

Hydrogenation of polyaromatic hydrocarbons in diesel fractions on Pt-Pd supported catalysts

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Ecological situation in the world dictates the necessity of non-polluting and high-quality fuel. Due to the strict environmental regulations and according to EC specifications the content of polycyclic aromatic hydrocarbons in fuels should not exceed 35%. The best way for aromaticity abatement is the process of hydrogenation. Hydrogenation of polyaromatics (present in diesel fuels by phenanthrene, naphthalene, tetralin) increases cetane number as well as ring-opening process. Supported noble metals are highly active catalysts for hydrogenation processes but they have low stability against sulfur-containing compounds in fuels (especially produced from oils of Kazakhstan). In this aspect it is very important to develop highly effective and stable catalysts on the basis of platinum metals.

The used catalysts on the basis of Pd and Pt were prepared by impregnation of support with aqueous solutions of different salts. Alumina, silica and Y zeolites were used as supports. For the catalysts characterization XRD, TEM, BET, TPD methods were used. Hydrogenation reaction has been studied at temperatures 220-320°C and hydrogen pressure 0.5-6.0 MPa.

Naphthalene was investigated for hydrogenation as model compound and diesel fuel as mixture of polyaromatics. The products of hydrogenation of naphthalene are the products of hydrogenation - tetralin and decalin and products of destruction - ring-opening process - alkylaromatics and alkylcycloalkanes. The effect of support, hydrogen pressure, temperature on conversion of aromatics, yields of products, activity, selectivity and stability of used catalysts has been studied. It must be noted that on zeolite supports the yield of products of hydrocracking processes much more than on oxide supports. So for ring-opening process mixed supports (oxide+zeolite) were used.

On the best catalyst Pt-Pd/Al₂O₃+Y we carried out the process of hydrodearomatization of two diesel fractions 180-350°C and 230-360°C taken from Shymkent refinery (ShNOC) with initial content of aromatics 50-55%. After reaction the content of aromatic compounds became 25-28%. Characteristics of these diesel fractions such as density, viscosity, cloud and solidification temperatures became better.

Table 1. Hydrogenation of diesel fractions on Pt-Pd/Al₂O₃+Y

Diesel fraction		Density, kg/m ³	Cloud temperature °C	Solidification temperature °C	Viscosity, mm ² /s	Aromatics content, %
180-310°C	before	833	-19	-22	3.15	50-55
	after	830	-21	-25	3.00	25
230-360°C	before	875	-28	-32	3.56	50-55
	after	864	-32	-35	3.41	28