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Effects of Co Addition on the Surface Structure and the Activity of Mo/Al_2O_3 Catalyst for the Hydrogenation of Olefins

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The present study investigated the effects of Co addition on the surface structure and activity of Mo/Al_2O_3 for the hydrogenation of C_6-C_{10} olefins. $CoMo/Al_2O_3$ (Co/Mo atomic ratio: 0.56) had lower activity for the hydrogenation of 1-hexene, 1-octene and 1-decene than Mo/Al_2O_3, whereas $CoMo/Al_2O_3$ had higher activity for the hydrogenation of 2-octene, 2,4,4-trimethyl-2-pentene and cyclohexene. Co/Al_2O_3 showed no activity for the hydrogenation of 1-octene and 2,4,4-trimethyl-2-pentene. NO uptake measurements over Mo/Al_2O_3 suggested that the coordinatively unsaturated sites of Mo atoms located at the edges of MoS_2 clusters were active for the hydrogenation of both 1-octene and 2,4,4-trimethyl-2-pentene. Diffuse reflectance FTIR measurements of NO adsorbed on $CoMo/Al_2O_3$ (Co/Mo atomic ratio: 0.56) indicated that Co atoms blocked Mo atoms located at the edges of MoS_2 clusters almost completely, *i.e.* formation of the Co-Mo-S structure. Therefore, formation of the Co-Mo-S structure depressed the activity for hydrogenation of 1-octene. The addition of Co promoter also increased the stacking number of MoS_2 clusters. Presumably the increase in the stacking number of MoS_2 clusters facilitated the adsorption of bulky olefins and promoted the hydrogenation. This may be the main reason for the promoting effect of Co for the hydrogenation of 2,4,4-trimethyl-2-pentene.

Keywords: Olefin hydrogenation, Steric hindrance, Cobalt molybdenum catalyst, Catalytic cracked gasoline, Surface structure

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