

SEMI C101-0621

TEST METHOD FOR DETERMINING PH OF CHEMICAL MECHANICAL PLANARIZATION (CMP) SLURRIES AND RELATED CHEMICALS

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1 Purpose

1.1 This Standard will define the test method for measuring and reporting the pH of slurries and post-chemical mechanical planarization (pCMP) cleaning chemicals in certificate of analysis (CoA) documents and define at what temperature the sample is measured. This Test Method will recommend the management of attainable significant figures in reporting based on current metrology capabilities. This Test Method will also recommend sample collection and preparation techniques.

2 Scope

2.1 This Test Method applies to slurries and pCMP application chemicals determined by the manufacturer and/or IDM to be relevant as a measure of material quality.

2.2 This Test Method describes the conditions and procedures for measuring the pH of single or multi-component slurries and pCMP chemicals with offline (benchtop) metrology instrumentation.

2.3 This Test Method provides a common basis for communication between slurry manufacturers and users.

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 Limitations

3.1 For all slurry and pCMP cleaning applications, the measurement will be sloped (calibrated) and reported at the manufacturer recommended storage and/or operating temperature.

3.2 This Test Method does not limit the type or manufacturer of benchtop metrology employed for measurement or reporting.

3.3 Any measurements of pH or processes post-arrival of slurry or pCMP chemicals at the integrated device manufacturer (IDM) site are not covered by this Test Method.

4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

SEMI C1 — Guide for the Analysis of Liquid Chemicals

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

5 Terminology

5.1 *Abbreviations and Acronyms*

5.1.1 *CoA* — certificate of analysis

5.1.2 *CMP* — chemical mechanical planarization

5.1.3 *COLIWASA* — composite liquid waste sampler

5.1.4 *IDM* — integrated device manufacturer

5.1.5 *pCMP* — post-chemical mechanical planarization

5.1.6 *MSA* — measurement system analysis

5.1.7 *TC* — temperature compensated

5.1.8 *SUT* — sample under test

5.2 Definitions

5.2.1 *buffer* — a solution with pre-determined pH that is used to determine the slope of the pH probe.

5.2.2 *calibration of a pH meter* — electronic characterization of a pH meter performed at the site of probe manufacture.

5.2.3 *certificate of analysis (CoA)* — a document describing the physical and chemical characteristics and specifications of a product delivered to the user.

5.2.4 *chemical mechanical planarization (CMP)* — a process which removes topographical structures from a surface by a combination of chemical action and mechanical forces.

5.2.5 *composite liquid waste sampler (COLIWASA)* — specifically a hand-held device which allows the discrete sampling of stratified liquids from a vessel at different depths (a.k.a. Drum Thief or Drum Sampler).

5.2.6 *homogenization* — the process of rendering the bulk material to be of uniform or similar composition throughout the container.

5.2.7 *integrated device manufacturer (IDM)* — typically, this is the principal end user of slurries and pCMP chemicals.

5.2.8 *measurement system analysis (MSA)* — procedure in which relevant sources of bias and variability associated with a measurement system (MS) are estimated.

5.2.9 *membrane* — in pH probe designs, this is a semipermeable barrier which allows an electro-potential to develop between a known concentration of hydrogen ions in the probe to a variable concentration of hydrogen ions in the SUT.

5.2.10 *pH* — a measure of alkalinity or basicity expressed as the logarithm of the reciprocal of hydrogen ion concentration in gram atoms per liter on a scale of 0 to 14. pH values are generally represented as unit-less numbers. Values less than 7 represent acidity and more than 7 basicity.

5.2.11 *porous junction* — a permeable barrier in pH probe designs which allows contact between the solution to be measured and the reference. This junction is typically designed to minimize outflow of reference electrolyte while maintaining minimal electrical resistance.

5.2.12 *post-chemical mechanical planarization (pCMP)* — typically used to describe a cleaning process that occurs immediately after planarization steps.

5.2.13 *reference half-cell* — the feature of a pH probe electrode responsible for providing a stable reference to the sensing half-cell measurement.

5.2.14 *sample under test (SUT)* — the slurry or chemical component to be tested. This incoming liquid generally arrives with a separate CoA from the vendor.

5.2.15 *sensing half-cell* — the feature of a pH probe electrode responsible for providing the measurement.

5.2.16 *slope of a pH probe* — the correlation between the pH probe output in millivolts to the pH of a series of known buffer standards.

6 Summary of Test Method

6.1 This Standard provides instructions for preparing slurry or chemical in source vessels for sampling, the sample vessel for receiving slurry or chemical drawn from the source vessel, and individual sample containers for the measurement.

6.2 This Standard also describes the general procedures for preparing the apparatus for measurement, sloping the pH probe, obtaining the measurement, and reporting.

7 Reagents and Materials

7.1 *Reagents* — pH buffers, reference electrode solution/pH storage solution determined by the probe manufacturer.