

Static Extraction / Leach Testing



Pre-Qualification of Materials and Components for Contamination-Free Processing

Materials and components are used throughout the fab in the UPW systems, chemical, air and gas supply lines, cleanrooms, packaging and process tools. These materials and components are potential sources of contamination that can affect your production yield, including:

- Metals
- Organics
- Total organic carbon (TOC)
- Ionics
- Particles
- Silica
- NVR, non-volatile residue

A cost-effective approach to contamination control is to ensure the cleanliness levels of materials and components used in technology manufacturing are pre-qualified for surface cleanliness before use. This will provide some level of appropriate protective measures to ensure the delivery of materials and components meets your specification.

Balazs™ NanoAnalysis offers material and component testing using sample preparation and static extraction conditions specified under SEMI Standard F57 and F40. We also offer a comprehensive wet bench materials qualification program to provide analytical results that can be used in selecting the most compatible, fire-safe wet bench materials for your processes.

Common materials tested include:

- Consumables: gloves, gowns, wipes, bags, bottles
- Carriers: FOUPs, PODs, compacts
- Components: Parts of tools, reactors, gas systems, o-rings, gaskets, piping, rollers, brushes, valves, regulators
- Materials: ceramics, quartz, sic, stainless steel, anodized Al, plated parts
- Process wafers, granules, optics, masks, reticles
- UPW and chemical filters, housing, components
- Wet bench materials (FM 4910 tests)
- HEPA/ULPA filters (new and used)

Testing to other standards is also available such as IEST 1246D, IEST RPCC-004,005, IDEMA test methods for the disk drive industry, ASTM test methods, IPC, or company-specific test methods.

Extraction Testing

Extraction (leach) experiments may be performed on a variety of materials in many solutions, including ozonated or ultrapure water and chemicals, at both ambient and elevated temperatures. The solution and duration of extraction are dependent on your application and need. For example, to evaluate bath components each bath material is preferably extracted with their appropriate bath solution (SC1, SC2, piranha, nitric acid).

Typical leach parameters are:

- UPW, acid or solvent extraction
- Short (1 h - 24 h) extraction at ambient or elevated (85°C) temperature
- Extended (> 7 days) extraction at ambient or elevated (85°C) temperature (e.g. SEMI F57 test)

Depending on the method, extraction solution can be analyzed for ions by Ion Chromatography (IC), trace metals by ICP MS, TOC, or particles. The detection limits depend on the geometry of the sample, resulting in different extraction solution volumes. In order to increase flexibility and improve detection limits, Balazs™ has acquired a capillary IC, requiring only <10% of the typical IC sample volume.

Element	Detection Limit	High purity		
	(ppb)	PVDF	PP	PVC
TOC	5	90	94	50
Fluoride	2	77	*	*
Chloride	0.25	1	0.66	49.54
Aluminium	0.05	2.3	0.68	1.16
Barium	0.01	0.24	0.09	0.05
Calcium	3	*	12	15
Magnesium	0.02	0.66	1	2.17
Sodium	0.06	0.51	0.18	23.22
Tin	0.02	*	*	1.19
Zinc	0.06	0.47	0.96	1.19

Table 1. Example of UPW 7-days extraction results of piping materials.

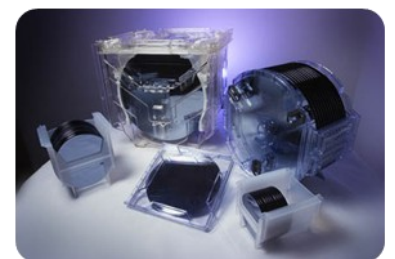
Organic Testing

Surface molecular organics (condensables) may adversely affect many technology processes, including cleaning, etching, oxide growth, high temperature processing, metrology and film deposition.

Surface extraction for organics may be performed using:

- UPW extraction for total organic carbon (TOC) or organic speciation by LC-OCD
- Methylene chloride and hexane for extractable organics by GC-MS or FTIR
- NVR (non-volatile residue by weight) for identification of residual molecular organics and particulate matter by FTIR or XPS

XPS can also characterize surface molecular organics directly on the surface. A typical application is to verify the cleanliness of material coupons and parts after cleaning. Cleaning recipes may be optimized using XPS as the qualification technique. Failed, rejected or contaminated parts are also analyzed.



Testing Protocols Supported

- SEMI F40: practice for preparing liquid distribution components for chemical testing
- SEMI F57: provisional specification for polymer components used in ultrapure water and liquid chemical distribution systems
- IEST 1246 D
- IEST RP 3, 4, 5, 16, 25, and 32
- IDEMA M7: organic contamination as nonvolatile residue
- IDEMA M9: particulate contamination test methods for hard disk drive components
- IDEMA M13: measurement of extractable/leachable anion contamination levels on drive components by ion chromatography (IC)