

Correct sample handling and sample introduction are critical to successful ultratrace analysis. The type and quality of materials that come into contact with the sample directly impact the level of the analytical blank. This is of most importance to the most sensitive trace metals technique – ICP-MS. And as ICP-MS has become the standard trace metals technique for most applications, more attention has turned to sample handling and sample introduction. The applications with the most stringent requirements for blank minimization are semiconductor and geochemical. Here, Savillex inert sample introduction systems and PFA nebulizers are widely used for sample introduction. For sample handling, micro autosamplers are generally preferred since they protect the sample from airborne contamination and also allow for the use of very small sample volumes, enabling the use of preconcentration for isotopic and elemental analysis in in geochemistry.



Traditionally, trace metal labs have used polyethylene (PE) and polypropylene (PP) autosampler vials, which after acid rinsing have been suitable for use with ICP-MS. As ICP-MS sensitivity has continually improved, however, most labs in semiconductor and geochemistry have found that these materials are not clean enough for use. The lowest trace metal backgrounds are found in fluoropolymers and while fluoropolymers such as PVDF, ETFE and PTFE can be used, it is well established that PFA has the lowest trace metals backgrounds. To manufacture PFA vials with the lowest trace metal backgrounds however, a number of steps must be taken:

- The highest purity grade of PFA resin must be used (PFA resin is available in different grades with different purity levels)
- Only virgin resin must be used (to reduce cost in manufacturing, scrap material is often reground and mixed with virgin resin, which introduces metallic contamination)
- Injection molding tooling must be designed with a particular focus on minimizing potential sources of contamination
- Extreme care must be taken to minimize environmental contamination during the injection molding process

When all of the above steps are taken, elemental contribution can be reduced to undetectable levels, which enables ICP-MS instrumentation, including ICP-QQQ-MS and HR-ICP-MS to be used to their full potential.

## Savillex Autosampler Vials

Savillex's standard PFA vials have been used in geochemistry for sample digestion for many years and can be found in virtually every isotope geochemistry lab worldwide. Sample digestion for isotope geochemistry is extremely challenging. The concentrated mineral acids, along with the sample, are added to the vial which is capped and heated on a hot plate. During this process, the total blank contribution from the reagents and the vial itself must be at the low pg level, even for Fe. Savillex has built up tremendous knowledge and expertise over many years to continually improve its manufacturing process to support the needs of geochemistry.

The same manufacturing techniques are applied to Savillex autosampler vials. Savillex produces PFA vials for ICP-MS autosamplers commonly used for ultratrace analysis, including the Agilent I-AS, Cetac ASX110/112 and ESI SC-Micro/SC-2/SC-4. All Savillex vials are molded from the highest purity grade of PFA resin and only virgin resin is used. Savillex molds and manufactures all of its PFA products in house and even produces its own tooling in house. When molding fluoropolymers, the demands on Injection molding tooling are particularly harsh, since extremely high temperatures must be used, and also highly corrosive HF gas is given off by the fluoropolymer when it is heated to high temperature. The design of the tool is critical to ensure long life and minimal contamination of the products being molded. Great care is also taken to prevent environmental contamination throughout the whole manufacturing process. Note that cleaning prior to initial and subsequent use must always be carefully performed.

## Cross Reference Tables

The cross reference tables below list autosamplers commonly used for trace metals ICP-MS analysis, with manufacturer's vial part numbers. Also listed are Savillex PFA equivalents for each product. Any differences in volume or design are shown in the notes. While some autosampler manufacturers do not offer closures, PFA closures are available for almost every Savillex vial, and if not listed below in the notes, can be found on the product information page for each vial at [www.savillex.com](http://www.savillex.com). Simply enter the Savillex part number for the relevant vial in the search bar.

### Agilent I-AS Autosampler

Agilent Part #	Agilent Part Description	Savillex PFA Equivalent Part #	Savillex Part Description	Notes
G3160-65317	1.5 mL PFA Vials for Tray D	200-915-44	1.5 mL PFA Vial, Conical Interior	12 mm PFA Press-On Closure (Part # 600-012-81)
G3160-65315	2 mL PE Vials for Tray D	200-002-44	2 mL PFA Vial, Conical Interior	12 mm PFA Press-On Closure (Part # 600-012-81)
G3160-65303	6 mL PP Vials for Tray A and E	200-004-13	4 mL PFA Vial, Rounded Interior	Savillex is 4 mL - Agilent is 6 mL 18 mm PFA Snap-On Closure (Part #600-018-88)
G3160-65304	18 mL PP Vials for Tray B, D, E	200-013-14	13 mL PFA Vial, Flat Interior	Savillex is 13 mL - Agilent is 18 mL 24 mm PFA Threaded Closure (Part #600-024-01)
G3160-65307	100 mL PP Rinse Jar With Lid	100-0090-01	90 mL Standard Jar	Savillex # is for Jar Only (90 mL)
		600-053-01	53 mm Closure (for 90 mL Standard Jar)	Savillex # is for Closure Only (no hole in closure)

