A preliminary study of $^{99}$Tc measurement using matrix-assisted low energy AMS - DTU Orbit (21/08/2019)

A preliminary study of $^{99}$Tc measurement using matrix-assisted low energy AMS

A renewed study of Tc and Ru fluoride anion formation in a Cs sputter source has confirmed an earlier observation that the relative yields of RuF$_{5}^-$ are dependent on the sputter target matrix composition. The yield of RuF$_{5}^-$ can be suppressed relative to TcF$_{5}^-$ with the presence of a PbF$_{2}$-based sputter target of certain elements: some strongly as in the case of Nb and some modestly as in the case of Fe. This provides an opportunity for $^{99}$Tc to be detected by low energy AMS using $^{99}$TcF$_{5}^-$ with the assistance of a carefully composed matrix to form the sputter target. Depending on the Ru content in a sample and the effort to reduce it during sample preparation, the best detection limit obtained so far was ≤5 in the unit of "fg $^{99}$Tc per mg FeO$_x$Hy precipitate", using targets made of ($^{99}$Tc)FeO$_x$Hy + PbF$_2$ (~1:10 by weight).

In several preliminary linearity tests with the detection of +4 ions in the gas ionization detector, the determination of $^{99}$Tc concentration within a FeO$_x$Hy precipitate was best shown with ~15% uncertainty. The quantification was made by the average count rate of $^{99}$Tc, subtracting that of $^{99}$Ru (determined by multiplying the counts of the isobar-free $^{101}$Ru by the ratio of their natural abundances 0.748), over an hour long time under steady-sputtering conditions. This quantification method is required due to the lack of a stable Tc isotope. This method shows promise for analyzing $^{99}$Tc in seawater samples using ≤2L volumes.

General information
Publication status: Published
Organisations: Center for Nuclear Technologies, The Hevesy Laboratory, Radioecology and Tracer Studies, University of Ottawa
Corresponding author: Zhao, X. L.
Contributors: Cornett, R. J., Zhao, X. L., Hou, X. L., Kieser, W. E.
Pages: 181-189
Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms
Volume: 455
ISSN (Print): 0168-583X
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
Original language: English
Keywords: Superhalogen anions, Cs+ sputter-induced fast ion-fluorine reactions, Matrix-assisted isobar discrimination, $^{99}$Tc-AMS using TcF$_{5}^-$
DOIs:
Source: FindIt
Source-ID: 2442839717
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review