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Uranium isotope ratio measurements with Atona Faraday detectors on a collision cell interfaced ICP multicollector mass spectrometer

ZENON A PALACZ, SIMON NELMS, MATT HOCKLEY AND DAVID ROUSELL

Isotopx Limited

We present the first isotope ratio measurements of a collision cell interfaced ICP-MC-MS equipped with ATONA Faraday collectors. Preliminary sensitivity measurements with argon in the collision cell obtain 700volts/ppm sensitivity, Abundance sensitivity 237/^{238}U is 6ppm. We find with an increase in argon pressure in the collision cell we obtain enhanced thermalization of the argon plasma. This improves the high mass abundance sensitivity to 1.2ppm and 250ppb with respect to 239/^{238}U and 240/^{238}U respectively. Uranium hydride peaks are clearly resolved from the high mass peak tailing and are 2.5ppm with respect to 238U for both $^{238}UH^{+}$ and $^{238}UH^{2}+$. Due to the exceptional dynamic range and low noise of the ATONA Faraday amplifiers we can measure ppm levels of Uranium and also resolve the minor isotopes of Uranium on the Faraday collectors without the need for ion counters. There are no residual signal artefacts (tau) from ATONA amplifiers as they are not resistors. For example a mass scan across the Uranium mass spectrum at 700volts ^{238}U to resolve the minor isotopes and uranium hydrides would be impossible with any single resistor, as the large ^{238}U signal would saturate the amplifier.

Fractionation corrected ^{234}U/^{238}U precision of ~20ppm can be attained. Mass bias is stable at the tens of ppm level for several hours. Further enhancement of abundance sensitivity, with a retardation filter and an ultra-low noise Zeptona Faraday collector, are anticipated to allow the measurement of ^{236}U in natural Uranium without the need for ion counters.