



Comparison of Total Evaporation (TE) and Direct Total Evaporation (DTE) methods in TIMS by using NBL CRMs

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The total evaporation (TE) is a well-established analytical method for safeguards measurement of uranium and plutonium isotope-amount ratios using the thermal ionization mass spectrometry (TIMS). High accuracy and precision isotopic measurements find many applications in nuclear safeguards, for e.g. assay measurements using isotope dilution mass spectrometry. To achieve high accuracy and precision in TIMS measurements, mass dependent fractionation effects are minimized by either the measurement technique or changes in the hardware components that are used to control sample heating and evaporation process.

At NBL, direct total evaporation (DTE) method on the modified MAT261 instrument, uses the data system to read the ion signal intensity and its difference from a pre-determined target intensity, is used to control the incremental step at which the evaporation filament is heated. The feedback and control is achieved by proprietary hardware from SPECTROMAT that uses an analog regulator in the filament power supply with direct feedback of the detector intensity. Compared to traditional TE method on this instrument, DTE provides better precision (relative standard deviation, expressed as a percent) and accuracy (relative difference, expressed as a percent) of 0.05 to 0.08 % for low enriched and high enriched NBL uranium certified reference materials.