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Designation: F 804 – 83 (Reapproved 1990)$^{\epsilon 1}$

Standard Practice for Producing Spin Coating Resist Thickness Curves[1]

This standard is issued under the fixed designation F 804; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

$^{\epsilon 1}$ NOTE—Test Method F 907 added to Referenced Document section editorially in July 1991.

1. Scope

1.1 This practice covers the procedure for producing spin coating thickness curves for radiation-sensitive resists on wafers, substrates, and mask blanks.

NOTE 1—Several types of thickness-measuring techniques and equipment are available for use in this practice.

1.2 This practice is applicable for resist coating thicknesses from submicrometre to several micrometres.

2. Referenced Documents

2.1 *ASTM Standards:*

F 127 Definitions of Terms Relating to Photomasking Technology for Microelectronics[2]

F 907 Test Method for Measurement of Rotational Acceleration of a Wafer for Photoresist Spin Coating[2]

2.2 *Other Standards:*

Fed. Std. No. 209B Clean Room and Work Station Requirements, Controlled Environment[3]

Code of Federal Regulations, Title 29, Part 1910, Occupational Safety and Health Standards[4]

3. Summary of Practice

3.1 A specific resist thickness is applied to the surface of a substrate by spin coating. The thickness after drying depends on the coating equipment parameters and characteristics of the substrate and resist. The resulting thickness of the dried resist layer is measured. A correlation between measured thicknesses and a set of spin coating speeds produces a spin coating curve for future applications.

4. Significance and Use

4.1 The delineation of the fine geometric patterns on photomask substrates and semiconductor wafers depends on the uniformity and repeatability of resist coating thickness. A standard practice, as described here, is essential for process control during the fabrication steps in microelectronics device manufacture.

4.2 This practice provides a means for verifying the performance of a spin coater to determine its reliability and repeatability.

4.3 The coating characteristics for various resists can be evaluated and compared.

5. Terminology

5.1 *Definitions:*

5.1.1 Terms used in this practice are found in Definitions F 127.

5.2 *Descriptions of Terms Specific to This Standard:*

5.2.1 *resist*—a radiation-sensitive material used to mask portions of a substrate surface in an imaging process that includes exposure of the material to patterned radiation of electromagnetic waves such as visible, ultraviolet, or X rays or of particles such as electron beams.

5.2.2 *spin coater*—apparatus or equipment by which resist is applied to the surface of a rotating substrate.

6. Interferences

6.1 Spin coaters vary in respect to specific coating characteristics. The spin coating recommendations supplied by resist producers provide a basic guide for user application.

6.2 Drying and baking conditions of time and temperature will affect the measured resist thickness through removal of the carrier solvent and densification of the layer for all types of measuring instruments.

6.3 In noncontact measurement techniques, changes in the optical parameters of the resist layer may result from the baking conditions used in drying the resist.

6.4 In noncontact measurement techniques, exposure of the resist layer to its radiation-sensitive wavelengths may affect the optical parameters of the layer.

6.5 In noncontact measurement techniques, the optical parameters (reflectivity, absorptivity, and refractive index) of any specimen surface layers underlying the resist will influence the measurements in this practice.

6.6 In contact thickness measurement techniques, chemically produced steps in the resist layer are generally unsatisfactory for profile measurement in this practice.

6.6.1 Resist removal by chemical scribing or wiping may produce distorted and tapered step edges which degrade the accuracy of measurement.

6.6.2 Resist exposure and image development to produce steps in the layer may change the original coated thickness basis for measurement.

NOTE 2—Measurement of the resist thickness utilizing exposed and developed images (thickness after development) is, however, a useful determination for lithographic process evaluations when used in con-

[1] This practice is under the jurisdiction of ASTM Committee F-1 on Electronics and is the direct responsibility of Subcommittee F01.08 on Microelectronic Imaging.

Current edition approved March 25, 1983. Published May 1983.

[2] *Annual Book of ASTM Standards,* Vol 10.05.

[3] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[4] Available from Occupational Safety and Health Review Commission, 1825 K Street, N.W., Washington, D.C. 20006.