# The 487th Geodynamics Seminar

# *In situ* optical studies using externally heated lever type diamond anvil cell

**Dr. Nadezda Chertkova (Postdoctoral Reseacher, GRC)**

**Date： 19 Jan. (Fri.) 2017, 16:30 ~**
**Venue： Meeting Room #486, Science Research Bldg. 1, Ehime Univ.**

EHIME UNIVERSITY
GRC
GEODYNAMICS RESEARCH CENTER

## Abstract

Recent advances in high-temperature and high-pressure technology give an opportunity to observe and analyze fluids, melts and minerals in situ, directly at the pressure and temperature conditions of interest. Diamond anvil cell technique, which provides optical and spectroscopic access to the sample through transparent diamond anvils, is widely used for this purpose.

In this work, we designed an external heating system, which is compatible with a lever type diamond anvil cell (Whale cell) and suitable for experiments at simultaneous high temperatures and high pressures. An external metal wire heater was placed in the central part of the diamond anvil cell and provided effective heating of the metal gasket, containing sample, while the temperature of the backside of diamond anvils was kept low enough to avoid their graphitization. Temperatures exceeding 850$^{o}$C at pressures above 6 GPa were achieved with this heating system without any substantial damage to the anvils.

This new externally heated diamond anvil cell was successfully applied for in situ Raman spectroscopy and visual observations of C-O-H samples under upper mantle conditions. It can also be used for in situ infrared spectroscopic measurements. In the studied system, stability of the solid phases was confirmed at high pressures and drastic changes of their spectroscopic features were observed with increasing temperature.

Our future work will aim to further extend experimental pressure and temperature conditions by replacing the single-crystal diamond anvils with nano-polycrystalline diamond anvils. Nano-polycrystalline diamonds show an order of magnitude lower thermal conductivity (Ohfuji et al., 2010), which will reduce the heat transfer from the culet to the table of the diamond anvils and the risk of graphitization at high temperatures. On the other hand, nano-polycrystalline diamonds demonstrated higher resistance to thermal stress at high pressures (Sumiya and Harano, 2012), and their application will ensure constant pressure generation without breakage at the highest experimental conditions.

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