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

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

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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-P04]Effect of silicon on initial friction of iron

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The knowledge of crystal structure of Fe alloy in the inner core of the Earth is of great importance for understanding the seismological observations (Vocadlo, 2007). The factors affecting internal friction of iron alloy can be used to explain the attenuation topography in inner core (Jackson et al., 2000; Alboussiere et al, 2010; Monnereau et al., 2010). Silicon is as one of candidate elements in the inner core (Poirier, 1994). However, the influence of silicon on the internal friction of iron in different phases is still unclear. There are several methods to measure the internal friction according different condition (Nowick and Berry, 1972).

In this study, the attenuation factor (Q^{-1}) of Si-bearing (3 wt. % and 5 wt. %) iron and pure iron in body centered cubic (bcc) and face-centered cubic (fcc) phases were determined. To realize the frequency range similar to the seismic waves, we use the deformation-DIA press with a function of short period oscillation, which could produce smooth sinusoidal stress in a wide range of oscillation period from 0.2 to 100 s and generating variable amplitudes (Yoshino et al., 2016). In-situ X-ray radiographic observations was performed at the bending magnet beam line BL04B1 at SPring-8. Q value characterizing attenuation was determined by phase lag of sample strain against the reference material.

The results show that there exists the distinct difference of Q^{-1} between the bcc and fcc phases. The Q^{-1} of Si-bearing iron in fcc phase is larger than that of pure iron in fcc phase, whereas in the bcc stability field, the Q^{-1} of Si-bearing iron is smaller than that of pure iron in bcc phase. The opposite effect of Si on the internal friction between bcc and fcc phases was observed. All the results show that the attenuation of sample in fcc phase is weak frequency dependence at this frequency range: as the increase of period, the attenuation increases, which is consistent with previous study (Jackson et al., 2000). And temperature dependence that the attenuation increases with increase of temperature could be observed in the fcc phase.

The heterogeneous distribution of Si in the inner core of the Earth may produce the attenuation heterogeneity observed at the outermost inner core if the temperature heterogeneity of that is small.