

## Development of an oxidation solid electrolyte micro-reactor for $\delta^{34}\text{S}$ analysis of nonvolatile organic substances by CF-IRMS

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Sulfur is an important constituent of many natural and anthropogenic organic compounds. Measurements of the sulfur isotope composition in solids and liquids are potentially very useful for tracing the origin of organic compounds and the processes that have affected them. The conventional approach to the sulfur isotope analysis of organic materials is based on their combustion to  $\text{SO}_2$  in an elemental analyzer (EA), followed by measurement of  $^{34}\text{S}/^{32}\text{S}$  in a gas source isotope ratio mass spectrometer. This analysis is limited to milligram quantities of materials. However sometimes it is necessary to measure  $\delta^{34}\text{S}$  in amino acids and nucleotides of smaller amount. Our system makes it possible to carry out  $^{34}\text{S}$  analysis of analytes containing 0.1-1 nmol S.

A high temperature electrochemical solid electrolyte reactor (SER) based on stabilized zirconium dioxide ( $0.9\text{ZrO}_2\text{-}0.1\text{Y}_2\text{O}_3$ ) has been designed for oxidation of nonvolatile organic compounds and is introduced in a continuous-flow isotope-ratio mass spectrometry (CF-IRMS) system. The working temperature of the micro-reactor is  $\sim 950^\circ\text{C}$ . The SER is made of tubular, thin-walled zirconia ceramics with inner diameter of 1 mm and of 10 cm total length. Depending on the value of the working electrode potential, SER can work in oxidation or reduction mode [1, 2]. The designed device is coupled to the Delta Plus isotope ratio mass spectrometer via Combustion I. It is composed of a sample inlet system, micro-reactor, 6-port Valco valves and cryogenic trap.

At present experimental device is being in the process of testing to determine its analytical performance for  $\delta^{34}\text{S}$  and  $\delta^{13}\text{C}$  analysis. Later on, in our device, a laser ablation system will be used as the sample inlet system. We hope that our new method with the use of SER will have extensive application in organic geochemistry.

[1] Galimov (2009) *Rapid Commun. Mass Spectrom.* **23**, 2461-2466. [2] Sevastyanov (2012) *Rapid Commun. Mass Spectrom.* **26**, 2584-2590.