^{99}Tc measurement with matrix-assisted low energy AMS

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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_n^- are very dependent on the sputter target matrix composition. The yield of RuF_5^- can be suppressed relative to TcF_5^- with the presence in 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, best detection limits of ≤5 fg ^{99}Tc per mg FeO_xH_y precipitate were indicated so far, using targets made of (^{99}Tc)FeO_xH_y+PbF_2 (~1:10 by weight). In preliminary linearity tests with the detection of +4 ions in the final ionization chamber, the determination of ^{99}Tc concentration within a FeO_xH_y precipitate was shown possible with ~15% uncertainty. The quantification was made simply by the average count rate of ^{99}Tc subtracting that of ^{99}Ru (measured as 0.748 times that of the isobar-free ^{101}Ru), over an hour long time under steady sputtering conditions. This quantification method avoids the normalization difficulties due to the lack of a stable Tc isotope; it is similar to ICP-MS except that with AMS it is a 'solid-state solution' that is placed into a Cs sputter ion source. This method has the potential for analyzing ^{99}Tc in Arctic seawater samples using ≤2 L volume sizes.

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