ONLINE ISSN : 1349-273X
PRINT ISSN : 1346-8804

Journal of the Japan Petroleum Institute
Vol. 46 (2003) , No. 5 pp.315-321

[PDF (358K)] [References]

Sulfur-tolerance of Al_2O_3- and TiO_2-supported Bimetallic Pt-Pd Catalysts for Naphthalene Hydrogenation

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(Received: February 27, 2003)

Naphthalene hydrogenation was carried out over TiO_2- and Al_2O_3-supported bimetallic Pt-Pd catalysts at 0.95-2.45 MPa and 473 K with and without addition of dimethyldisulfide. The bimetallic catalysts were characterized by infrared spectroscopy of the adsorbed CO. Compared with the Pt-supported catalysts, the Pd-supported catalysts had higher catalytic activity in the presence of sulfur. Pd catalysts had a higher sulfur-tolerance, because the catalytic activity of the Pt catalysts was higher than that of the Pd catalysts in the absence of sulfur. Coexistence of Pd with Pt induced significant synergy in the catalytic properties in the presence of sulfur. However, such synergy was not observed in the absence of sulfur. The optimum Pd/(Pt + Pd) molar ratio for the Al_2O_3- and TiO_2-supported catalysts was 0.8 and 0.5, respectively. The difference was an effect of metal particle size. Infrared spectroscopy of the adsorbed CO on the bimetallic catalysts showed the formation of Pt-Pd bimetallic particles. However, no electronic interaction between Pt and Pd was observed. Therefore, the synergy was due to the geometric effect.

Keywords: Naphthalene hydrogenation, Bimetallic catalyst, Platinum-palladium catalyst, Titanium oxide support, Aluminum oxide support, Sulfur tolerance

To cite this article:

Koki ITO, Kaori SATOH, Tadahiro TOMINO, Masao MIYAKE, Masa-aki OHSHIMA, Hideki KUROKAWA, Kazuo SUGIYAMA and Hiroshi MIURA, *Journal of the Japan Petroleum Institute*, Vol. **46**, No. 5, p.315 (2003) .

doi:10.1627/jpi.46.315

JOI JST.JSTAGE/jpi/46.315