Feasibility Study of CO_2 Methanation in a Circulating Fluidized Bed Reactor

Pham Hai Hung, 고강석†, Son Ich Ngo[1], 이도연, 서명원,
임영일[1], 전상구, 류호정, 노남선
Korea Institute of Energy Research;
[1]Hankyong National University

Power to Methane (PtM) is one of promising concepts for the storage of renewable energy sources due to high storage capacity, longer discharging time, and easy distribution with the existing infrastructure and technology. Among the technologies of PtM, catalytic methanation reaction with CO_2 and H_2 was known as kinetically fast reaction accompanying with a high exothermic heat. In this respect, the commercialized adiabatic fixed bed methanation processes consist of several fixed bed reactors in series and numbers of intermediate gas coolers to control to bed temperature below a certain limit for the life of catalysts. Therefore, the concept of methanation using a circulating fluidized bed reactor (CFBR) with a high heat transfer rate is very attractive since it can remove the heat of reaction efficiently inside the reactor. In this study, the feasibility of methanation reaction with the nickel-based catalyst in a CFBR via 1-D mathematical model was investigated. As results, the effect of the superficial gas velocity, solid hold-up, temperature, and pressure on the CO_2 conversion and CH_4 selectivity were found.