

Non-matrix matched in situ $\delta^{33}\text{S}$ and $\delta^{34}\text{S}$ isotope analyses by UV-fs-MC-ICP-MS

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Sulphur isotope analysis have a long record for tracing a large variety of geochemical process. Traditionally gas mass-spectrometry is used determining bulk isotope ratios at high precision and accuracy. In recent years several publications have been focusing on the possibility of in-situ sulphur isotope analysis and several minerals have been proposed as reference materials¹ in order to facilitate matrix matched analysis during standard LA-MC-ICP-MS analysis. Several micro-beam techniques can analyse sulphur isotope ratios such as Secondary Ion Mass spectrometry and a novel technique like fs-LA-GC-IRMS, a gas mass spectrometry system couple to a modified laser ablation system². Using an inhouse build UV-fs ablation system coupled to a Thermo Neptune plus instrument the possibility of non- matrix matched standardization is evaluated using a large chalcopyrite with a $\delta^{34}\text{S}_{(\text{VCDT})}$ value of -1.6 ‰ as the bracketing standard. Chalcopyrite (GC-1)¹, Pyrite (RPPY)¹, Galena (NWU-GN)¹ and Sphalerite (Sph-1)¹ were measured and the analytical details, including background reduction which limits the precision during analysis, are considered. All analysis lie on the terrestrial mass dependent fractionation line and an internal precision of better than 0.08 ‰ (2s) for the $\delta^{34}\text{S}$ ratio and 0.2 ‰ (2s) on the $\delta^{33}\text{S}$ can be achieved. Best reproducibility was achieved for the GC-1 reporting $\delta^{34}\text{S} = -0.63 \pm 0.24$ (2SD; n=25). Detail analysis of Galena (NWU-GN) revealed a core to rim inhomogeneity of ~ 1-2 ‰ in the $\delta^{34}\text{S}$ value. The significant deviations from the so far reported data for the $\delta^{34}\text{S}$ of 28.21 ‰ maybe due to the smaller ablation diameter and the significantly smaller ablation rate during fs-LA. Our findings show isotopically light values of $\delta^{34}\text{S} \sim 27\text{‰}$ in the core of NWU-GN to values of $\delta^{34}\text{S} \sim 30\text{‰}$ in the rim using a lateral resolution of 30 μm which is outside the analytical uncertainty reported.

1) Lv, N et al. (2022), Geostandard Geoanalytic Res.

2) Guo, D et al. (2024) Rapid Comm Mass Spectrometry