

High Pressure Studies on Methane-Ethane system and Existence of Van der Waals Compound

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High pressure experiments of methane-ethane system were performed in the pressure range from 0.1 MPa to 20.1 GPa at room temperature by using diamond anvil cell (DAC). Three samples with methane/ethane ratios of 97 mol% / 3 mol%, 75 mol% / 25 mol% and 50mol % / 50mol % were examined. Characterizations were made by *in situ* optical microscopy, powder X-ray diffractometry and Raman spectroscopy.

The optical, X-ray, Raman studies revealed phase transitions in methane-ethane system as follows. After filling the sample into the DAC, the samples of the three composition exhibited homogeneous fluid. With increasing pressure, the homogeneous fluid separated into two fluids. And solid methane, solid ethane and phase X, a van der Waals compound in methane-ethane system last year, appeared depending on initial compositions and pressures. The results should that there was only one VdWC, of which composition is approximately 85methane-15ethane to 75methane-25ethane. The methane-ethane system is composed of two sub-eutectic systems, one is methane-phase X and the other is phaseX-ethane.

The XRD pattern of a pressure-induced solid ethane was indexed as a tetragonal system, with the lattice parameters of $a=5.028(2)$ Å, $c=3.654(3)$ Å at 7.0 GPa. This structure can be related to the temperature-induced solid ethane previously reported.