



An Inert Desolvating Nebulizer System and Rapid Washout Accessory for Tungsten Isotope Measurements with Multicollector ICP-MS

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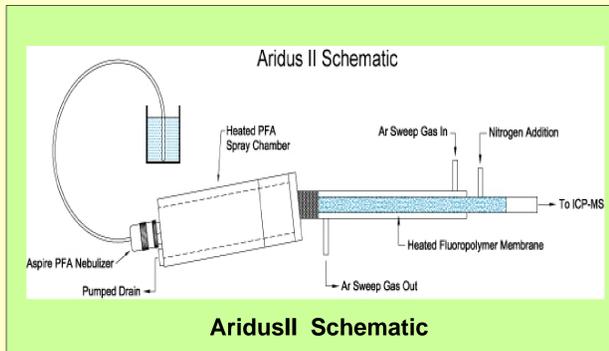
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Abstract: Multicollector ICP-MS instruments are specialized devices for high-precision isotope ratio measurements. Prepared liquid samples may be concentrated (100 to 1000 µg/L) in elements of interest; these higher concentrations can cause longer analyte washout times and signal spikes. This poster will describe an inert, low flow (50 to 200 µL/min) desolvating nebulizer system with a rapid washout accessory. This nebulizer system can also be equipped with a dedicated autosampler that features a dual-flowing rinse capability to minimize sample carryover. Wetted parts are composed of fluoropolymers such as PFA (perfluoroalkoxy) for lowest trace metal blanks and maximum chemical resistance. Optimum operating conditions for the nebulizer system with a contemporary multicollector ICP-MS will be detailed. Figures of merit will include signal enhancement, isotope ratio measurements and long-term (12 hour) ratio stability, and rinse out characteristics with and without the rapid washout accessory [1].



CETAC AridusII Desolvating Nebulizer System



QuickWash

CETAC QuickWash Accessory

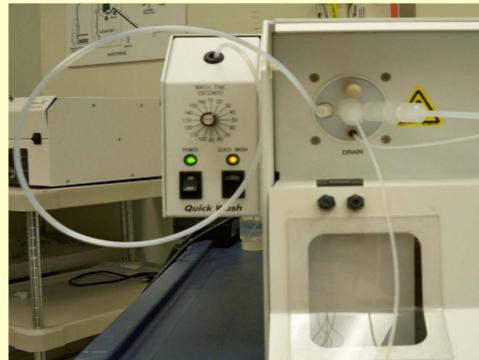
Useful for analyte concentrations above 100 µg/L, particularly U, Th, and W.

Consists of a gas/liquid line which provides a tangential spray of dilute acid inside the AridusII PFA spray chamber during the rinse cycle.

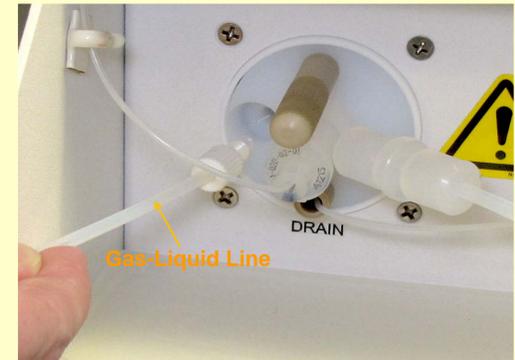
The QuickWash (QW) gas flow is 2 to 3 L/min Ar with a rinse solution flow of up to 2mL/min (pumped).

The QW can be triggered manually or via the ASX-112FR Autosampler.

The QW rinse time is preset in increments of 10 seconds up to 160 sec.



QuickWash Front View – AridusII Door Open



QuickWash Gas-Liquid Line (at left)

Nebulizer System Operating Conditions

Nebulizer System: CETAC AridusII
PFA Nebulizer: PFA-50, PFA-100
Uptake rate: 50 or 100 µL/min
Nebulizer Gas: 0.60 L/min
Spray Chamber Temp: 110 C
Membrane Oven Temp: 160 C

