Process modeling of a heat exchangeable multi-stage fluidized bed process for carbon capture

김기웅, 김대욱, 이종엽, 박용기[1], 이득기[2], 이원보, 이광순*
서강대학교; [1]한국화학연구원; [2]광주대학교
(kslee@sogang.ac.kr*)

A heat integrated multi-stage fluidized bed process for carbon capture is proposed and developed from the first principles. The process is divided in 3 cycles deployed in LTC (low temperature cycle), MTC (middle temperature cycle), and HTC (high temperature cycle) to achieve internal heat integration. The endothermic heat of reaction to regenerate the partially carbonated particle in the regenerator of LTC and MTC is supplied from the exothermic heat of reaction generated in MTC and HTC. The K_2CO_3, MgO, and CaO are utilised as the absorbents in LTC, MTC, and HTC, respectively. The shrinking core model, two zone expanding grain model, and spherical grain model are used to describe the heterogeneous reaction between gas and solid phases and the reaction rate parameters are obtained from the relevant literature. The process simulation was conducted using Aspen Custom Modeller to which 60 Nm^3/hr flue gas was subjected. The different reactor configurations of the combination of dense (bubbling fluidized) and dilute (fast fluidized) beds were exploited and reviewed in the aspects of process performances.