[EE] Evening Poster | S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Tectonophysics

[S-IT22]Interaction and Coevolution of the Core and Mantle in the Earth and Planets

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Recent observational and experimental investigations have significantly advanced our understanding of the structure and constituent materials of the deep Earth. Yet, even fundamental properties intimately linked with formation and evolution of the planet, such as details of the chemical heterogeneity in the mantle and light elements dissolved in the core, remained unclear. Seismological evidence has suggested a vigorous convection in the lower mantle, whereas geochemistry has suggested the presence of stable regions there that hold ancient chemical signatures. The amounts of radioactive isotopes that act as heat sources and drive dynamic behaviors of the deep Earth are also still largely unknown. We provide an opportunity to exchange the achievements and ideas, and encourage persons who try to elucidate these unsolved issues of the core-mantle evolution using various methods, including high-pressure and high-temperature experiments, high-precision geochemical and paleomagnetic analyses, high-resolution geophysical observations, geo-neutrino observations, and large-scale numerical simulations. Since this session is co-sponsored by geomagnetism, paleomagnetism and rock magnetism division of the SGEPSS, contributions in geomagnetism and geodynamo simulation are also encouraged.

[SIT22-P14]Multiple sulfur isotope analytical system using IRMS MAT-253 for high pressure experimental run products

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The candidates for major light elements in the core are carbon, sulfur, oxygen and hydrogen. Based on geophysical studies and high pressure experimental results, the core composition and its evolution have been the focus of several previous studies. However, recent studies have suggested the presence of isotope fractionation at high temperature and high pressure conditions, especially in magma ocean environment and core segregation (e.g. Satish-Kumar et al., 2011; Labidi et al., 2016). In order to understand the light element isotope fractionation processes in the deep earth, it is necessary to measure isotope composition accurately in micro to nano mole scales, because of the small volume run products from high pressure experiments.

At Niigata University, MAT-253 mass spectrometer (Thermo Fisher Scientific) was installed through the MEXT Grant-in-Aid for Scientific Research on Innovative Areas. Carbon and oxygen isotopic composition are measured using CO_2 and sulfur isotopic composition are measured using SF_6 gas. A new micro-volume inlet system was installed and fundamental parameters such as pressure effect and capillary flow effect were tested. Using the micro-volume inlet system the minimum volume required for each analysis is 1 micro mole sample gas, and the precession of carbon isotopic composition is better than 0.1 ‰.

Multiple sulfur isotope measurement system consists of; 1) curie point pyrolyzer for rapid conversion of small volume samples to SF_6 gas (Ueno et al., 2015), 2) gas chromatograph for purifying the SF_6 gas and 3) micro-volume inlet system for introduction of sample gas to ionization chamber. Initial measurements on small volume samples gave precession better that 0.1‰ for both $d^{34}S$ and $d^{33}S$. However, $d^{36}S$ has large errors due to possible contamination by hydrocarbons. Experiments are now being carried out with better vacuum conditions and higher purity carrier gas for refining the precision of $d^{36}S$. Sulfur-bearing samples from experimental run products as well as natural samples will be measured for multiple sulfur isotopes for understanding the presence of mass independent fractionation in mantle reservoirs and possible isotope exchange during core-mantle interaction.

References

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