

Dynamic modeling and simulation of a slurry bubble column reactor (SBCR) for hydrocracking and hydrotreating of vacuum residue.

Pham Hai Hung^{1,2}, 고강석^{3,†}, 임석현³, 노남선³, 류호정³, 권은희³, 김광호³, Pham Anh Dung³

¹University of Science and Technology; ²Korea Institute of Energy Research (KIER); ³한국에너지기술연구원

(ksgo78@kier.re.kr[†])

Slurry-phase hydrocracking recently has gained great interest in heavy oil upgrading field because of the remarkable feed flexibility with high conversions, a simple design and an easy operation with nearly isothermal mode. To design a more efficient reactor with optimum reaction conditions, this study proposes 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 are used to present the hydrodynamics of SBCR. The kinetic models for hydrocracking and hydrotreating are developed from slurry hydrocracking experiment at a CSTR. The hydrocracking kinetic model takes into account of a five-lump model. The hydrotreating kinetic model includes hydro-desulfurization, hydro-demetalization, hydro-deasphaltenization, hydro-demicrocarbonization. In addition, hydrogen consumption kinetic is also included. Results showed that the model can adequately represent the phenomena occurring in the SBCR with a less than 10% error compared to experimental data.