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ガルバノ光学系を用いたLA-MC-ICPMSによるテーナイト相の鉄同位体比分析
Fe isotope measurement of taenite using LA-MC-ICPMS technique with Galvano scanner system

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The laser ablation-multicollector-inductively coupled plasma mass spectrometry (LA-MC-ICPMS) is widely accepted as the powerful technique to reveal the isotope ratios of solid sample. This technique can achieve the in-situ analysis of micro region with swiftness. On the other hand, it is difficult to avoid the mass spectrometric and non-mass spectrometric interferences from coexistent elements in this technique because the produced sample particles by laser ablation are directly introduced into the ICP with carrier gas. Such interferences have a potential to intercept to reveal the precise and accurate isotope data. The effect on the isotope ratios of analyte from coexistent elements can be corrected by using the standard material which include same amount of coexistent elements as the sample. However, synthesis of isotopic homogeneous solid material is extremely difficult.

In this study, we have developed a technique to measure the Fe isotope ratios of taenite in iron meteorites. The Fe isotope signature of iron meteorites is one of the key information to understand the core formation of planetesimals and terrestrial planets. However, the in-situ Fe isotope measurement of taenite is difficult because of the abundant Ni (>25 wt%) in it. In order to overcome this problem, we have applied Galvano mirrors and a telecentric optical system (Yokoyama et al., 2011) for LA-MC-ICPMS technique. In this technique, pure iron (IRMM-014) and pure Ni were ablated at a time using femtosecond laser with Galvano system as the Fe isotope standard. The ablated Ni amount was adjusted to the Ni amount in the taenite sample. The Fe isotope ratios ($^{56}Fe/^{54}Fe$ and $^{57}Fe/^{54}Fe$) of taenite phases were measured using MC-ICPMS and the mass fractionation in the mass spectrometry was corrected by sample-standard bracketing technique. The precision and accuracy of Fe isotope data obtained by the presented technique will be discussed in this presentation. The isotope analytical technique developed in this study can be applied not only for taenite phase in iron meteorite but also for other sample which include coexistent elements.

Keywords: ICP-MS, laser ablation, taenite, Fe isotope, Galvano