High resolution, multicollector noble gas mass spectrometry: HELIX-MC

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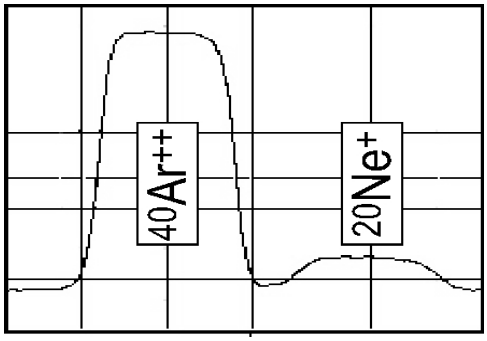
The problem of Ne isotopes

Accurate determination of the isotopic composition of Ne is problematic due to isobaric interferences at m/z = 20 and 22 from $^{40}Ar^{++}$ and CO_2^{++} respectively. Generally, corrections are made on the basis of measuring $^{40}Ar^{+}$ and CO_2^{+} during the analysis and correcting the m/z= 20 and 22 signals using previously-determined $^{40}Ar^{++}/^{40}Ar^{+}$ and CO_2^{++}/CO_2^{+} ratios. However, given that there is pressure-dependent isotopic discrimination in Neir type ion sources (of the order several %) and that the ratios $^{40}Ar^{++}/^{40}Ar^{+}$ and CO_2^{++}/CO_2^{+} are also dependent on the spectrometer pressure at the time of measurement, it is impossible to completely deconvolve the m/z = 20 and 22 signals (three variables, two isotope ratios).

GV Instruments have specifically targeted this problem by developing a multicollector noble gas mass spectrometer +, the Helix MC, with sufficient resolution (≈ 1500 M/ΔM) to separate $^{40}Ar^{++}$ from ^{20}Ne. For the first time, it is possible to measure $^{20}Ne^{+}$ without $^{40}Ar^{++}$ (as shown in the figure), and thereby Ne isotopic discrimination can be measured directly. Similar advantages exist for measuring N isotopes free from CO isobaric interferences. A 5 collector Helix-MC was delivered to CRPG, Nancy at the end of 2005, and we describe here the characteristics of the machine.

With 5 'miniDual'™ collectors (4 moveable and one fixed), two of which are high resolution (>1500 M/ΔM), the Nancy Helix is optimized for analysis of Ne and N_2 isotopes. However, each 'miniDual'™ collector contains both faraday and ion multiplier (i.e. the spectrometer has 5 multipliers and 5 faradays in total), therefore the spectrometer can readily meασυρε ιν μυλτιχολλεχτιον μοδε αλλ νοβλε γασεσ ωιτ η τηε εξχεπτιον οφ Ηε (ωηιχη χαν ονλψ βε μεασυρεδ βψ πεακ φυμπινγ). Ωε ωιλλ πρεσεντ ηερε δατα δεσχριβινγ τ ηε μαχηινε περφορμανχε (σταβιλιτψ, ρεπροδυχιβιλιτψ ανδ δισχριμινατιον) φορ Νε, Αρ ανδ Ξε.



Φιγυρε: Σχαν αχροσσ μ/ζ= 20 ατ ρεσολυτιον M/ΔM = 1500, showing that even large contributions of $^{40}Ar++$ can be completely resolved from the $^{20}Ne+$ signal.