

Kinetic Study on Steam Gasification of Thai-Lignite Using a Drop Tube/Fixed Bed Reactor (DT/FBR)

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Abstract

Coal gasification has been considered worldwide as a promising process for energy production. However, there are a few works on the Thai-lignite gasification, especially on direct gasification. To increase a better understanding for a design and practical gasification process of Thai lignite, the kinetics study using a drop tube/fixed bed reactor (DT/FBR) is therefore of interest. The results from the study show that, for the isothermal pyrolysis of Thai lignite at temperature of 750, 800, and 850 °C, the pyrolysis reaction completed over the range of reaction times from 5 s to 30 s, and the char yields decreased when increasing the reaction temperature. In case of steam-N₂ mixing gasification, the char yields were found to continuously decrease with increasing in the reaction time. This is because of the progress of gasification reaction. The char yields were also found to decrease with an increase in reaction temperature due to the fact that the gasification process is an endothermic reaction. By observation, the reactivity of steam-N₂ gasification of Thai lignite consisted of two periods. The early period was strongly affected by the mineral matter, which could be attributed to the zero order reaction as shown in term of rate constant at reaction time = 0 and overall rate constant for the loss of active catalytic species, whereas the latter period was noticed to be well described by the random pore model, which is a function of the conversion and the growing of pore surface areas. In addition, the steam gasification rates obtained from experiments were found to be corresponding to the total gasification rate obtained by calculations.

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