The Effect of Diffusion on the Hydrotreatment of n-C16: A Novel Method to Calculate the Weisz-Prater Number

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Abstract

Weisz-Prater number (NW-P) is often applied to assess the internal diffusion effect in heterogeneous catalytic reactions. However, the traditional calculation method with excessive empirical reference values affects the accuracy remarkably. A series of Pt/HPMo/SBA-15 catalysts with the pore size as a single variable were prepared to calculate the NW-P with a developed model combining the diffusion-reaction kinetic method. Utilizing dimensionless variables, internal effectiveness factor (η) and Thiele modulus (Φ .n), and the apparent activities over catalysts with different diffusion capacity, NW-P is obtained with improved accuracy. For the diffusion effect on the hydrotreatment of n-C16, according to the more precise NW-P, the pore size should be not less than 10 nm to avoid the step-limitation of internal diffusion in the premise of adequate acid sites. Using the novel method, a conclusion is drawn that the formation of m-i-C16 is more susceptible to internal diffusion than the consumption of n-C16.

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