

The 468th Geodynamics Seminar

Effect of pressure on temperature measurements using WRe thermocouple and its impact on geophysics

Dr. Yu Nishihara (Associate Professor, GRC)

Date: 21 Apr. (Fri.) 2017, 16:30 ~

Venue: Meeting Room #486, Science
Research Bldg. 1, Ehime Univ.



Abstract

Recently, we have developed a new method to determine the absolute pressure effect on thermocouple EMF at higher pressures based on a single wire method using Kawai-type multi-anvil apparatus. Based on this method, we have measured pressure effect on the EMF of W3Re-W25Re (type D) thermocouple up to 16 GPa and 900°C. The difference of the nominal temperature from the real temperature was calculated to be -27°C at 16 GPa and 900°C. An extrapolation of the raw results suggests the temperature difference of -70°C at 23 GPa and 1500°C. P-T condition of the post-spinel phase boundary in Mg_2SiO_4 determined using type D thermocouple shifts to higher pressure by 0.5–0.7 GPa when temperature values are corrected. This corresponds to 12–16 km change of depth of the 660 km discontinuity. The temperature correction also has significant influence on the activation volumes for thermally activated processes such as element diffusion and rheology. The real values of activation volume determined at 0–10 GPa and 1500°C is calculated to be $\sim 1.3 \text{ cm}^3/\text{mol}$ higher than nominal values when they are determined by experiments using type D thermocouple and the activation energy is 500 kJ/mol. This means that element diffusion and rheology are getting more sluggish with increase of depth in the Earth's mantle than previously estimated.

Contact : Prof. Nishi (e-mail: nishi@sci.ehime-u.ac.jp)