**Effect of Promotion Metals on Activity of Zirconia Supported Molybdenum Sulfide Catalyst in Parallel Hydrodesulfurization of 1-Benzotiophene and Hydrogenation of 1-Methyl-Cyklohex-1-ene.**

Kaluža, Luděk
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# EFFECT OF PROMOTION METALS ON ACTIVITY OF ZIRCONIA SUPPORTED MOLYBDENUM SULFIDE CATALYST IN PARALLEL HYDRODESULFURIZATION OF 1-BENZOTHIOPHENE AND HYDROGENATION OF 1-METHYL-CYCLOHEX-1-ENE

**Luděk Kaluža and Daniela Gulková**

*Institute of Chemical Process Fundamentals of CAS, v. v. i.; Rozvojová 135; 165 02 Prague 6–Suchdol; Czech Republic*

Promotion of hydrodesulfurization and hydrogenation activity of $MoS_2$ supported on unconventional support $ZrO_2$ (baddeleyite, $S_{BET}$ = 108 $m^2g^{-1}$) by Co, Ni, Ru, Rh, Pd, Ir, and Pt was studied. The model reactions were hydrodesulfurization of 1-benzothiophene (HDS) and in selected cases also parallel hydrodesulfurization of 1-benzothiophene and hydrogenation of 1-methyl-cyclohex-1-ene (HYDO) [1]. Methods of deposition of Mo and the promoters were compared using aqueous and toluene impregnation methods. Despite the fact that the transition metal governed the ranking of the HDS activity (CoMo ≈ NiMo > PtMo ≈ RhMo > PdMo > IrMo > RuMo), the preferred way of preparation was found to be the deposition of the promoter form the solution of the metal acetylacetonate in toluene onto sulfided Mo species previously deposited onto the $ZrO_2$ from aqueous solution of ammonium heptamolybdate. The catalysts prepared by this preferred way were compared in 1-methyl-cyclohex-1ene hydrogenation (HYDO) that proceeded together with 1-benzothiophene HDS. It was found that HYDO reaction decreased the catalysts activity in HDS reaction by the factor 0.64-0.85 but did not change the HDS activity ranking. The $ZrO_2$ support eased up the temperature-programmed reduction (TPR) of sulfide Co(Ni)Mo phase but led to practically the same amount of chemisorbed $O_2$ as it was observed for the reference industrial $Al_2O_3$-supported counterparts. The Mo/$ZrO_2$ promoted with Ru, Rh, Pd, Ir, and Pt did not consumed so pronounced amount of $H_2$ during TPR in the region 100-280 °C as it is typical for Co(Ni)Mo phase. The promotional effect of the novel metal on HDS activity was lower than it is typical for Co and Ni. The activities in HYDO over all $ZrO_2$-supported catalysts were desirably low and about the same as those over the reference $Al_2O_3$-suppored catalysts. The weight normalized HDS activities of Co(Ni)Mo/$ZrO_2$ catalysts remained lower than that of the high surface area ($S_{BET}$ 325 (253) $m^2g^{-1}$) reference $Al_2O_3$-supported ($S_{BET}$ 325 (253) $m^2g^{-1}$) counterparts.

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**Reference:**

[1] Kaluža, L.; Gulková, D. Reac. Kinet. Mech. Cat. **2016**, 118, 313-324.