Elemental Scientific
ICP | ICPMS | AA

Automated Introduction
Semiconductor Chemicals

Fluoronetic prep*FAST* S
Ultraclean Sample Introduction System

prep*FAST* S™

Automated Sample Preparation and Introduction System for Semiconductor Applications

The prep*FAST* S has revolutionized the way ultrapure semiconductor grade chemicals are analyzed with ICPMS detection. The prep*FAST* S utilizes syringe-driven flows of UPW, semiconductor grade acids, and standard solution to automate both sample dilutions and standard curve generation. It eliminates manual handling of samples to deliver sub-ppt detection limit capabilities.

prep*FAST* S System

prep*FAST* S Autocalibration

The prep*FAST* S automatically prepares calibration curves for over 40 elements controlled in semiconductor manufacturing processes. Calibrations are generated by automatically diluting an enclosed multielement stock standard. Automation with the high-purity prep*FAST* S achieves low to sub-ppt calibrations.

High Purity Automation with PPT/PPQ results

Automation

- Automatic external and MSA calibrations
- Automated sample sensing
  - accounts for viscosity and automatically adjusts timing
  - detects and injects the sample and triggers the ICPMS
- Automated syringe-driven sample introduction
  - Sample loading
  - Sample preparation
  - Inline dilution
  - Acid addition

Ultraclean

- Ultraclean sample preparation
- Integrated ultraclean sample environment
  - Includes ultraclean fluoronetic autosampler and air shower
  - Options include:
    - ULPA (Ultrapure air) filter
    - Sample racks for PFA containers (<1 mL to 500 mL)
- Continuously-flowing high purity UPW rinse (user-supplied UPW)
- UPW polishing columns for low background

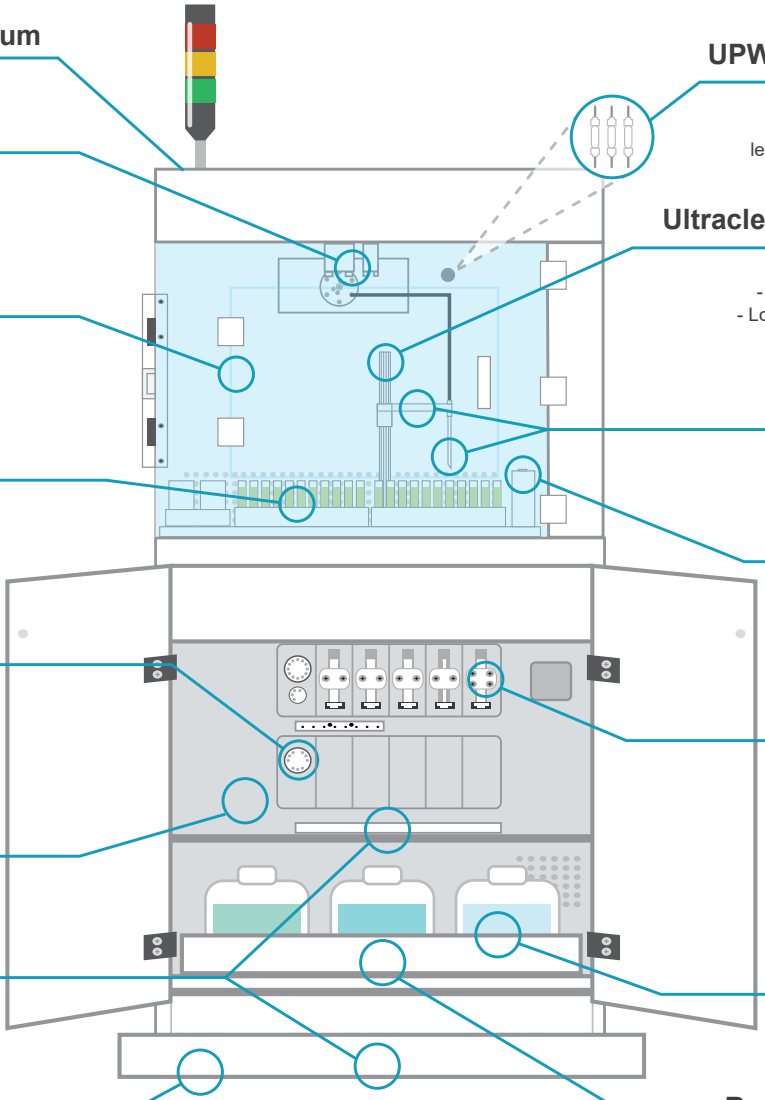
PPT/PPQ Results

- Capability to analyze all semiconductor grade chemicals
- PPT/PPQ detection limits for all semiconductor elements

prep*FAST* S System						
System	Integrated Mobile Autosampler & Enclosure	Ultraclean Air Shower	Integrated *FAST* valve modules	PFA Nebulizer with Integrated Capillary	PFA Sample Probes	Syringe Pump S500V2
prep*FAST* S	✓	✓	✓	✓	✓	✓

