Modeling Bubble-Liquid Mass Transfer between CO_2 and Aqueous Lime Solution in the Stirred Tank Reactor: Effects of Design and Operation Parameters

박성언, 나종걸, 박성호, 안진주, 김민준, 한종훈†
서울대학교
(chhan@snu.ac.kr†)

The present study investigates the system in which carbon dioxide(CO_2) gas bubble reacts with aqueous lime ($Ca(OH)_2$) solution to produce $CaCO_3$ precipitates. When this reaction system applied to Carbon Capture and Utilization (CCU) technology, it can create significant value not only by utilizing exhausted CO_2 gas as a reactant to reduce the carbon emission quantity, but also by wide applications of its product in the field of construction and civil engineering works. To carry out this multiphase reaction, the gas-sparged stirred tank reactor is regarded as a suitable choice in the way that it can maximize the contact area of gas and liquid phase to facilitate the reaction. In order to design the reactor properly, it is very important to develop the accurate mass transport model by first-principle approach. In that respect, the purpose of this work is to rigorously model the mass transfer rate of a single bubble inside the reactor and analyze the influence of main parameters, such as bubble size, pressure and a solution level in the reactor, on the behavior of CO_2 bubbles.