Potassium isotopic compositions of NIST potassium standards and $^{40}Ar/^{39}Ar$ mineral standards

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Knowledge of the isotopic ratios of standards, spikes, and reference materials is fundamental to the accuracy of many geochronological methods. For example, the $^{238}U/^{235}U$ ratio relevant to U-Pb geochronology was recently re-determined [1] and shown to differ significantly from the previously accepted value employed during age determinations. These underlying values are fundamental to accurate age calculations in many isotopic systems, and uncertainty in these values can represent a significant (and often unrecognized) portion of the uncertainty budget for determined ages.

The potassium isotopic composition of mineral standards, or neutron flux monitors, is a critical, but often overlooked component in the calculation of K-Ar and $^{40}Ar/^{39}Ar$ ages. It is currently assumed that all terrestrial materials have abundances indistinguishable from that of NIST SRM 985 [2]; this is apparently a reasonable assumption at the 0.25‰ level (1σ) [3]. The $^{40}Ar/^{39}Ar$ method further relies on the assumption that standards and samples (including primary and secondary standards) have indistinguishable $^{40}K/^{39}K$ values.

We will present data establishing the potassium isotopic compositions of NIST isotopic K SRM 985, elemental K SRM 999b, and $^{40}Ar/^{39}Ar$ biotite mineral standard GA1550 (sample MD-2). Stable isotopic compositions ($^{41}K/^{39}K$) were measured by the peak shoulder method with high resolution MC-ICP-MS (Thermo Scientific NEPTUNE *Plus*), using the accepted value of NIST isotopic SRM 985 [2] for fractionation [4] corrections [5]. ^{40}K abundances were measured by TIMS (Thermo Scientific TRITON), using $^{41}K/^{39}K$ values from ICP-MS measurements (or, for SRM 985, values from [2]) for internal fractionation corrections. Collectively these data represent an important step towards a metrologically traceable calibration of ^{40}K concentrations in primary $^{40}Ar/^{39}Ar$ mineral standards and improve uncertainties by ca. an order of magnitude in the potassium isotopic compositions of standards.

[1] Hiess et al. 2012. [2] Garner et al. 1975. [3] Humayun and Clayton 1995. [4] Heumann et al. 1998. [5] Morgan et al. 2012.