A Model of Mineral Carbonation Kinetics for Carbon Capture, Utilization and Storage (CCUS) Technology

나종걸, 김민준, 박성언, 정재훈, 안진주, 조호용[1], 유윤성[1],
한종훈†
서울대학교; [1]연세대학교
(chhan@snu.ac.kr†)

Intrinsic kinetics of the dissolution of carbon dioxide into the base solution such as calcium hydroxide solution should be obtained for designing the carbonation reactor and process which is the key unit of the carbon capture, utilization and storage (CCUS) technology. In this research, CO_2 chemisorption from flue gas in calcium and sodium hydroxide solution in micro-bubble reactor is modelled. Dynamic changing of particle of calcium hydroxide and flue gas bubble during reaction is calculated with algebraic equations. Reaction kinetics is formulated with differential algebraic equation (DAE) and parameters are estimated by experimental data from 500 ml lab scale carbonation reactor with orthogonal array data set. Temperature, CO_2 molar fraction, $Ca(OH)_2$ wt%, NaOH wt%, bubble diameter, particle diameter, and other important operating condition dependent kinetics is developed. We strongly believe that the kinetics can be applied to designing the reactor and scheduling the semi-batch type carbonation process.