

Structural transition of Xe + tetra-n-butyl ammonium chloride (TBAC) semi-clathrates as revealed by phase equilibria and X-ray diffraction

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Xe is a noble gas utilized in light-emitting devices and medical industry. A cryogenic process has been used to obtain highly pure Xe, but it requires a very high operating cost. Gas hydrates that can capture small gas molecules at high pressure and low temperature conditions can also be used for separating and storing Xe. However, the operating conditions of high pressure and low temperature need to be altered for their actual application. Tetra-n-butyl ammonium chloride (TBAC) is one of thermodynamic promoters which can shift phase equilibrium curves of gas hydrates to mild regions and also forms semi-clathrate with water. In this study, the phase equilibria of the Xe + TBAC + water systems were experimentally measured at different TBAC concentrations in the wide pressure range (0 -3 MPa). The PXRD patterns of Xe + TBAC semi-clathrates were obtained and analyzed using the FullProf program. The phase equilibrium curves and PXRD patterns clearly demonstrated that the structure of Xe + TBAC semi-clathrates was transformed depending on the temperature and pressure. The experimental results are expected to contribute to gas hydrate or semi-clathrate based Xe capture and storage.