Catalysis in Industry 2010 vol.2 N4, pages 393-401

Selection of the optimum composition of an alumina support of Pd/Al 2O3 catalysts for pyrolysis gasoline hydrogenation

Lamberov A., Il'Yasov I., Khalilov I., Bikmurzin A., Shatilov V., Nazmieva I., Laskin A.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

To optimize the chemical composition of catalysts for the selective hydrogenation of diene and vinyl aromatic hydrocarbons in pyrolysis gasoline, we study the effect of the acid-base and textural characteristics of a support modified with additives of sodium compounds on the activity and stability of the catalysts in reactions of hydrogenation and oligomerization of unsaturated compounds. It is shown that the rate of formation of oligomeric compounds depends on the number of Lewis (Q CO > 34 kJ/mol) and Brönsted sites (νOH = 3688 cm-1). An increase in their total amount on the catalyst surface leads to an increase in the rate of formation of oligomeric hydrocarbons. The amount of surface condensation products is determined by the concentration of strong aprotic sites with Q CO > 35 kJ/mol. Alumina support samples with a high surface concentration of medium-strong Lewis sites, wedge-shaped or conical pores, and the preferential distribution of porometric volume in pores with a diameter of 5-15 nm are characterized by a significant ability to oligomerize unsaturated compounds. Catalysts that contain 0.5 wt % Na exhibit the lowest oligomerization ability and a high stabile activity in reactions of hydrogenation of diene and vinyl aromatic hydrocarbons in pyrolysis gasoline. For the selective hydrogenation of diene and vinyl aromatic hydrocarbons in pyrolysis gasoline, we recommend a catalyst with 0.5 wt % Pd supported from palladium acetylacetonate on δ-Al2O3 modified with 0.5 wt % sodium; it is characterized by the absence of wedge-shaped or conical pores, the preferential (60.7%) distribution of porometric volume in a range of d p > 15 nm, and a low aprotic acidity (L = 3.1 μmol/g), which contributes to the decrease in the amount of resulting condensation products (V = 3.6 μg/(gcat h)) and a high stable activity (DN = 0.68 g J2/100 g) in reactions of hydrogenation of unsaturated compounds. © 2010 Pleiades Publishing, Ltd.

http://dx.doi.org/10.1134/S207005041004015X

Keywords

alumina palladium catalysts, hydrogenation, pyrolysis gasoline