Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SMP044-P04 Room:Convention Hall Time:May 25 14:00-16:30

Measurement of elastic constants of single-crystal chromian spinel by high frequency resonant ultrasound spectroscopy

Yuya Harada[1], Akira Yoneda[2], Junji Yamamoto[3], Daisuke Yamazaki[2], Takashi Yoshino[2], Takuo Okuchi[2], Tohru Watanabe[1*]

[1]University of Toyama, [2]Okayama University, [3]Kyoto University

Chromian spinel found in mantle xenoliths contains fluid inclusions whose residual pressure (fluid density) can provide us the origin depth of the xenoliths. A host chromian spinel grain should have deformed in response to a change in ambient temperature and pressure during its transport, and changed the fluid density. Elastic and plastic properties of chromian spinel are essential for evaluation of the deformation and precise estimation of the origin depth. Although elastic constants of spinel ($MgAl_2O_4$) and chromite ($FeCr_2O_4$) have been already reported, few studies have been done on chromian spinel. We thus have studied elastic constants of a single-crystal chromian spinel using a resonance method. Chromian spinel crystals were collected from mantle xenoliths from Sveyagin, Russia (Yamamoto et al., 2009, Island Arc). One crystal was selected in terms of the uniformity of crystallographic orientation examined by SEM-EBSD. Each face was polished flat ($<$ 1 micrometer) in an orientation parallel or perpendicular to $\{100\}$ by the X-ray precession method. The selected crystal was shaped into a rectangular parallelepiped (0.412x0.407x0.497 mm^3). The Mg/(Mg+Fe(II)) ratio is 0.75, and the Cr/(Cr+Al) ratio 0.08. The density is 4.3 x 10^3 kg/m^3. The resonant frequency was measured from 3 to 11 MHz using a system specially designed for such a small sample (Yoneda et al., 2007, JJAP). Preliminary analysis has shown that C_{11}, C_{12}, and C_{44} are 263.26, 137.96, and 123.71 (GPa), respectively. Comparison with elastic constants of spinel and chromite will be discussed in terms of the compositional difference.

Keywords: elastic constants, resonance method, chromian spinel