Hydrodenitrogenation Kinetics of Diesel Oil and Catalyst Stacking Simulation

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Abstract

The kinetics of hydrodenitrogenation (HDN) was systematically studied in an isothermally high-throughput reactor over three kinds of catalysts (CoMo, NiMo, NiMoW) to produce clean diesel meeting latest national standard of China. The influences of reaction temperature, reaction pressure, volume ratio of H2 to oil and space time on hydrodenitrogenation were investigated to obtain kinetic parameters. Two-lump kinetic model considering the influence of self-inhibition was selected for the HDN reaction of diesel oil after the comparison with one-lump kinetic model. The model could well predict the evolution of nitrogen-containing compounds concentration along the axial length of reactor. Based on the two-lump kinetic model, the simulation on the HDN activity of various catalyst stacking-schemes is close to the experimental data, which proves the model is applicable for the simulation of catalyst stacking system. And the concentration of nitrogen-containing compounds was predicted for the catalyst gradation model of different loading sequences.

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