**K105-005** **Room: 101B** **Time: May 18 11:33-11:45**

# Thermal stress estimation on the synthetic felsic rock using X-ray diffraction method

# Kotaro Sekine[1]; Kazuo Hayashi[1]

[1] Inst. Fluid. Sci., Tohoku Univ

Temperature change in an aggregation of different minerals yields formation of thermal stress due to contrasting property of thermal expansion between the minerals. Such thermal stress development is essential for igneous rocks that have passed significant temperature changes in formation and is inferred to be a major source for the natural fractures in igneous rocks. The purpose of the research is to evaluate thermal stress induced by temperature change in an aggregation of minerals for better understanding the nature of rock fracturing in igneous rocks.

In evaluation of thermal stress in rocks, heating experiment on rock specimen is not suitable for understanding thermal stress due to temperature change, because the outcrop specimens have been already thermally and/or tectonically fractured during their cooling process and thermal stress which causes natural fracture during cooling process is not reproducible in the heating experimental manner. Taking the fact stated above into consideration, cooling experiment on synthetic mineral aggregation composed from quartz and potassium feldspar (referred to as the synthetic felsic rock, hereafter) was applied to understand the thermal stress of igneous rock in this research.

Fine powders of quartz and potassium feldspar were prepared from pegmatite and mixtures of those two phases with known ratio were pre-pressed into cylindrical forms. Thermal experiments on the pre-pressed cylindrical specimens were conducted using electric furnace under ambient pressure at given temperature conditions between 1100 to 1500 degC for 2 hours to produce a partially molten rock. Then the specimens were solidified with subsequent cooling to room temperature to make the synthetic felsic rock. Electron microscope observation was conducted to examine the microtexture and the microcracks of the synthetic felsic rocks. X-ray diffraction method was adapted to determine residual stress derived from thermal contraction of the minerals in the synthetic felsic rocks.

The positions of diffraction angle of quartz in the synthetic felsic rocks were likely to shift to slightly lower and the FWHM values were increased compared to those of the untreated powder materials. Those characteristics in diffraction angle and FWHM show no correlation with regard to sample orientation. In addition, X-ray diffraction pattern subsequently acquired with powder sample produced by grinding of the synthetic felsic rocks demonstrates the same peak angles with untreated quartz powder sample and peaks having narrow FWHM value in comparison with those of the synthetic felsic rocks. Thus, inhomogeneous residual stress in regard to magnitude and orientation is inferred to occur due to the cooling process. Based on diffraction angle shifts between the synthetic felsic rock and untreated power sample, the magnitude of the residual stress exhibits 20 to 60 MPa of tensile stress in quartz grain.