Mercury core size constrained from elastic properties of Fe-Ni-S-Si liquid

Iori Yamada[1], *Hidenori Terasaki[1], Ryo Tsuruoka[1], Asaka Kamiya[1], Tadashi Kondo[1], Yoshinori Tange[2], Yuji Higo[2]

1. Graduate School of Science, Osaka University, 2. JASRI

Surface on Mercury is found to contain 1–4 wt% of sulfur from X-ray spectroscopy of the MESSENGER spacecraft (Nittler et al. 2011). The S content on the surface suggests that certain amounts of S and Si are likely to be contained in the Mercury core based on partitioning of S and Si between metal and silicate melts (Chabot et al. 2014).

In this study, we measured the V_P of liquid Fe–Ni–S–Si up to 17 GPa and investigated the effect of pressure and alloying of S+Si on the V_P to constrain the radius of Mercury core. High pressure experiments were performed using 1500 ton Kawai-type multianvil press at BL04B1 beamline, SPring-8 synchrotron facility. The P-wave velocity was measured using the pulse-echo overlap method.

The V_P of Fe-Ni-S-Si liquids of this study locate in between reported V_P of Fe-Ni-S and Fe-Ni-Si. Thus, there is an offset between S and Si effects on the V_P. Based on the obtained elastic properties of liquid Fe-Ni-S-Si, we estimated the Mercury core radius which satisfies the observed total mass and moment of inertia of Mercury and discuss possible core composition.

Keywords: Mercury, Sound velocity, iron-alloy, Core

