I143-P003 **Room: Poster Session Hall** **Time: May 17**

Equation of state for Fe3C and implication for the terrestrial planetary core

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The Earth's inner core is estimated to be 2-3% less dense than pure iron,implying that the inner core must contain light elements as well as the outer core [1]. The physical properties of the light elements alloy in Fe-Ni metal are one of the key issues to discuss the constituents of the inner core. B.J.Wood proposed that Fe3C might be the major constituent of the inner core [2]. The thermoelastic parameters of Fe3C used by Wood yielded density at the inner core P-T condition, which is in good agreement with that expected from the PREM [3]. After his proposal, two subsequent measurements were conducted by high pressure experiments at room temperature with a diamond anvil cell [4, 5]. Their experimental results were in good agreement with Wood's estimation. However, recent first-principle calculations reported that those elastic properties (used by Wood) are inappropriate to discuss the inner core, since the magnetic state of Fe3C should be different from that observed in room temperature experiments [6, 7]. Their calculations indicate that the magnetic transition in Fe3C affects its elastic properties strongly. Therefore, we performed in-situ observations in order to investigate the effect of magnetic transition on the thermoelastic properties.

In-situ X-ray diffraction experiments were performed in the pressure range of 0-22 GPa and the temperature range of 300-1073 K using a Kawai-type apparatus installed at SPring-8. The P-V-T data set was fitted by using the Birch-Murnaghan and Mie-Grüneisen-Debye equation of state. The fitting result shows that the paramagnetic Fe3C is more incompressible than the ferromagnetic phase, which is consistent with the prediction by first-principle calculations. However, bulk modulus determined by our experiment indicates that the effect of magnetic transition is significantly smaller than estimation by the first-principle calculations. Using our experimental results, Fe3C has enough density at the inner core P-T conditions to account for that expected from the PREM.

[1] H. K.Mao et al., J. Geophys. Res., 1990, 95, 21737-21742
[2] B. J. Wood, Earth Planet. Sci. Lett., 1993, 117, 593-607
[3] A. M. Dziewonski and D. L. Anderson, Phys. Earth Planet. Inter., 1981, 25, 297-356
[4] H. Scott et al., Geophys. Res. Lett., 2001, 28, 1875-1878
[5] J. Li et al., Phys. Chem. Minerals., 2002, 29, 166-169
[6] L. Vocadlo et al., Earth Planet. Sci. Lett., 2002, 203, 567-575
[7] L. Huang et al., Geophys. Res. Lett., 2005, 32, L21314