

Precise Determination of Cr Stable Isotopic Composition Using a Double Spike Method

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Chromium stable isotopic system has been widely used for tracing both low- and high-temperature processes[1,2]. However, chromium isotopic analyses can be compromised by both direct isobaric (^{50}Ti , ^{54}Fe) and polyatomic interferences on MC-ICP-MS. In this study, we developed a high-precision method for measuring Cr stable isotopic composition in natural rock samples. We have tested various factors that could cause analytical artifacts on Cr isotopic analyses.

This method combines a double-spike (^{50}Cr and ^{54}Cr) technique and a MC-ICP-MS. Doping experiments showed that our method can fully account for Fe and Ti isobaric interferences with Fe/Cr and Ti/Cr ratio up to 0.05. Long-term reproducibility of an inter-laboratory standard (SCP) is 0.045‰(2SD, N=184), while the $\delta^{53}\text{Cr}$ value of this standard relative to NIST 3112a is 0.071 ± 0.052 (2SD, N=53), consistent with that measured on TIMS in this work(0.07 ± 0.04). Systematic measurements of a set of USGS geological reference rocks are performed. Measurements of different aliquots of USGS basalt standards BIR-1 obtained in different analytical sessions show consistent values averaging at -0.13 ± 0.08 (MC-ICP-MS), which also agrees with the TIMS measurement (-0.16 ± 0.07). The dunite standard DTS-2 yields an identical isotope composition of -0.15 ± 0.05 with a previous works(-0.152 ± 0.045).

A detailed theoretical reduction on the effect of the systematic bias resulting from the “double spike” calibration procedure on the measured Cr isotopic composition in the sample was also performed in this work. Our results show that the δ value stays unaffected even if the mass-fractionation calibration of “double spike” is inaccurate.

[1] Schoenberg R. et al. (2008) *Chem. Geol.*, **249**, 294-306. [2] Bonnand P. et al. (2011) *JAAS.*, **26**, 528-535.