### ESI SC-Micro/SC-2/SC-4 Autosampler

ESI Part #	ESI Part Description	Savillex PFA Equivalent Part #	Savillex Part Description	Notes
V-14-0312CG-X	2 mL PFA Vial Qty 10	200-002-44	2 mL PFA Vial, Conical Interior	12 mm PFA Press-On Closure (Part #600-012-81)
V-14-0314CG-X	4 mL PFA Vial Qty 10	200-004-44	4 mL PFA Vial, Conical Interior	12 mm PFA Press-On Closure (Part #600-012-81)
V-27-0360-V	25 mL PFA Bottle TFM Insert (Qty 5) Fits ESI Rack SR2-21-27	200-030-20	30 mL Standard Vial, Rounded Interior	Savillex is 30 mL - ESI is 25 mL 33 mm PFA Threaded Closure (Part #600-033-01)
V-28-0260-L	50 mL PP Vial Fits ESI Rack SR2-21-27	200-030-20	30 mL Standard Vial, Rounded Interior	Savillex is 30 mL - ESI is 25 mL 33 mm PFA Threaded Closure (Part #600-033-01)

### CETAC ASX110/112 Autosampler

CETAC Part #	CETAC Part Description	Savillex PFA Equivalent Part #	Savillex Part Description	Notes
SP5477	0.5 mL PFA Vial	200-905-50	500 $\mu$ L Microcentrifuge Vial, Conical Interior	8 mm Snap On-Opening 8 mm PFA Snap-On Closure (Part #600-008-83)
SP5472	1.5 mL PFA Vial Conical Bottom 14 mm	200-915-44	1.5 mL PFA Vial, Conical Interior	12 mm PFA Press-On Closure (Part #600-012-81)
SP6332	4 mL PFA Vial with Closure	200-004-13	4 mL PFA Vial, Rounded Interior	Savillex Vial is 4 mL - Agilent Vial is 6 mL 18 mm PFA Snap-On Closure (Part #600-018-88)
		600-018-88	18 mm Snap-On Closure	Closure for #200-004-13
SP6334	10 mL PFA Vial	200-010-13	10 mL PFA Vial, Rounded Interior	18 mm Snap-On Opening 18 mm PFA Snap-On Closure (Part #600-018-88)
SP6333	20 mL PFA Vial	200-020-13	20 mL PFA Vial, Conical Interior	31 mm PFA Snap-On Closure (Part #600-031-88)
SP6335	30 mL PFA Vial	200-030-13	30 mL PFA Vial, Flat Interior	31 mm PFA Snap-On Closure (Part #600-031-88)
SP5480	1 mL PP Vial	200-915-44	1.5 mL PFA Vial, Conical Interior	12 mm PFA Press-On Closure (Part #600-012-81)
SP5178A	7 mL PP Vial with Closure	210-005-21	5 mL Standard Tube, Rounded Interior	Open Top Savillex Tube Has No Closure
SP5178K	8 mL PP Vial	210-005-21	6 mL Standard Tube, Rounded Interior	Open Top Savillex Tube Has No Closure
SP5178B or SP5178B5 (500 qty)	14 mL PP Vial	210-015-20	15 mL Standard Tube, Rounded Interior	Threaded Top 18 mm PFA Threaded Closure (Part #600-018-01)
SP5540 or SP5540A (100 qty)	2 mL PP Vial	200-915-44	1.5 mL PFA Vial, Conical Interior	12 mm PFA Press-On Closure (Part #600-012-81)
SP5479	0.5 mL PP Vial Screw Top	200-905-50	500 $\mu$ L Microcentrifuge Vial, Conical Interior	8 mm PFA Snap-On Closure (Part #600-008-83)
SP5511	Closure for 0.5 mL PP Screw Top Vial	600-008-83	8 mm Snap-On Closure	