SOLID-WATER INTERFACIAL PROCESSES

3-0-0-0-5

Review of basic aquatic chemistry; Review of thermodynamics and equilibrium of acid-base reactions, concept of free energy, ideal and non-ideal systems, ionic strength and activity, equilibrium speciation, complexation reactions, oxidation states, redox chemistry and redox scales, chemical kinetics-first order, second order, pseudo-first order; Introduction to Equilibrium Modeling Software: Visual MINTEQ; Dissolution-precipitation; Oxides and hydroxides, Other solids, Competition between solids, Coexistence of solids and phase rule; Modeling kinetics of nucleation-precipitation; Sorption-Desorption; Introduction to adsorption on mineral surfaces and isotherms, Sorption on organic matrices; chemical partitioning to solids distribution coefficient; sorption in natural and engineered systems, Surface complexation: surfaces and reactions; Surface complexation modeling: double-layer, constant capacitance, and triple-layer models. Experimental techniques for solid-phase investigations; Diffraction: Principle of XRD, Bragg's law, Fundamentals of crystal structures- unit cells, lattice planes and Miller indices, important structure types, phase identification, Scherer equation. Microscopy: Principles and applications of SEM, TEM and associated energy dispersive X-ray spectroscopy (EDXS), Spectroscopy: Principles and applications of X-ray Fluorescence (XRF), Vibrational (IR and Raman), Absorption (XANES, EXAFS).