Phase Transitions of Albite and Andesine at High Pressure

Yingxin Liu[1], Dan Ju[1], Jingjing Niu[2]

1. China University of Geosciences, Beijing, 100083
2. Peking University, Beijing, 100871

Feldspar is a ubiquitous and important rock-forming mineral, which comprises nearly 60% of the volume of the Earth's crust. Even in subducted oceanic crust, albite is widely distributed in metamorphosed mid-ocean ridge basalt (MORB) i.e., zeolite to garnet granulite facies rocks with a modal abundance ranging between ~18-22% [Hacker, 2003].

In order to understand feldspar's circulation process in the crust, subduction zone, even in the mantle, the structures of Albite ($Na_{1.178}Ca_{0.04}(Mn_{0.003}Al_{0.983}Si_{2.960}O_8)$) and Andesine ($Na_{0.593}K_{0.033}Ca_{0.429}Mg_{0.005}(Fe_{0.016}Mn_{0.003}Ti_{0.005}Al_{1.411}Si_{2.545}O_8)$) have been studied using in-situ high pressure Synchrotron Radiation X-ray diffraction and conventional Raman spectrometer. The lattice parameters, phase transition, P-V equation, lattice vibration and volume modulus of two plagioclases were discussed.

The in situ high-pressure XRD (HPXRD) experiment of Albite was done in 13BMC of Advanced Photon Source. Several phase transitions were observed up to 50.2 GPa, which is around 5.0, 9.6 and 19.0 GPa. The HPXRD experiments of Andesine were carried out up to 11.6 GPa at BL15U of SSRF, with phase transitions around 2.4, 4.5, and 9.2 GPa, which can be deduced from the appearance and disappearance of peaks.

The in-situ HP-Raman Spectra of Albite and Andesine were also studied up to 11.6 and 19.4 GPa, respectively. Raman peaks of Albite (478 cm^{-1} and 506 cm^{-1}), which belong to the flexural vibration of the Si-O-Si and Al-O-Si, merged at about 5.8 GPa. Meanwhile, the 762 cm^{-1} peak (the Al-O stretching vibration) split into two peaks at first, and merged with 816 cm^{-1} at about 8.8 GPa. These processes show there are two phase transitions in Albite. The HP-Raman results of Andesine indicate there are two phase transitions near 4.6 GPa and 9.0 GPa. The first transition is deduced from the merge of 480 cm^{-1} and 507 cm^{-1} peak at about 4.6 GPa, and the second can be seen from the sharp increase of its intensity around 9.0 GPa.

Keywords: Albite, Andesine, High Pressure, Phase Transition, X-ray, Raman