Reactor modelling and simulation of bubble column for slurry phase hydrocracking of vacuum reside.

Pham Hai Hung, 고강석†, 임석현, 노남선,
권은희, 류호정, 임영일[1]
한국에너지기술연구원; [1]한경대
(ksgo78@kier.re.kr†)

Slurry-phase hydrocracking recently has gained great interest in heavy oil upgrading because of the remarkable feed flexibility with high conversions, a simple design and an easy operation with nearly isothermal condition. To design a more efficient reactor with optimum reaction conditions, this study proposed one-dimensional dynamic model for a slurry bubble column reactor (SBCR). An axial dispersion model and a gas holdup correlation derived from cold-bed experiment were used to present the hydrodynamics of SBCR. The kinetic models for hydrocracking and hydrotreating were developed from slurry hydrocracking experiment at a CSTR. The proposed model considered the calculation of Henry constants for the volatile components through a state equation and the variation in superficial gas velocity regarding the Gas–Liquid mass transfer. The model was validated with experimental data from a bench scale unit for a wide range of operating conditions. Finally, a parametric sensitivity study was elaborated to analyze the effects of the superficial gas velocity, temperature, and LHSV.