New determination of ^{40}K decay constant: preliminary results

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Application of the $^{40}Ar/^{39}Ar$ isotopic geochronometer to dating rocks, minerals, fossils and meteorites is limited by insufficient precision and consistency in existing determinations of the half-life of its parent isotope ^{40}K. To constrain the half-life of ^{40}K, accurate and precise isotopic composition of K must be known.

We determined K isotopic composition in an enriched ^{40}K material that is used in liquid scintillation activity measurements for half-life determination. Isotopic ratios are determined using Total Evaporation TIMS [1] that involves the measurement of isotopic ratios with gradually increasing filament current from the first appearance of ion beam until complete exhaustion of the sample. Direct loading of 0.5 ng to 2 ng samples on outgassed filaments made of zone refined rhenium yielded low loading blanks, negligible Ca isobaric interference, and consistent fractionation patterns. The $^{40}K/^{39}K$ and $^{41}K/^{39}K$ ratios were measured on a MAT261 TIMS by in static multicollector mode. Our enriched ^{40}K material yielded $^{40}K/^{39}K$ = 0.035252 ± 0.000021 and $^{41}K/^{39}K$ = 0.09645 ± 0.00011, corresponding the isotopic abundance of ^{40}K in our tracer of $^{40}K/K$(atomic) = 0.031150 ± 0.000015 (1σ).

A liquid scintillation counting experiment using this ^{40}K enriched material and its isotopic abundance determined by the total evaporation measurements yielded a preliminary ^{40}K half-life of 1.2469 x10^9 years (± 0.25%, 1σ). This result is similar within uncertainty to those obtained by [2]. Further refinement of this value depends on precise determination of the ^{40}K decay branching ratio.

[1] Fiedler R. (1995) *International Journal of Mass Spectrometry*, 146-147, 91-97.

[2] Kossert K. and Günther E. (2004) *Applied Radiation and Isotopes*, 60, 459-464.