Measurements of Iron Meteorites ^{60}Ni/^{58}Ni by means of MC-ICP-MS: Procedure development and performances characterization at CIRCE Lab

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Isotope fingerprints represents an attractive target for examining the nucleosynthetic origins of Solar System material, relating differentiated and primitive meteorite types, and studying mixing processes in the early solar nebula. Among the others chemical elements, Nickel is a moderately refractory and siderophile element, and also a major component of both iron and silicate meteorites, hence representing an attractive target for cosmochemistry studies [1]. ^{60}Ni isotope variations can therefore potentially be used to date nebula events. Likewise, ^{60}Fe is believed to be synthesised in a high temperature stellar environment and not within the Solar System [2]. The presence of live ^{60}Fe inferred from Ni isotope compositions represents a diagnostic fingerprint of material created in a nearby stellar explosion that was subsequently transported to the nascent solar nebula more than 10 Ma. The initial abundance of ^{60}Fe, relative to other short-lived nuclides, can fill some important gaps placing important constraints on the nucleosynthetic processes responsible for creating these nuclides. In this field of research MC-ICP (Multi Collector-Ion Coupled Plasma) mass spectrometry represents the ideal mas spectrometry methodology capable to guarantee:
i) the necessary sensitivity (i.e. ϵ^{60}Ni=.03) to detect small ^{60}Ni enrichments;
ii) a low time consuming chemistry (i.e. mostly based upon ion exchange chromatography);
iii) an overall high ionization efficiency onto the isotopic species to be anlysed;
iv) a high mass sensitivity allowing for isobar separation and/or correction.
This paper presents complete method development (i.e based on [3] and and procedure isotope characterization at the MC-ICP-MS Lab of Centre for Isotopic Research on Cultural and Environmetal heritage (CIRCE). A series of treated and untreated reference material (NIST SRM 986) samples were measured together with some terrestrial (USGS) samples already measured in other studies [3] in order to evaluate procedure and machine characteristics. FInally samples from the Chonditres of Brenham e and Mineo.

References

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