Spectroscopic measurements on dissolution mechanism of quartz in C-O-H fluid under high pressure and temperature.

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C-O-H fluids affect the phase relation and melting of silicate minerals in the Earth’s mantle. The mantle is expected to become progressively reduced with increasing depth, so that H$_2$ fluid is considered to exist in the deep mantle with H$_2$O fluids. Influence of H$_2$O fluids to stability and dissolution of silicate minerals have been reported. SiO$_2$ components dissolved into H$_2$O fluid as SiOH groups under high pressure and temperature. On the other hand, dissolution mechanism of SiO$_2$ components in H$_2$ fluid is still unknown. In this study, stability and dissolution mechanism of quartz in presence of H$_2$ fluid was examined using a laser heated diamond anvil cell. Dissolution of quartz was observed after heating at 1500 K to 1700 K and 1.7 GPa to 3.0 GPa by SEM observation of the recovered sample. In situ Raman and infrared absorption spectra under high pressure and room temperature indicates that SiO$_2$ components dissolved in H$_2$ fluid as Si-H group. The dissolution mechanism in H$_2$ fluid is differ from that was observed in SiO$_2$-H$_2$O system, in which SiO$_2$ components dissolved in H$_2$O fluid to form Si-OH groups.

Keywords: C-O-H fluid, quartz, laser heated diamond anvil cells, Raman, IR