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Preparation and Application of new Synthetic Uranium Isotopic Reference Materials at IRMM

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For many applications in the geological sciences, in particular in geochemistry research, isotope ratio measurements play a significant role. For instance, in geochronology isotope abundances of uranium and its daughter products thorium and lead have been used since more than five decades to determine the age of various samples of geological interest.

However, in order to validate mass spectrometric measurement procedures and to calibrate detector systems, suitable isotope reference materials are needed. IRMM is a well recognized provider for nuclear isotope reference materials to the nuclear industry and nuclear safeguards authorities, which can also be used for geological applications. This paper gives an overview of isotope reference materials for uranium prepared and certified at IRMM. These materials are synthetic isotope reference materials prepared based on proven methods of purifying and mixing highly enriched oxides.

Firstly, a set of 10 mixtures of ^{233}U, ^{235}U and ^{238}U was made in which the ^{235}U:^{238}U ratios were kept at 1:1 and the ^{233}U/^{235}U ratios varied from 1.0 to 10^{-6}(IRMM-072). This set is ideal for checking the linearity response of detectors used in isotope mass spectrometry. Recently, after the IRMM-072 series was exhausted, it has been replaced by the IRMM-073 and IRMM-074 series.

Secondly the double spike IRMM-3636 with a ^{233}U/^{236}U ratio of 1:1 was prepared which allows internal mass fractionation correction for high precision ^{235}U/^{238}U ratio

measurements. The ^{234}U abundance of this double spike material is low enough to allow an accurate and precise correction of $^{234}U/^{238}U$ ratios, even for measurements of close to equilibrium uranium samples.