Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.4645

High-precision W isotope measurements using a Nu TIMS

MR. DANIEL JAMES ROBERTS[1], TU-HAN LUU[2], EDWARD INGLIS[3], PAMELA GUTIERREZ[2] AND CATHERINE CHAUVEL[4]

[1]Nu Instruments
[2]Université de Paris - IPGP - CNRS/UMR 7154
[3]Université de Paris, Institut de physique du globe de Paris, CNRS/UMR 7154
[4]Université de Paris, Institut de Physique du Globe de Paris, CNRS UMR 7154

Presenting Author: daniel.roberts@ametek.com

High-precision isotope ratio measurements are necessary to address fundamental questions about the formation of the Earth and its subsequent evolution. The most challenging measurements relate to the detection of very small isotopic anomalies generated during the very first phases of Earth's accretion. To this end, two extinct radiogenic systems are particularly interesting: the ^{182}Hf-^{182}W system with a half life ($t_{1/2}$) of only 9 Ma, and the ^{146}Sm-^{142}Nd system with a $t_{1/2}$ of 103 Ma. However, the daughter isotopic ratios (^{182}W/^{184}W and ^{142}Nd/^{144}Nd) vary by no more than 15 ppm in terrestrial materials [1, 2], requiring measurements with a routine precision better than 5 ppm to be achieved.

The Nu TIMS instrument equipped with 16 Faraday detectors, that can be connected to 10^11, 10^12 and 10^13 Ω pre-gain amplifier resistors, and utilizes a zoom optics system allows the acquisition of multiple static or dynamic measurements for a variety of elements incuding W.

Here we report measured values for a W standard solution (SPEX). The standard solution was measured on 1.5 µg loads using a La and Gd activator [3]. Tungsten measurements were acquired using negative ions, a 7 lines multidynamic setting and lasted ~ 15 hours. Measured values are: $^{182/184}$W = 0.8649187 ± 3.3 ppm (2rsd) and $^{183/184}$W = 0.4671421 ± 2.5 ppm (2rsd) using the method [3].

These results demonstrate the capability of the Nu TIMS to determine to a precision better than 5 ppm for W isotope ratios. The instrument offers the additional benefits of a large number of detectors that can be dynamically connected to different resistors, providing the opportunity to explore high-precision isotopic measurements of other isotopic systems.

[1] Mundl et al. (Science, 2017), [2] Peters et al. (Nature, 2018), [3] Archer et al. (IJMS, 2017)