Lead Isotope Analysis for Picogram Size Samples by TE-DS-TIMS using Amplifier equipped with 10^{13} Ohm Resistor

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The total evaporation (TE) method is suitable for measuring isotope ratios of small-scale samples using TIMS. The combination of TE-TIMS with the ^{204}Pb-^{207}Pb double spike method (TE-DS-TIMS) achieved a precision of 0.37 ‰ (2SD) for ^{206}Pb/^{204}Pb ratio in the repeated measurement of 0.5 ng of NIST 981 [1]. To further reduce the requisite sample amount in the Pb isotope measurement with TE-DS-TIMS, the use of amplifiers equipped with high resistance resistors (10^{12} or 10^{13} Ω) would be preferred [2]. Although such high resistance amplifiers are effective to improve the signal/noise ratio during Pb isotopic analysis, their signal response is much slower than that of the normal, low resistance amplifier (10^{11} Ω) [3].

This study aims to evaluate the influence of the different signal response for high (10^{13} Ω) and low (10^{11} Ω) resistance amplifiers in the Pb isotope measurement with TE-DS-TIMS. To this end, 100 and 10 pg of NIST 981 Pb were repeatedly measured with TE-DS-TIMS (^{204}Pb-^{207}Pb double spike) using TRITON *plus* at JAMSTEC, with the following amplifier settings: (a) 10^{11} Ω for all isotopes, (b) 10^{13} Ω for ^{204}Pb and 10^{12} Ω for the other isotopes.

In spite of the difference in the signal response, Pb isotope ratios measured by the setting (b) were consistent with those measured by (a) within the analytical uncertainties. The precisions (2SD) of ^{206}Pb/^{204}Pb ratio measured by (b) were 0.59 ‰ and 1.2 ‰ for the measurement using 100pg and 10 pg of NIST 981, respectively. For the measurement of 10 pg of Pb, the precision was improved by approximately 14 times compared to that for setting (a). Therefore, no correction for the response time is needed in the analytical setting (b) in which two types of amplifiers with different signal response are simultaneously used for the Pb isotope measurement with TE-DS-TIMS.

[1] Fukami et al., 2014, *J. Anal. At. Spectrom*., **32**, 848-857. [2] Koornneef et al., 2014, *Anal. Chim. Acta*, **819**, 49-55. [3] Kimura et al., 2015, *J. Anal. At. Spectrom*., **31**, 790-800.