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

[S-IT18]Planetary cores: Structure, formation, and evolution

convener:Hidenori Terasaki(Graduate School of Science, Osaka University), Eiji Ohtani(Department of Earth and Planetary Materials Science, Graduate School of Science, Tohoku University), William F McDonough (共同), George Helffrich(Earth-Life Science Institute, Tokyo Institute of Technology)
 Mon. May 21, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

There are fundamental links between the formation and evolution of planets and their satellites to that of their cores. Defining the physical and chemical properties of the cores of these terrestrial bodies are fundamental for understanding their internal structures and thermal profile. Recent advances in experimental and theoretical studies provide new insights and applications to the Earth's cores and other terrestrial bodies. Future exploration missions will obtain data on the internal structure of terrestrial planets (e.g., Mars and Mercury) and planet-satellite systems. We anticipate presentations on recent advances on the physical and chemical properties of cores and discussions regarding the latest views of their formation and evolution. We welcome contributions from mineral/rock physics, geophysics, geochemistry, geodynamics, and planetary science.

[SIT18-P06]Study of differentiation process between metal and silicate induced from shock impact events

Takashi Fujikawa¹, *Tatsuhiro Sakaiya¹, Hidenori Terasaki¹, Tadashi Kondo¹, Keisuke Shigemori²
 (1.Graduate School of Science, Osaka University, 2.Institute of Laser Engineering, Osaka University)
 Keywords:Core formation, melt, compaction, pressure decay, porosity

In the planetary evolution process, the protoplanet is formed by accumulation of dust in the protoplanetary disk, formation of small planetesimals, and their collisional coalescence. In the surface of the protoplanet, magma ocean is formed by impact energy, iron alloy and silicate are separated inside the magma ocean and the iron alloy falls to the bottom. It is thought that the planetary core of iron alloy are formed by falling to the center of the planet due to gravitational instability. On the other hand, in computer simulation study, it is reported that the planetary core formation is possible by triggering the local iron-silicate separation on the planetary surface by thermal energy caused by impact event. In understanding the planetary evolution process, it is important to investigate how iron alloys and silicates separate from undifferentiated objects due to impact event. In this study, we conduct the impact recovery experiment in order to investigate the separation process of iron alloy and silicate inside the undifferentiated objects caused by impact event.

In order to simulate shock wave propagation at impact event, the laser-generated shock wave was propagated into the sample. The pressure was 220-510 GPa (impact velocity of 10-17 km/s) on the titanium plate surface. The sample was the mixture of olivine powder and iron sulfide (FeS) powder. The porosity was about 30%. The mixing ratio of the sample was 6.6-10.3 vol.% of FeS. The cross section of the recovered sample was observed by scanning electron microscope (SEM) to measure the porosity of the sample, the aspect ratio of FeS particles, the number of FeS particles and the size distribution of FeS particles. We analyzed the composition of the molten segment in the recovered sample using an energy dispersive spectrometer (EDS) of the SEM.

It was found from the change of the aspect ratio of the FeS particles that the shock wave propagated through the sample with attenuating the pressure. There was a compression history in the shock wave propagation direction from the size distribution of the FeS particles and it was found that the number of flattened FeS particles increased around the sample surface from the volume fraction of the FeS

particles.