

Improved Techniques and Certified Reference Materials for Nuclear and Geological Isotope Ratio Measurements

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Isotope mass spectrometry is an important technique for a variety of geological samples analyses. Isotopic measurements made for geological purposes may have important scientific and even legal consequences and therefore require careful quality control. In order to prove the accuracy of isotopic measurements and to calibrate detectors such as secondary electron multipliers (single or multiple ion counters) the use of reference materials is required. This presentation gives an overview about state of the art measurement techniques and reference materials for nuclear isotope ratio measurements, in particular those applicable for geological purposes.

At the IRMM several projects for the certification of new reference materials suited for nuclear and geological isotope ratio analyses are ongoing. For instance the re-certification of the IRMM-184 uranium isotopic reference material allows improved quality control and instrument calibration for measurements of close to natural or equilibrium samples with a $^{234}\text{U}/^{238}\text{U}$ ratio of approximately $5.5\text{E-}5$ [1]. An improved technique for the measurement of $^{234}\text{U}/^{238}\text{U}$ ratios for this kind of samples using Faraday detectors for both ^{234}U and ^{238}U will be introduced and compared with previous techniques using an ion counter to detect ^{234}U .

On the other hand, for a variety of isotope ratio measurements, e.g. measurements of $^{230}\text{Th}/^{232}\text{Th}$ ratios in the order of $6\text{E-}6$, the use of secondary electron multipliers in ion counter mode is still required. In order to assess the performance of secondary electron multipliers and allow for accurate correction of detector non-linearity, special isotope reference materials are needed [2]. As a replacement of the well-known IRMM-072/1-15 series, the new series IRMM-074/1-10 has been prepared, characterized by a $^{235}\text{U}/^{238}\text{U}$ ratio of 1 and $^{233}\text{U}/^{238}\text{U}$ ratios varying in 10 steps from 1 down to 10^{-6} . Examples for linearity tests and possible correction procedures for non-linearity using these isotope reference materials will be given.

References

- [1] Richter S., Alonso A., Kühn H., Verbruggen A., Wellum R. and Taylor P.D.P., 2005, *IJMS*, 247, 37-39.
- [2] Richter S., Goldberg S. A., Mason P. B., Traina A. J. and Schwieters J. B., 2001, *IJMS*, 206/1-2, 105-127.