

SEMI C99-0320

TEST METHOD FOR DETERMINING CONDUCTIVITY OF CHEMICAL MECHANICAL POLISH (CMP) SLURRIES AND RELATED CHEMICALS

This Standard was technically approved by the Liquid Chemicals Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on December 12, 2019. Available at www.semiviews.org and www.semi.org in March 2020.

1 Purpose

1.1 This Document provides a standardized test method for measuring and reporting the conductivity of slurries and post-chemical mechanical polish (CMP) chemicals. The test method will define the number of significant digits to which conductivity will be reported, given the limitations of current metrology and methodology capabilities, and define a standardized temperature for the measurement. This Document will also supply a method of calibrating conductivity probes and temperature analytics relative to standards.

2 Scope

2.1 This Document applies to slurries and post-CMP application chemicals determined by the manufacturer and/or integrated device manufacturer (IDM) to be relevant as a measure of material quality.

2.2 This Document describes the conditions and procedures for measuring the conductivity of single or multi-component slurries and post-CMP chemicals with offline (benchtop) metrology instrumentation.

2.3 This Document 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 This Test Method is limited to slurry or post-CMP cleaning chemicals as purchased (in point-of-use dilution or concentrated form) from the manufacturer. If the slurry or chemical has a conductivity less than 100 $\mu\text{S}/\text{cm}$, conductivity measurement may not be an appropriate measure of quality.

3.2 For all slurry and post-CMP cleaning applications, the measurement will be calibrated and reported at the manufacturer recommended storage and/or operating temperature.

3.3 This Document does not limit the type or manufacturer of benchtop metrology employed for measurement or reporting.

4 Referenced Standards and Documents

4.1 *ASTM Standard*¹

ASTM D1125-14 — Standard Test Methods for Electrical Conductivity and Resistivity of Water

4.2 *Other Documents*

EPA Method 9050A — Specific Conductance²

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

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: +1.610.832.9585, Fax: +1.610.832.9555, <http://www.astm.org>

² Environmental Protection Agency, 1200 Pennsylvania Avenue, N.W. Washington, DC 20460, USA. Telephone: +1.202.564.4700, <http://www.epa.gov>

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 *IDM* — integrated device manufacturer

5.1.2 *SUT* — sample under test

5.2 Definitions

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

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

5.2.3 *conductivity (electrical)* — a measure of the ease with which charge carriers flow in a clear chemical or suspended solid-based liquid material; the reciprocal of resistivity. It is often reported in units of $\mu\text{S}/\text{cm}$ or mS/cm for most slurries or post-CMP chemicals present in semiconductor manufacturing operations.

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

5.2.5 *integrated device manufacturer* — typically, this is the principal end user of slurries and post-CMP chemicals.

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

6 Summary of Test Method

6.1 This Document 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 Document also describes the general procedures for preparing the apparatus for measurement, calibration of the conductivity measurement device, obtaining the measurement and reporting.

7 Reagents and Materials

7.1 *Reagents* — Conductivity standards. Demal solutions or ASTM D1125-14 Solution D may be useful. Standards should be chosen to bracket the expected conductivity of the sample. The range of conductivity standards employed in calibrations can be quite broad, that is, $100 \mu\text{S}/\text{cm}$ to $200 \text{ mS}/\text{cm}$.

7.2 *Cleaning Liquids* — Conductivity probes may require cleaning with reagents other than ultra-pure water (UPW). Examples of possible reagents include dilute solutions of potassium hydroxide, nitric acid or ammonium hydroxide based on consideration of compatibility with the measured chemicals and conductivity probe materials.

8 Safety Precautions

8.1 *Calibration Reagents* — Consult the metrology manufacturer's and chemical SDS' recommendations for safe handling.

8.2 *Cleaning Liquids* — Consult the slurry manufacturer's and/or chemical SDS' recommendations for safe handling.

9 Test Specimens

9.1 *Test Specimen Retention* — A limit should be placed on the time between sample extraction and measurement. Consult the manufacturer of the slurry or chemical to obtain the shelf life of the sample and the recommended conditions for handling and storage during that period.

10 Preparation of Apparatus

10.1 Basic Materials Required

10.1.1 A conductivity probe and transmitter capable of reading the electrical conductivity of the sample in the range and within the error bandwidth required.