

THS High Sensitivity Skimmer Cone on the Nu Plasma MC-ICP-MS

Introduction

A new specially designed and manufactured THS skimmer cone is now available as an option to the existing Nu Plasma customers. The THS cone increases the ion transmission in desolvation mode, whilst maintaining good vacuum and low oxide formation, allowing for improved analytical performance. We present sensitivity data across the whole mass range (Table 1), together with isotope data to demonstrate the analytical performance.

Sensitivities

When combined with the Teledyne Cetac Aridus 3 desolvation nebulizer system, the typical sensitivities achieved using the THS cone are shown below in comparison with those achieved using the standard ES cone:

Table 1:

Typical sensitivity comparison between the standard ES skimmer cone and the new THS high sensitivity skimmer cone, both used in combination with the Aridus 3 desolvation system and a C-flow nebulizer aspirating at a rate of 0.12 ml/min.

**The following sensitivity values will not be used as performance specifications.*

Element	ES sensitivity (V/ppm)	THS sensitivity (V/ppm)
Li	390	550
Mg	445	760
Ca	650	1180
Cu	505	810
Sr	725	1280
Nd	880	1360
Hf	855	1160
Pb	1470	2250
U	1160	1610

Isotope ratios

Three different isotope systems were measured to evaluate the instrument analytical performance using the THS cone.

Nd: A 10 ppb JNDi-1 standard solution was measured, ^{140}Ce and ^{147}Sm beams were monitored for interference correction, all Nd ratios were normalized to $^{146}\text{Nd}/^{144}\text{Nd} = 0.7219$. An analysis consisted of 60 integrations each lasting 8 seconds, following a 60 second zero measurement by ESA deflection

at the beginning of the analysis. The measured $^{144}\text{Nd}^{16}\text{O}/^{144}\text{Nd}$ ratio was below 0.08% both before and after the sequence, well within the typical oxide range using other types of skimmer cone. The Nd isotopic measurement results are within error of the published values.

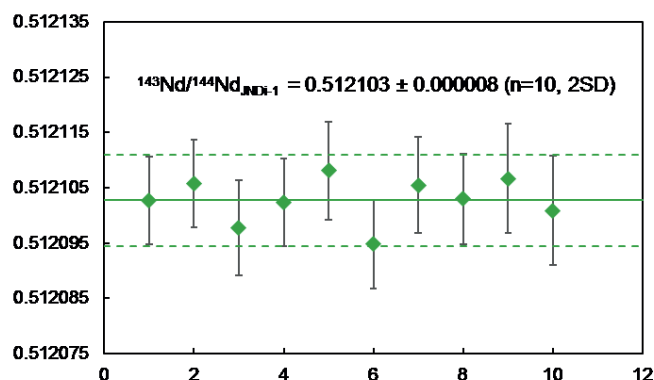
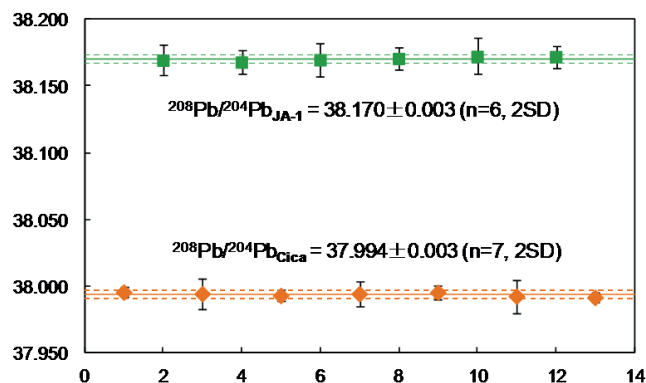


Figure 1: Nd JNDi-1 isotopic results measured using the THS cone in desolvation mode.

Pb: A 10ppb Cica sample solution and a 1ppb JA-1 standard solution (supplied by JAMSTEC, Japan) both doped with 1ppb TI NIST SRM 997 standard were measured, ^{202}Hg beam was monitored for interference correction, all Pb ratios were normalized to $^{205}\text{Ti}/^{203}\text{Ti} = 2.3871$. The two solutions were measured alternatively, each analysis lasting 240 seconds followed by a 180 second wash in 2% HNO_3 . A 240 second 'on peak zero' was measured in 2% HNO_3 at the beginning of the sequence. The measurement results of both JA-1 and Cica are within error of the expected values.



Li: A 3 ppb SPEX standard solution was measured against a 3 ppb L-SVEC standard solution (supplied by JAMSTEC, Japan). The two solutions were measured alternatively, each analysis lasted 200 seconds followed by a 180 second wash in 2% HNO₃. A 200 second 'on peak zero' was measured at the beginning of the sequence. The obtained $\delta^7\text{Li}$ is within error of the expected value.

Table 2 Li SPEX and L-SVEC isotopic results measured using the THS cone in desolvation mode:

Standard	$^7\text{Li}/^6\text{Li}$	1 SE	$\delta^7\text{Li}$ (‰)
L-SVEC	14.659	8.13E-04	
SPEX	15.854	9.60E-04	81.73
L-SVEC	14.653	8.35E-04	
SPEX	15.850	9.67E-04	81.77
L-SVEC	14.651	8.52E-04	
SPEX	15.846	9.90E-04	81.61
L-SVEC	14.650	7.98E-04	
SPEX	15.843	9.96E-04	81.56
L-SVEC	14.646	7.84E-04	
SPEX	15.840	8.45E-04	81.60
L-SVEC	14.645	7.49E-04	
Average $\delta^7\text{Li}$ (‰)			81.65
2 SD (‰)			0.18

Summary

The new high sensitivity THS skimmer cone improves the instrument sensitivity by a factor of 1.5 – 2 across the mass range compared to the standard ES skimmer cone when used in the desolvation mode, without compromising the instrument analytical performance. The THS cone opens up more doors for the accurate and precise isotope measurements of small samples.