

## Phase relation in the hydrogen-helium system at high pressure

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Hydrogen and helium are the most abundant elements in the universe and the major components of giant planets. In order to consider the interior of those planets, it is important to determine the phase relation in the hydrogen-helium system at high pressure and high temperature.

The phase relation in this system has been studied up to 12 GPa and 373 K (Van Den Bergh et al., 1987, Loubeyre et al., 1987; 1991). Loubeyre et al. (1987) suggested that a fluid-fluid domain could be closed at high pressure and high temperature. In this study, we have studied the phase relation of the hydrogen-helium system up to 30 GPa at room temperature.

The high pressure experiments were performed using a diamond anvil cell. Pressures were measured with the ruby fluorescence method (Zha et al., 2000). Samples were two gas mixtures of which compositions were H<sub>2</sub>:He=1:1 (51.5 mol%) and H<sub>2</sub>:He=3:1 (25.5 mol%). The optical microscope was used for the phase observation and identification. Raman spectra of H<sub>2</sub> Q1 vibron mode were also measured.

Helium-rich fluid phase (F2) which exsolved from the hydrogen-rich solid phase (S1) has been observed in the S1 grain because of decrease the solubility of helium in S1 with pressure. In the case of H<sub>2</sub>:He=1:1, coexistence of S1 and helium-rich solid phase (S2) has been confirmed up to 30 GPa.

Raman spectra can distinguish S1 which is in equilibrium with hydrogen-rich fluid phase (F1) and F2 from fluid phase by its intensity and FWHM (full width at half-maximum).

Helium concentration of a fluid phase has been estimated by Q1 vibron frequency in the fluid phase and a scale of the helium concentration calibrated by Loubeyre et al. (1991). There was disagreement between this study and Loubeyre et al. (1991). Therefore the helium concentration was recalibrated.

Although there were some differences, the phase diagram of hydrogen-helium system with newly calibrated composition was consistent with Loubeyre et al. (1991). It is necessary for accurate estimation to make further experiments with different compositions.