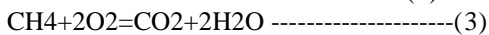
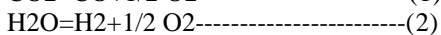
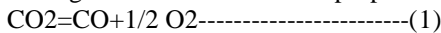


Chemical behavior of CO₂ in the C-H-O-N system

Hiroaki Kaneda[1]

[1] Dept. of Geosystem Eng., School of Eng., Univ. of Tokyo

Physico-chemical investigation of CO₂ fluid in the C-H-O-N system is the most important and effective for improvement of CO₂ preservation technique. CO₂ should be preserved with the duration of geologic time in natural field of surface of the earth. Liquid CO₂ phase is stable within fluid inclusions and frequently is observed under microscopic observation. Liquid CO₂ exists surrounding gas bubble of fluid inclusion. The bulk CO₂ concentration of a fluid inclusion in which liquid phase is stable is approximately more than a several mole %. In addition, the fluid inclusion more than a several mole % in CO₂ concentration contains solid CO₂ phase (CO₂ hydrate) with liquid CO₂ within a fluid inclusion at temperature of 10 degree Celcius below a room temperatures. The following species are examined in the phase relation of C-H-O-N system; CO₂, CO, O₂, H₂O, H₂, CH₄ and N₂. The 7 species are estimated to be in equilibrium at a given temperature and pressure. Here, the following chemical reactions are proposed for the C-H-O system fluid.



Where, equilibrium constants K(1)-K(3) are given at a given temperature and pressure for equations (1)-(3). In addition, the C-H-O-N system fluid gives the following values of total N=constant, total H =constant, total O=constant and total C=constant in equilibrium condition.

$$\text{total N} = N \text{CO}_2 + N \text{CO} + N \text{H}_2\text{O} + N \text{N}_2 + N \text{CH}_4 + N \text{O}_2 + N \text{N}_2$$

$$\text{total H} = 2N \text{H}_2 + 2N \text{H}_2\text{O} + 4N \text{CH}_4$$

$$\text{total O} = N \text{CO} + 2N \text{CO}_2 + N \text{H}_2\text{O}$$

$$\text{total C} = N \text{CO} + N \text{CO}_2 + N \text{CH}_4$$

Where, N CO₂ indicates the concentrations of CO₂ in mole. total N, total H, total O and total C represent total amounts in moles of chemical species, H-bearing species, O-bearing species and C-bearing species, respectively. Here, quantitative values of 7 species such as CO₂, CO, O₂, H₂O, H₂, CH₄ and N₂ are analyzed based on the 7 equations of K(1), K(2), K(3), total N, total H, total O and total C. The proportion of major species in the earth fluids determined to be controlled strongly by oxygen fugacity.