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High-precision iron isotopic measurements in low resolution using collision cell (CC)-MC-ICP-MS

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Here we present an analytical method for Fe isotopic measurements in low resolution mode, using a Nu Sapphire collision cell-equipped multi-collector inductively coupled plasma mass spectrometer by standard-sample bracketing. High Fe sensitivity was obtained through reducing Ar based interferences by over 9 orders of magnitude whilst other analytes remained unaffected. The effect of Fe concentration, Fe beam intensity and HNO_3 molarity mismatch between standard and sample and the presence of matrix elements have been evaluated. The long-term analyses of JMC Fe and BCR-2 indicates that the obtained isotopic ratios are highly reproducible, with precisions of better than ± 0.03‰ for $\delta^{56}Fe$ (2SD). Such accurate and precise data could be acquired via 3 to 6 repeat measurements consuming 50-100 ng Fe, which has improved by a factor 40 compared to those previously reported on other instruments. Accurate measurements were achieved by close matching Fe intensities between sample and standard (a 5% mismatch would create a 0.02‰ offset in the $^{56}Fe/^{54}Fe$ ratio). On the other hand, the ratio of the concentration between the matrix elements and Fe, such as C_{Na}/C_{Fe}, C_{Mg}/C_{Fe}, C_{Ca}/C_{Fe}, C_{Ti}/C_{Fe} and C_{Ni}/C_{Fe} should be kept under 0.1, C_K/C_{Fe} under 0.3, C_{Al}/C_{Fe} and C_{Cu}/C_{Fe} under 1, and C_{Co}/C_{Fe} and C_{Zn}/C_{Fe} under 2 to avoid any matrix effect. In addition, high precision Fe isotopic data were obtained on twenty-one geological reference materials and were highly consistent with the literature values. Furthermore, we obtained $\delta^{56}Fe$ of standard chalcopyrite (XTC) for the first time: 0.127 ± 0.027‰ (2SD, n = 3).