

Experimental investigation of exothermic heat during CO₂ methanation and its heat transfer coefficient measurement in a bubbling fluidized bed reactor

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As one of clean fuel technologies, CO₂ methanation is recently paid attention as it captures and converts CO₂ into CH₄ by reacting with H₂ gas. An exothermic heat during CO₂ methanation is an important issue to be solved to achieve the maximum CH₄ production and its operating efficiency. To achieve a stable reaction temperature throughout the fluidized bed reaction chamber, the investigation of exothermic heat generation and heat transfer coefficients was performed during CO₂ methanation. First, the increase in the reactor temperature due to the exothermic heat of CO₂ methanation was understood by varying the conditions of the amount of reactant gas and the ratio of inert material (or height) at a constant temperature, U_{mf}, and pressure conditions. Then the heat transfer coefficients in a fluidized bed reactor were investigated at the temperature (250 – 450 °C), minimum fluidizing velocity (1.3 – 4.0 U_{mf}), and reaction pressure (1 – 5 bar) using nickel based bed material. The current study is expected to be an important material for the development of a fluidized bed reactor that handles the exothermic CO₂ methanation reaction.