Ar Sweep Gas: 6.0 L/min
N₂ Addition Gas: 8 mL/min

MC-ICP-MS Operating Conditions

MC-ICP-MS: Thermo Neptune w. Jet Interface
ICP RF Power: 1200 W
Plasma Gas: 15 L/min
Auxiliary Gas: 0.70 L/min
Nebulizer Gas: 0.60 L/min
Torch Injector: Quartz, 2.0 mm i.d.
Resolution: Low
Integration time: 8 sec
Cycles: 96

Analytical Performance & QW Conditions

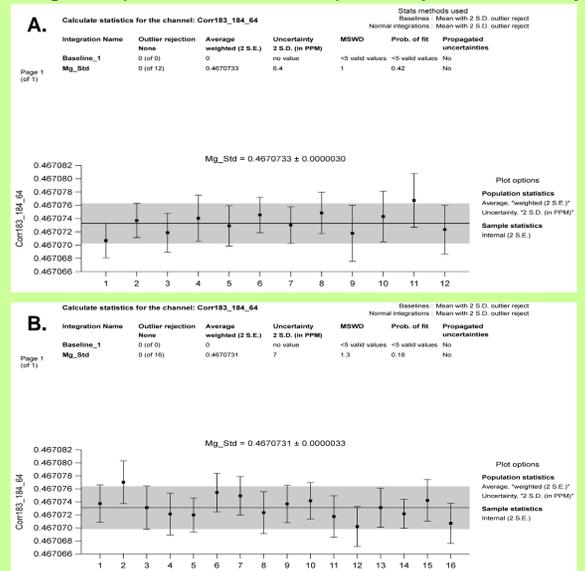
¹⁸³W/¹⁸⁴W ratios are mass bias corrected using ¹⁸⁶W/¹⁸⁴W.

Sensitivity of the MC-ICP-MS w. AridusII is ~1200 V/ppm in low-resolution mode.

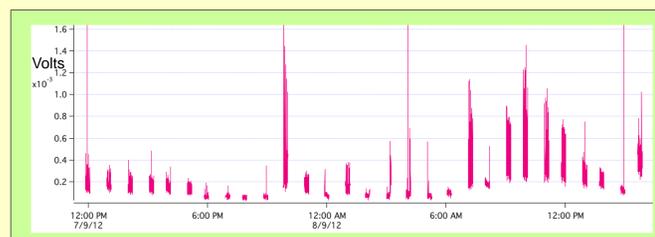
A >12 hr. ¹⁸³W/¹⁸⁴W run has a 2sd of 6.4 ppm ; a > 16 hr. run has a 2sd of 7 ppm.

QuickWash rinse time for tungsten is 70s using 2% high-purity HNO₃ with trace (0.02M) hydrofluoric acid.

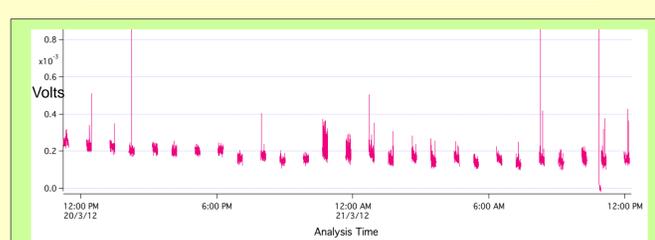
Long Term (A. > 12 hr & B. > 16 hr) W Isotope Ratio Stability



¹⁸⁴W Background Signal Without QuickWash



¹⁸⁴W Background Signal With QuickWash



Notes:

10 µg/L W introduced to the AridusII and MC-ICP-MS with a 50 µL/min PFA nebulizer.

¹⁸³W/¹⁸⁴W measured for 15 minutes followed by a normal 30 minute washout. The ¹⁸⁴W background is then measured for 15 min. (top graph)

¹⁸³W/¹⁸⁴W measured for 15 minutes followed first by a 70 sec QuickWash cycle and then a normal 30 minute washout. The ¹⁸⁴W background is then measured for 15 min. (bottom graph). Background signal and W signal spikes are significantly reduced.

Overall, use of the QuickWash shortens washout times by 25%, as a typical measurement/washout cycle is now approximately 45 min. vs. 1 hour.

1. Holst JC, et al. (2013) ¹⁸²Hf-¹⁸²W age dating of a ²⁶Al-poor inclusion and implications for the origin of short-lived radioisotopes in the early SolarSystem. *Proc. Natl. Acad. Sci.*, 110 (22) 8819-8823.