

LAL-MC-ICPMS 法による普通コンドライトに含まれる Fe-Ni 相の鉄同位体比測定 Fe isotopic study of Fe-Ni metal in ordinary chondrite using LAL-MC-ICPMS

岡林 識起^{1*}, 横山 哲也², 平田 岳史¹

OKABAYASHI, Satoki^{1*}, YOKOYAMA, Tetsuya², HIRATA, Takafumi¹

¹ 京都大学 LPSC, ² 東京工業大学 地球惑星科学専攻

¹Laboratory for Planetary Sciences, Kyoto University, ²Department of Earth and Planetary Sciences, Tokyo Institute of Technology

The ordinary chondrite is the most abundant and primitive meteorite in the solar system. It is widely believed that the formation sequence of the ordinary chondrites tell us details of the early solar system history. Among the various minerals or components found in the ordinary chondrites, the Fe-Ni metal is one of the characteristic materials of ordinary chondrite. Despite the major components, the formation processes of Fe-Ni metals have still been veiled. The Fe isotopic signature is one of the key information to unveil the formation processes of Fe-Ni metals in the ordinary chondrites, because (a) Fe is ubiquitously distributed in various minerals or phases in the meteorites, and (b) Fe isotope composition can vary through the formation processes. Standing on this view point, some previous studies measured the Fe isotopic ratios of Fe-Ni metals in the ordinary chondrites [1, 2]. In those studies, the ordinary chondrites were crushed in the mortar and Fe-Ni metals were sampled through handpicking or micro-mill technique to collect Fe-Ni metals. It should be noted that these techniques have the risk of the contamination from the equipments or apparatus used for the sample handling although these techniques have been widely accepted as the sampling methods of the solid materials for the isotopic analysis.

In this study, we applied a new sampling technique, LAL (laser ablation in liquid) [3, 4], to collect Fe-Ni metals from the ordinary chondrites for the Fe isotopic measurement using MC-ICPMS. For the LAL sampling, the sample surface was polished and the metal phase was ablated in the deionized water using the femtosecond laser (wavelength 780 nm). Unlike with the conventional sampling techniques applied in the previous studies, the LAL technique can provide minimum risk of contamination of Fe from equipments. After the LAL sampling procedure, the resulting sample suspension was collected using micropipette and was then subsized to acid digestion using conc. HCl and conc. H₂O₂. The sample solution was heated until dryness and the resulting sample cake was re-dissolved in 0.1% HCl, and then used for the isotopic analysis of Fe using MC-ICPMS connected to the desolvating nebulizer system.

Total 15 ordinary chondrite metals were analyzed in this study. The delta ⁵⁶Fe data for L chondrites did not vary with the delta ⁵⁶Fe data for LL chondrites. In contrast, Fe in the H chondrites was isotopically slightly lighter than those for L or LL chondrites. These Fe isotopic variations among H, L and LL chondrites are consistent with the data obtained by Theis et al. (2008) [1]. These Fe isotopic ratios within the metallic phase in the H, L and LL chondrites is possibly related to the formation processes of them, however, cannot be explained by the simple redox reaction suggested by Theis et al. (2008). Possible cause of the present variation of Fe isotopic ratios will be discussed in this presentation.

[1] Theis, K.J., Burgess, R., Lyon, I.C. and Sears, D.W., (2008), *Geochim. Cosmochim. Acta*, **72**, 4440-4456. [2] Needham, A.W., Porcelli, D. and Russell, S.S., (2009), *Geochim. Cosmochim. Acta*, **73**, 7399-7413. [3] Okabayashi, S., Yokoyama, T.D., Kon, Y., Yamamoto, S., Yokoyama, T. and Hirata, T., (2011), *J. Anal. At. Spectrom.*, **26**, 1393-1400. [4] Douglas, D.N., Crisp, J.L., Reid, H.J. and Sharp, B.L., (2011), *J. Anal. At. Spectrom.*, **26**, 1294-1301.

キーワード: レーザーアブレーション, 液中レーザーアブレーション, 普通コンドライト, 鉄同位体

Keywords: laser ablation, laser ablation in liquid, ordinary chondrite, iron isotope