Cosmogenic Effects on Cr Isotopic Composition of Iron Meteorites

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^{53}Mn-^{53}Cr short-lived chronometer ($t_{1/2}$=3.7 Myr) is a powerful tool for high resolution chronological studies of the early Solar Sytem events occurred in the very first 10 Ma. However, cosmogenic effects, induced by spallation and thermal/epithermal neutron capture processes, could hamper the correct determination of radiogenic contribution to ^{53}Cr, therefore influence the accuracy of ^{53}Mn-^{53}Cr chronometry, especially for samples with high Fe/Cr, Ni/Cr ratios and long exposure ages ([1,2]). Metal and olivine phases in meteorites that are often used for the determination of Mn-Cr age, have high Fe and/or Ni contents and could be vulnerable to cosmogenic effects. Thus it is necessary to examine the comogenic Cr isotopic signature in meteorites, and to find a proper method to correct for such effects on Cr isotopic composition in order to obtain meaningful Mn-Cr ages.

Iron meteorites are ideal samples for investigating cosmogenic effects on Cr isotopic composition because of their high Fe/Cr, Ni/Cr ratios and relatively long exposure ages. In this study, we analyzed 25 iron meteorite samples from 9 chemical groups using a Thermo Finnigan Triton multi-collector thermal ionization mass spectrometer at DTM. The samples display large coupled variations in ε^{53}Cr and ε^{54}Cr (up to ~250ε for ε^{53}Cr and up to ~1000ε for ε^{54}Cr) with a ratio of approximately 1:3.9. This ratio is similar to that determined through three pieces of Carbo meteorites in [3] and is consistent with our modeling results (~1:3.4). We found that this correlation is very robust and is independent of the chemical composition (different Fe/Ni ratio) of the meteorites. Therefore, we can use this correlation to correct for cosmogenic effects on ε^{53}Cr, because the pre-exposure ε^{54}Cr (anomalies) are often known and the magnitude is small compared to the variation generated by comgenic effects.

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