

KINETICS OF HYDROTHERMAL REACTIONS OF MINERALS IN NEAR-CRITICAL AND SUPERCRITICAL WATER

ZHANG RONGHUA AND HU SHUMIN

Open Research Laboratory of Geochemical Kinetics, Chinese Academy of Geological Sciences, Baiwanzhuang Road 26, Beijing 100037, China This work presents new experimental results on the kinetics of mineral dissolution in near-critical and supercritical water in a temperature range (T): from 25 to 400°C and a constant pressure of 23 M Pa. Kinetic experiments were carried out by using a flow reactor (packed bed reactor) of an open system. The dissolution rates of albite, magnetite and pyrite have been measured under these experimental conditions. Na, Al and Si release rates for albite dissolution in water were measured as function of temperature and flow velocity in the reaction system. The maximum release rates of Na, Al and Si of albite dissolution in the hydrothermal flow systems under different flow velocities were always obtained at 300°C. This is said that maximum albite dissolution rates in the flow systems, regardless of different flow rates, were repeatedly at 300°C. Results indicate a wide fluctuation in albite dissolution rates occurring close to critical point of water. The dissolution rates increased from 25 to 300°C and decreased from 300°C to 400°C. Under some flow velocities, the dissolution rates rose as the temperature surpassed 374°C. Albite dissolution was incongruent in water at most temperatures. It was only at 300°C that albite dissolution was congruent. The albite dissolution from 25 to 300°C (at 23 M Pa) will changes from incongruent to congruent. As from sub-critical 300°C to 400°C (at 23M Pa), the dissolution will change from congruent to incongruent. The release ratio of Al/Si (or Na/Si) is positive at T300°C, and it is negative at T300°C. The dissolution rates of magnetite and pyrite in water increased with increasing T until T at critical point of water or around it. The authors believe this is caused by the wide fluctuations in water properties under the conditions from near-critical and to supercritical state.