
[EJ] Evening Poster | P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS06] Formation and evolution of planetary materials in the Solar System

convener: Akira Yamaguchi (National Institute of Polar Research), Wataru Fujiya (Ibaraki University, College of Science), Yoko Kebukawa (横浜国立大学 大学院工学研究院, 共同), Masahiro KAYAMA (Department of Earth and Planetary Material Sciences, Faculty of Science, Tohoku University)

Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

This session will focus on the evolution in the Solar System with interaction and co-evolution in minerals, water, organic matter, and noble gas in meteorites and interplanetary dust particles. New innovative analytical and theoretical techniques in various fields will be discussed. The developing methods are welcome to submit for the future mainstream of meteorite study. In order to explore the planetary materials and their evolution, both meteorite studies and experimental approaches are necessary. In this session, we will discuss these topics from extraterrestrial sample analyses and experimental works. Research works on undifferentiated and differentiated meteorites and parent body processes such as aqueous alteration, thermal metamorphism, shock metamorphism, volcanic activity, and core-mantle-crust differentiation are especially included in this session.

[PPS06-P05] Primordial, thermal and shock features of ordinary chondrites: Bulk X-ray diffraction study using in-plane rotation of polished thin section

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Introduction

The X-ray diffraction data of stony meteorites includes information on the thermal and shock metamorphism modified from primordial features as well as the chemical group. The X-ray diffraction method is convenient, and rapidly clarifies bulk features of stony meteorites. In the present study, mainly Antarctic ordinary chondrites were examined using in-plane rotation method of polished thin section, and we established the criteria for the characterization.

Experiments

Sixty ordinary chondrites (23 H, 21 L, and 16 LL) were used for X-ray measurements (RIGAKU, SmartLab) on the condition of Cu K α ; with 40kV and 30mA through the slit of 10x10 mm in size. Peaks were mainly focused on olivine 130, clinopyroxene (Cpx) 22-1, orthopyroxene (Opx) 511 and kamacite 110.

Results and Discussion

Olivine 130 position is clearly correlated with the chemical group for equilibrated ordinary chondrites (EOCs), while the peak was splitted or broad for unequilibrated ordinary chondrites (UOCs) corresponding to olivines with different compositions in chondrules and matrices. The intensity ratios of kamacite was useful for distinguishing the chemical group between H and L-LL, but not definite, mainly due to terrestrial

weathering of kamacite in H chondrites. The intensity of orthopyroxene (Opx) 511 is positively correlated with the metamorphic sequence from 3 to 6, and that of clinopyroxene (Cpx) 22-1 is inversely correlated. Shock stage is positively correlated with the full width of half maximum (FWHM) of Opx 511 and olivine 130 for each class. Part of Opx (Pbca) transformed finally to Cpx (P2₁/c) through Cpx (C2/c), where Cpx (C2/c) is stable under high pressure condition for shock stage S6 (Tenham and NWA 4719). The shock melted LL chondrite is characterized by deficiency in Cpx but instead abundant homogeneous olivine. Both effects of thermal and shock metamorphism are thus included in the bulk X-ray diffractions.

Implications

The present method can apply for initial analyses of various extraterrestrial samples. We emphasize that it is newly developed approach for characterizing extraterrestrial materials without any significant damage during the measurements.