European Mineralogical Conference
Vol. 1, EMC2012-304-1, 2012
European Mineralogical Conference 2012

Laterally resolved 4-isotope Sulfur high precision measurements with SIMS

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Secondary Ion Mass Spectrometry (SIMS) technique provides direct in situ measurement of elemental and isotopic composition in selected μm-size areas of the sample.
Conventional sulfur isotope studies focus on the two most abundant isotopes ^{32}S and ^{34}S. However, there has been an increasing interest in the minor ^{33}S ($\sim$0.7%) and ^{36}S ($\sim$0.02%) isotopes since mass independent fractionation effects have been discovered [1-3].
This paper presents 4-isotope sulfur data obtained on standard and unknown pyrite samples. Measurements have been performed using a small 10μm Cs^+ beam spot, and moderate mass resolution conditions ($\sim$4,500) to resolve the hydride mass interferences. The four S isotopes have been collected simultaneously: ^{32}S, ^{33}S and ^{34}S on Faraday Cup detectors (FC), and the low abundance ^{36}S (intensity ca. 2x10^5 c/s) on an Electron Multiplier (EM). The EM yield drift has been automatically monitored and corrected using a proprietary algorithm. More than 100 spot analyses have been performed in fully automated mode, with an analysis time of 4 minutes per spot.
Data on the standard sample show that a precision < 0.2 permil (1SD) can be achieved for δ^{34}S, δ^{33}S (and Δ^{33}S). An excellent precision, < 0.3 permil (1SD), is also obtained for δ^{36}S and Δ^{36}S. This measurement protocol with multicollection configuration FC-FC-FC-EM allows to work with good spatial resolution (spot size $\sim$10μm) and yields excellent precision for all Sulfur isotopes, including for the lowest abundant ^{36}S.
The CAMECA IMS 1280-HR is well suited for this task because it can easily achieve the required mass resolution power without loosing transmission. Furtheron it is mandatory beeing able to configure the detectors of the multicollection individually in spacing and make a free selection of EM or FC. It is this ultra high sensitivity ion microprobe that delivers unequalled analytical performance for a wide range of SIMS applications: isotope ratio measurements, geochronology applications (U-Pb dating in Zircon), trace element analyses, particle screening measurements and others.

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[2] Williford et al. (2011) GCA 75, 5686-5705.
[3] Whitehouse (2011) Goldschmidt 2011 abstract, 2155.