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

[S-IT27]Property and role of liquids inside the Earth

convener:Tatsuya Sakamaki(Department of Earth Science, Tohoku University), Yoichi Nakajima(Kumamoto University, Priority Organization for Innovation and Excellence)

Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Liquids of silicates and metals inside of the Earth have played important role in the physical, chemical, and thermal evolutions of our planet. This session aims at understanding the physical and chemical properties of liquids from shallower to deep parts of the Earth, which are strongly related to the long history of the Earth's from the planetary accretion to the present-day dynamics. In addition, we call for presentations by researchers from various backgrounds of geochemical, experimental, theoretical/computational, and seismic/geodynamical ones, who investigate the physical and chemical properties of liquids and the behaviors and roles inside of Earth. Relevant topics include, but are not limited to, partial melting and melt extraction, liquid-solid partitioning, high pressure experiments on melts, and seismic detections of mantle melts and outer core anomaly.

[SIT27-P01]Sound velocity measurements on liquid Fe-P alloy under high pressure

*Daisuke Kinoshita[1], Yoichi Nakajima[1,4], Shotaro Kosugi[1], Yasuhiro Kuwayama[2], Kei Hirose[2], Daisuke Ishikawa[3], Alfred Q.R. Baron[4] (1.Kumamoto Univ., 2.Tokyo Univ., 3.JASRI, 4.RIKEN SPring-8 Center)

Keywords:Erath's outer core, Sound velocity, High pressure

The Earth’s outer core occupying 95 vol.% of the entire core is molten. The outer core is composed mainly of iron, and containing some lighter elements. The nature of the light element is a key to understand the core formation, its chemical and thermal evolutions, and the present dynamics. The core composition can be constrained by comparing the seismological observations and the sound wave velocity of possible Fe alloys under relevant high-pressure and -temperature conditions in the core. Phosphorous is one of the candidates for the light elements in the core because it is found in iron-meteorites and depleted in the silicate mantle relative to chondrites [e.g. 1]. In this study, we determined the P-wave velocity of liquid $Fe_{75}P_{25}$ up to 60 GPa and 2700 K, using laser-heated diamond-anvil cells combining with high-resolution inelastic X-ray scattering (IXS) spectroscopy. IXS measurements were performed at a beamline BL43LXU [2] of the RIKEN SPring-8 Center in Japan. We observed the longitudinal acoustic phonon mode of liquid $Fe_{75}P_{25}$ in a momentum transfer range of 3-5.7 nm^{-1} at each pressure-temperature condition. The P-wave velocity was determined from the dispersion relation. Comparing the present results of $Fe_{75}P_{25}$ and that of pure Fe [3], we found that phosphorous has negligible influence on the sound velocity of liquid Fe. On the other hand, the elastic parameters based on the present study indicate that phosphorous decreases both density and bulk modulus of liquid Fe under the present experimental conditions.

References

[1] McDonough (2003) Treatise on Geochem. vol. 2, 547-568.
[2] Baron (2010) SPring-8 Inf. Newsl. 15, 14-19.
[3] Anderson and Ahrens (1994) J. Geophys. Res. 99, 4273-4284.