Pure Automation

prep*FAST* S



Electronics in Rear Plenum

SampleSense Valve

Automatically detects all sample types and eliminates method timing variables

Exhausted Enclosure

Built-in to allow for maximum safety when directly analyzing concentrated chemicals

Sample Containers

<1 mL up to 500 mL

Ultrapure Water Valve

Controls UPW flow into and throughout the prep*FAST* S

Integrated Ultra-high-purity Syringe Dilution

Inline automated calibration and dilution system

Leak Sensors

With external warning light and auto-shut-off

Double Containment Tray

UPW Polishing Columns

UPW is used as carrier, diluent, and rinse to control background levels and improve detection limits

Ultraclean Fluoronetic Z-rail

- True fluoropolymer action
- Magnetically coupled linear drive
- Long-lived and chemically resistant

Auto Aligning Arm and PFA Probe

Overflowing UPW Dual Rinse Station

Micro Sampling

Precision loading for micro sample analysis

High Purity PFA Reservoirs

Reagent Level Sensors

prep*FAST* S Inline Dilution of Semiconductor-grade Chemicals

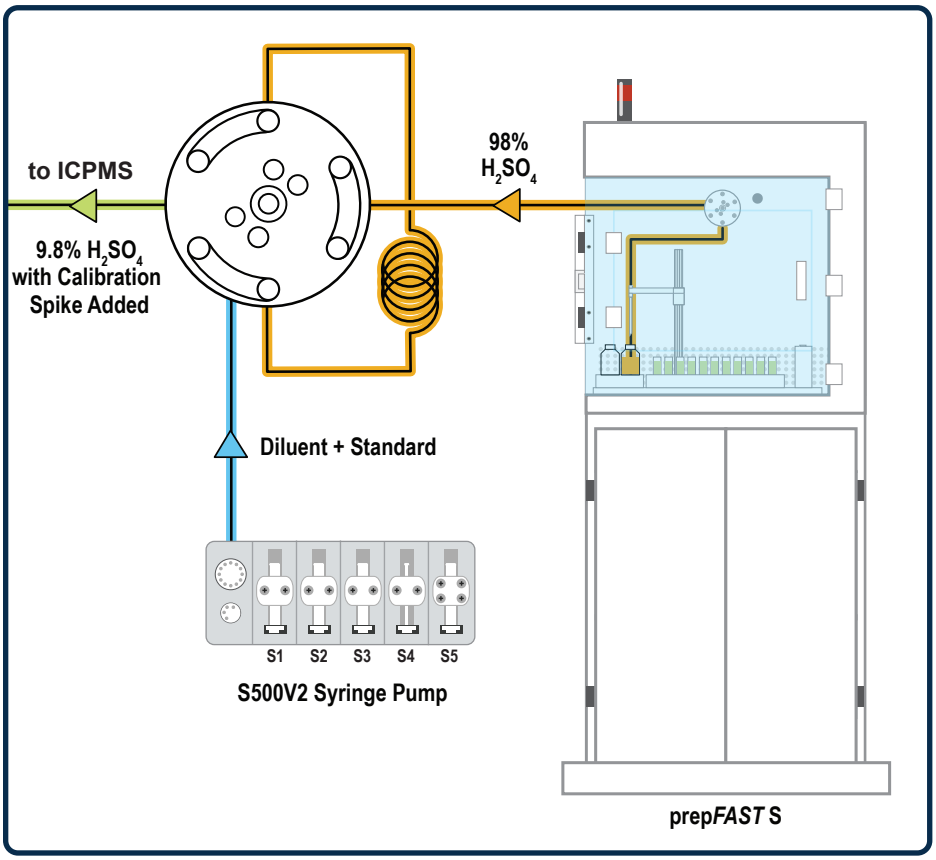


Diagram showing 10x inline dilution of concentrated H_2SO_4 with prep*FAST* S.

The prep*FAST* S allows dilution by volume or weight for all semiconductor-grade chemicals. Metals are quantified using automated inline MSA or external calibration. Automated direct analysis of concentrated chemicals eliminates sample contamination caused by manual dilution into a secondary container.

Examples of Semiconductor Chemicals Analyzed at the ppt Level with prep*FAST* S						
Acids	98% H_2SO_4	89% H_3PO_4	70% HNO_3	49% HF	35% HCl	30% H_2O_2
Bases	22% NH_4OH	2.38% TMAH	25%TMAH	KOH		
Organics	IPA	PGMEA/PGME	Photoresist	NMP	Butyl Acetate	Cyclohexanone

