Semiconductor Components, Instruments and Subsystems (SCIS)

Technology Community

SCIS Overview & Activity Status
September 2018
Supply Chain Issue

**Problem Statement:** Defects introduced by process-critical OEM components affect final wafer quality resulting in lower yields and higher manufacturing costs.

- Several yield excursions are linked to wide range of component and sub-components induced defectivity.

- Components and sub-components defect traceability lack the rigor for advanced technologies (detectability, sensitivity/methodology).

- Existing standards, if any, are inadequate for addressing advanced process control requirements.

30-35 nm particles
SEMISCISS Technology Community
(Semiconductor Components, Instruments, and Subsystems)

• **Focus**: Establishing a baseline for measuring defects introduced by process-critical components.
  – Particle or defect limits will not be defined, but will focus on defining consistent methodologies for measuring defects.

• SCIS provides a forum that fosters discussion and aligns stakeholders on pre-competitive industry-critical issues.
  – Participants are not expected to disclose IP but are expected to provide parameters for standardized measurement.
SCIS Organizational Structure

Executive Advisory Committee

SCIS Steering Committee

- Seals & Valves Group
- Critical Chamber Components Group
- Traceability Verification Group
- RF Group
- Gas Delivery Group
- Liquid Delivery Group
- Dry Pumps Group
Status Indicators / Process Flow

SEMI
SCIS

►

SEMI
Standards

Identify | Scope/Recruit | Develop | Framework ➤ Pre-Draft

Initialize | Draft | Ballot | Publish

Define | Fund | Deploy | Report

Alpha-Testing / Verification (if applicable)
SCIS Focus Areas [1/4]

- **Seals**
  - **Focus:** Seal Leak Rate
  - **Rationale:** Seal failure can generate defects through atmospheric leaks into process environments or from degraded seal material. There is a need to develop a standardized way for measuring a seal’s ability to hold vacuum when exposed to elevated temperatures and/or process and clean chemistries.

- **Valves**
  - **Focus:** Develop methods for CIP elastomer testing
  - **Rationale:**
    - When introducing new elastomer material types to an 'already designed / marathon tested valve', marathon testing on that new elastomer material (as it relates to Valve performance) is currently lacking → This is a valve measurement gap today
    - Improve the marathon testing that Valve suppliers already do for new design Valves AND ALSO introduce marathon testing for 'elastomer-based CIP Valve redesign' that is applicable for all elastomer types
    - Resulting test method would help determine whether CIP elastomer provides any improvement or would help indicate the need for a new valve design
SCIS Focus Areas [2/4]

• RF
  – **Focus**: New topics. Work on RF generator transient response has been completed
    • Topics under consideration:
      – Generator Reliability – via transient load testing
      – Power Measurements – modulated loads, accuracy etc.
      – Pulsing, Frequency tuning and Arc Management

• Critical Chamber Components
  – **Focus**: Develop preliminary measurement approaches for showerhead process characterization and quality check
  – **Rationale**: Ensure consistent report of results for each supplier, not as means to compare suppliers or showerheads

• Traceable Verification
  – **Focus**: Develop information exchange model that will enable an industry standard parts traceability process
  – **Rationale**: Lack of supply chain visibility, robustness of information, time to information
SCIS Focus Areas [3/4]

• Gas Delivery
  – Focus: Develop test method for pulse testing of gas valves
  – Rationale: Many valves in the gas supply lines and tools are switched many times and also related to wafer cycles. Particles that are generated during switching can be the main contributor to contamination. Therefore, measurement of the number of particles added per switch is needed

  – Focus: Develop test method for extracting and measuring hydrocarbon elements in gas delivery systems
  – Rationale: Current in-line hydrocarbon measurement methods are limited in sensitivity and are only able to detect high volatility hydrocarbons. A method that is more sensitive and able to detect semi-volatile and non-volatile hydrocarbons is needed
  – Currently, there are no industry standards for determining the metallic contributions of ultra-high purity gas delivery components and plumbing. The proposal provides a standard method of evaluating wetted surface material composition of ultra-high purity (UHP) gas delivery components and plumbing

  – Focus: Develop test method for extracting and measuring metal elements in gas delivery systems
  – Rationale: Currently, there are no industry standards for determining the metallic contributions of ultra-high purity gas delivery components and plumbing. The proposal provides a standard method of evaluating wetted surface material composition of ultra-high purity (UHP) gas delivery components and plumbing
SCIS Focus Areas [4/4]

- **Liquid Delivery**
  - **Focus:** Develop standard for measuring organic contamination from critical components in relevant solvents
  - **Rationale:** Evidence from end-users has linked organic contamination to wafer quality. To date, no standards exist for determining relative organic levels from critical components — most preferably on a bulk and specific basis.

- **Dry Pumps**
  - **Focus:** Develop a standardized test method to measure noise at the supplier facility
  - **Rationale:**
    - Noise can be an indicator of a defective pump (or pending pump failure) or is simply a characteristic of the pump as designed by the manufacturer.
    - Pump manufacturers are already providing noise ratings, but do not measure them exactly in the same way.
SCIS Standardization Initiatives – Status

SEMIs Standards Published
- SEMI F51 Seal Impurities (Nov 2015)
- SEMI F51 Seal Cleaning, Packing & Handling (Sep 2017)
- SEMI E135 RF Generator Transient Response (Sep 2018)

SEMIs Standards Balloting / Drafting
- Gas Delivery Metallic Elements (Balloting)
- Gas Delivery Hydrocarbons (Balloting)
- Chamber Components Metals Contamination Showerheads (Drafting)
- Parts Traceability (Drafting)
- Traceability Parts Labeling (Drafting)

SCIS in Development
- Dry Pumps Sound Levels (SCIS WIP)
- Valve Marathon Testing for CIP Elastomers (SCIS WIP)
- Liquid Delivery Organics (SCIS WIP)
- Seal Leak Rate (SCIS WIP)

* WIP – work in progress
Contact Information

Paul Trio
Senior Manager, Strategic Initiatives
673 S. Milpitas Boulevard
Milpitas, CA  95035
Phone: 1.408.943.7041
Email: ptrio@semi.org