Concept of a new thermal isotope mass spectrometer

S.J.G. Galer
H.-J. Laue
S.L. Goldstein
K. Mezger
A.W. Hofmann
A. Tegtmeyer
M. Wegener

Max-Planck-Institut für Chemie, W-55020 Mainz, Germany

Spectromat GmbH, 28205 Bremen, Germany.

Several important areas of present geological research require an accuracy in the measurement of Sr and Nd isotope ratios that challenge the analytical capabilities of existing thermal ionization mass spectrometers, where true reproducibility at the 95% confidence level is not better than ~15 ppm even by the most accomplished analysts. The ability to measure isotope ratios more precisely is limited by disturbances in traditional sector field mass spectrometers, and new developments can at best only result in marginal improvements in measurement.

We have designed a new instrument for precise isotopic analysis that resolves many of the factors limiting present-day measurements, and which should be able to improve the accuracy of Sr and Nd isotope measurements to ~2 ppm. This machine has a straight flight path. Variable mass dispersion will be accomplished by a Wienfilter sandwiched by two quadropole doublets. The ion optics has been designed with a special emphasis on correction of image aberrations. The design of the detector system contains a precise variable slit system which solves the problem of different cup distances related to different mass ranges. This desing can be combined with a fixed detector system, in our case consisting of 11 oversized fixed faraday cups, and will alow simultaneous measurement of isotope ratios over a large mass range. All applied voltages and currents will be controlled by optically coupled DACs and ADCs. Peak jumping to any desired reference or interfering masses will be fast and easy.