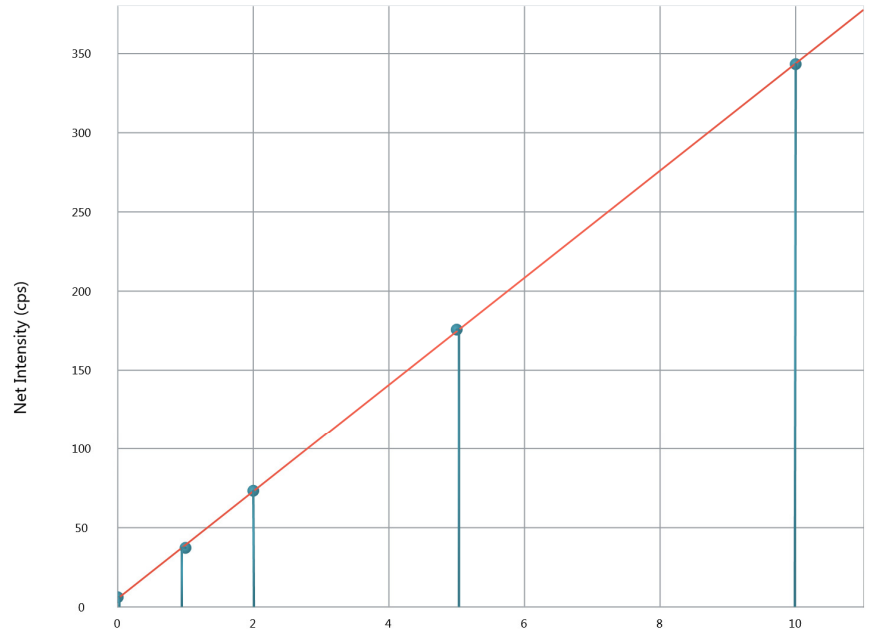
This table contains only a partial list of chemicals which can be analyzed using prep*FAST* S.

Detection Limits

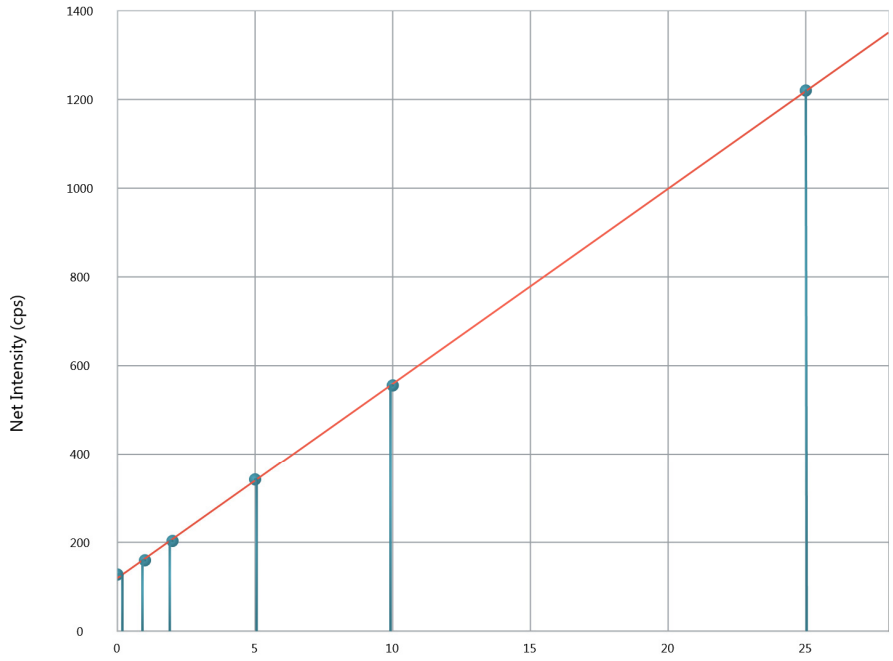
Example of Detection Limits in Non-cleanroom environment			
Element	**DL (ppt)**	**Element**	**DL (ppt)**
^{7}Li	0.02	^{72}Ge	0.04
^{9}Be	0.007	^{75}As	0.2
^{11}B	0.9	^{85}Rb	0.008
^{23}Na	0.07	^{88}Sr	0.008
^{24}Mg	0.01	^{90}Zr	0.004
^{27}Al	0.03	^{93}Nb	0.002
^{39}K	0.06	^{95}Mo	0.5
^{40}Ca	0.4	^{111}Cd	0.07
^{48}Ti	0.02	^{115}In	0.004
^{51}V	0.1	^{118}Sn	0.05
^{52}Cr	0.1	^{121}Sb	0.05
^{55}Mn	0.009	^{137}Ba	0.04
^{56}Fe	0.04	^{178}Hf	0.003
^{58}Ni	0.01	^{181}Ta	0.01
^{59}Co	0.007	^{182}W	0.01
^{60}Ni	0.01	^{205}Tl	0.002
^{63}Cu	0.03	^{208}Pb	0.005
^{64}Zn	0.04	^{232}Th	0.000
^{71}Ga	0.002	^{238}U	0.003

Autocalibration

UPW Autocalibration for ^{40}Ca



HCl Autocalibration for ^{56}Fe



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