High-accuracy isotopic analysis of enriched isotopes by mixed-array total evaporation technique

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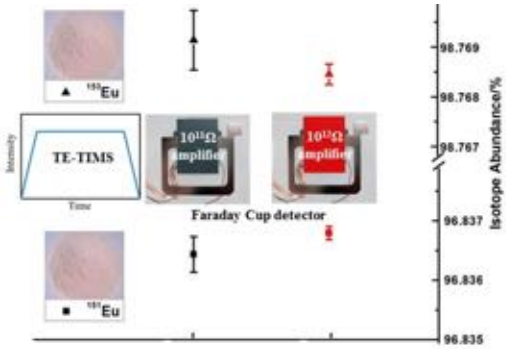
Highly precise and accurate isotopic conposition analysis is the prerequisite for related application areas. Enriched isotopes play fundmental role in primary/authority isotopic methods such as ID-MS, double-spike method and calibration mass spectrometry. However, it remains tough challenge for highly precise and accurate isotopic analysis of enriched isotopes due to its extreme isotopic ratio and the lack of suitable certified reference materials. Total evaporation thermal ionization mass spectrometry (TE-TIMS) is a theoretically calibration free method as its mass fractionation is overcame through sample total evaporation and signal integration, which is the ideal choice for enriched isotope abundance analysis.[1] However, traditional TE-TIMS struggles to achieve highly precise and accurate isotopic analysis for minor isotopes.[2]

In this work, a mixed-array total evaporation technique was developed for accurate determination of isotopic compositions for enriched isotopes. By using faraday cup coupled to 10^{12} Ω current amplifier for the minor isotope of enriched europium, while using traditional 10^{11} Ω current amplifier for the major one, the measured abundance of enriched ^{151}Eu and ^{153}Eu were 0.9683676(11) and 0.9876851(21) respectively, whose reproducibility was 3 times better than that obtained using troditional TE-TIMS. Similarly, for element with more than 3 isotopes (*eg.* Yb, Er), we used 10^{10} Ω current amplifier for the major isotope, while using 10^{11} Ω or 10^{12} Ω current amplifier for the minor isotope, the analytical precision and accuracy was significantly improved.



1. Wang J *et al*. *J Anal At Spectrom*. 2015; 30(6): 1377-1385.
2. Richter S *et al*. *J Anal At Spectrom*. 2011; 26(3): 550-564.