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Analyses of Cs isotopes by MC-ICP-MS: suppression of Ba isobaric interferences using N_2O as a reactant gas in the collision-reaction cell

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In the general framework consisting of acquiring experimental data in nuclear fuel samples to validate neutronic calculation codes, the precise and accurate determination of Cs isotopic composition is required.

High precision isotope ratios measurements are usually performed with sector field mass spectrometers, either by Thermal Ionization Mass Spectrometry (TIMS) or by Multiple Collection Inductively Coupled Mass Spectrometry (MC-ICP-MS). One of the major drawbacks in analyzing fission Cs isotopes (mass numbers 133, 134, 135 and 137) is the occurrence of isobaric interferences, in particular with 134, 135 and 137 Ba isotopes. Here we propose to suppress these interferences by adding N_2O as a reaction gas in the collision-reaction cell of the MC-ICP-MS (Isoprobe, GV Instruments, Manchester, UK). Ba reacts with N_2O in order to form BaO and BaOH whereas Cs remains unreactive. This difference of reactivity with N_2O allows the measurement of Cs isotopes with precision and accuracy similar to those obtained after a previous chemical separation of Cs from Ba using anion-exchange resin and liquid chromatography separations. The data obtained on two different nuclear fuel samples solutions will be presented in details.

This study thus confirms that collision-reaction cells are powerful tools to perform isotopic measurements of irradiated materials without former systematic chemical separations (see also Isnard et al., 2006). This approach offers new analytic perspectives

in various scientific domains other than the nuclear one where the determination of isotopic compositions is hampered by the occurrence of isobaric interferences.