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NIOBIA SUPPORTED MOLYBDENUM SULFIDE HYDRODESULFURIZATION CATALYSTS PREPARED USING NITRILOTRIACETIC ACID

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The effect of addition of chelating agent nitrilotriacetic acid, NTA, to the impregnation solution of ammonium heptamolybdate, AHM, for preparation of Mo/Nb_2O_5 hydrodesulfurization, HDS, catalysts was studied. The Nb_2O_5 support was obtained by calcination of commercial $Nb_2O_5.xH_2O$ at 400 °C and its surface area, S_{BET}, was 93 m^2 g^{-1}. In contrast to previous papers dealing with NTA $Co(Ni)Mo/Al_2O_3$ HDS catalysts (references are given in [1]), NH_4OH was not used in the preparation of AHM-NTA impregnation solution in the present paper. The natural pH of this solution was about 2. The catalysts were tested in HDS of thiophene at total pressure 1 MPa. The NTA Mo/Nb_2O_5 samples were not calcined before sulfidation. The dependence of weight activity on MoO_3 loading was compared for Mo/Nb_2O_5, NTA Mo/Nb_2O_5 and conventional Mo/Al_2O_3 catalysts. The activity of Mo/Nb_2O_5 samples was low, irrespectively of loading. The activity of Mo/Al_2O_3 catalysts increased up to the monolayer loading of about 22 wt.% MoO_3 (S_{BET} of Al_2O_3 was 262 m^2 g^{-1}) and was much higher than that of Mo/Nb_2O_5 samples. However, the use of NTA improved HDS activity of Mo/Nb_2O_5 catalysts; the effect increased with MoO_3 loading and it was one order of magnitude at high loadings of 20-25 wt.% MoO_3. Surface area of sulfided NTA Mo/Nb_2O_5 catalysts was only 35-40 m^2 g^{-1}, while that of conventional Mo/Al_2O_3 was about 210 m^2 g^{-1}. However, surface area activity per 1 m^2 of NTA Mo/Nb_2O_5 samples was much higher than that of conventional Mo/Al_2O_3 catalysts. At the loading of 22 wt.% MoO_3, the ratio of these activities was 5.1, which is higher than that achieved in previous papers in the literature. In spite of low surface area of sulfided NTA Mo/Nb_2O_5 catalysts, their weight activity per 1 g was higher than that of conventional Mo/Al_2O_5 samples in the broad loading range of 10-25 wt.% MoO_3. Mo/Nb_2O_5 catalysts with such high relative weight normalized activity were not reported in the literature up to now. The high activity was not achieved by increasing the extensive factor i.e. surface area of Nb_2O_5 support. S_{BET} of the starting Nb_2O_5 was not radically higher than it was reported in previous papers in the literature. Unprecedentedly high weight normalized activity of Mo/Nb_2O_5 catalysts was achieved by addition of NTA to the impregnation solution without use of NH_4OH to dissolve it.

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Reference:

[1] Kaluža, L.; Zdražil, M. Current Topics in Catalysis **2014**, 11, 65-74.