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MESOPOROUS SILICA-ALUMINA MODIFIED BY ACID EXTRACTION
AS SUPPORT OF Pd AND Pd-Pt CATALYSTS IN HDS
OF MODEL COMPOUNDS

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Mesoporous silica-aluminas (MSA) are often studied as supports of catalysis for hydrodesulfurization (HDS) because of large surface areas, suitable porosity and acidity. Recently, we synthesized a MSA containing 50 % alumina by co-gelation [1]. This carrier has further been modified by extraction of the alumina phase by HNO_3 in order to increase its acidity. Pt catalysts prepared from such modified support showed substantially higher HDS activity [2]. Similar positive effect was also observed in the case of Pd catalysts [3]. The effect of acid extraction on the properties of MSA support and on activity of Pd and Pd-Pt catalysts is subject of this work.

A new batch of MSA contained 52 % alumina (MSA52). Part of MSA was extracted by 1 N HNO_3 at 75°C/2 h and calcined at 400°C. The product contained 9 % alumina (MSA9). Both supports were characterized by N_2 adsorption, Hg porosimetry, ^{27}Al MAS NMR and by tests in cyclohexene isomerization and cumene cracking. The catalysts were prepared by impregnation of supports with $\text{Pd}(\text{CH}_3\text{COO})_2$, $\text{Pd}(\text{NH}_3)_4\text{Cl}_2$ and $\text{Pt}(\text{NH}_3)_4(\text{OH})_2$. The bimetallic Pd-Pt catalyst was prepared by co-impregnation. Catalysts were reduced by H_2 at 400°C. A CoMo/alumina catalyst was sulfided with 10 % H_2S in H_2 at 400°C. The activities of catalysts were tested in HDS of thiophene and benzothiophene.

Extraction of MSA52 diminished the alumina content to 9 % and increased the BET area and isomerization and cracking activities. This was ascribed to partial removal of the non-acidic Al_{ox} species and unblocking of the strong acidic sites of silica-alumina, associated with the Al_{br} species. Higher acidity and surface area of the MSA9 improved the activities of Pd catalysts in HDS of thiophene and benzothiophene. The bimetallic Pd-Pt catalyst prepared from MSA9 showed highest HDS activity.

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References:

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