Incorporation of H2O molecules into channel of beryl

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Cordierite and beryl are ringsilicate minerals which are often found in contact metamorphic rock and pegmatite. The crystal structure of cordierite and beryl is characterized by long cavity which is formed by corner sharing hexagonal ring of SiO4 or AlO4 tetrahedra stacked along the c-axis. The long cavities of the hexagonal rings are often called channel of cordierite and beryl, H2O and CO2 molecules are often incorporated into the channel of natural cordierite and beryl. Two kinds of H2O molecules in the channel of cordierite and beryl have been reported by infrared (IR) spectroscopic studies. Type 1 is a H2O molecule of which H-H vector is parallel to the c-axis. Type 2 is H-H vector normal to the c-axis. IR absorption spectra due to H2O molecules in the channel of natural beryl show a sharp peak at 3700cm-1. Cordierite and beryl are stoichiometrically anhydrous minerals, and H2O molecules can be incorporated into the channel sequentially ranging from 0 to 2.9 mol per cent. Thus, cordierite and beryl can be fugacity indicators of water under geological condition, and various hydrothermal equilibrium experiments of cordierite, beryl and water have been done. However, experimental study using single crystal of cordierite and beryl was not done. We confirmed incorporation of H2O molecules into channel of cordierite single crystal by hydrothermal high pressure experiment (Koetsuka, 2002). In this study, incorporation of H2O molecules into the channel of beryl single crystal by hydrothermal experiment with hydrostatic pressure vessel and IR spectroscopic measurements of H2O molecules in beryl are reported. A synthetic beryl by flux method was prepared as staring material. The synthetic beryl was confirmed to be anhydrous by IR absorption spectra which show no absorption peak due to H2O molecules between 3000 cm-1 and 4000cm-1. The synthetic beryl was polished into thin sections and was sealed into gold capsule with a small amount of distilled water. The gold capsule was confined in hydrostatic high pressure vessel and annealed at 873K and 650bar for 72 hours. IR spectra of the recovered sample show a sharp absorption peak at 3700cm-1. The absorption peak is consistent with the peak due to H2O molecules in the channel of natural beryl. Therefore, H2O molecules can be incorporated into the channel of synthetic beryl single crystal by the hydrothermal high pressure experiment.