987. This committee plans to complete and revise the guideline as appropriate. Comments will be welcomed.

3 Scope

3.1 Virtually all lithographic fabrication processes vary in some way from location to location, even for the same type of resist. Consequently, it is impossible to provide a stringent evaluation program acceptable to most users. It is, therefore, the aim of this guideline to provide a program of tests and methods that allows variable, but controlled, process differences. In order to maintain a proper baseline control for each process, all tests should be run relative to some internal standard product whose functional characteristics are known and characterized. It is understood that each product is to be run at its own preferred or recommended conditions and that different products may be evaluated under different conditions. It should also be understood that some properties, variables, or conditions, such as normality, are specific to resist type, such as positive photoresist, and are to be used only where applicable. Further, since this guide is directed to functional testing, it is assumed that any products to be evaluated have passed all relevant chemical and physical testing before such functional testing.

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.

4 Priorities

4.1 This guideline has been divided into two separate groups. The first group, called "Sustaining Tests," includes tests that are necessary for timely adjustments to coating and exposure conditions in order to maintain consistent image dimensions (Tables 1 through 3). The second group, called "Extended Testing," includes tests that are required for full evaluation of the resist system (Tables 4 through 6). These tests may, or may not, be necessary for evaluation of each lot of product, depending on the individual requirements of the user.

5 Referenced Standards and Documents

5.1 *ASTM Standards*[1]

ASTM F518 — Practice for Determining Effective Adhesion for Photoresist of Hard-Surface Photomask Blanks and Semiconductor Wafers during Etching

ASTM F527 — Practice for Adjusting Photoresist Exposure Time

ASTM F528 — Method for Measurement of Common-Emmiter D-C Current Gain of Junction Transistors

ASTM F804 — Practice for Producing Spin Coating Resist Thickness Curves

[1] ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: 610.832.9585, Fax: 610.832.9555, http://www.astm.org

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ASTM F863 — Practice for Detection of Defects in Spin-coated Resist

ASTM F890 — Practice for Determining Pinhole Density in Photoresist Films Used in Microelectonics Device Processsing

ASTM F1059 — Standard Practice for Calculating the Contrast and Threshold Sensitivity of a Positive Photoresist

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

6 Terminology

6.1 *test method* — a definitive procedure for the identification, measurement, and evaluation of one or more qualities, characteristics, or properties of a material, product, system, or service that produces a test result.

Table 1 Sustaining Tests – Resist Coating

Characteristic	*Measured Property*	*Variable*	*Fixed Conditions*	*Test Methods*
Thickness curve	Film thickness	Spin speed	Viscosity/Solids	ASTM F804
			Substrate	
			Measurement method	
			Softbake	
			Coating program	
			Acceleration	
			Dispense volume	
			Exhaust rate	
			Environment	
Film uniformity	Film thickness	Across	As above	
		Wafer to wafer		
Striations	Fringes		As above	
	Film thickness variation		Before and after developing	
Cleanliness	Particles	In/On coating	Filtration	ASTM F863
		On substrate after removal	Housekeeping	
			External sources	
			Defect size	
			Test method	
Film integrity	Pin holes	Film thickness	As above	ASTM F890

Table 2 Sustaining Tests – Characteristic Information

Characteristic	*Measured Property*	*Variable*	*Fixed Conditions*	*Test Methods*
Threshold energy	Film thickness	Exposure energy	Measurement method	
			Calculation method	
			Exposure conditions	
			Developer type	
			Developer normality	
			Development time	
			Rinse type(s)	
			Agitation/Spray	
			Softbake	
			Environment	

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