

Characterization of nickel sulfate supported on SiO₂ for ethylene dimerization and promoting effect of Al₂O₃ on catalytic activity

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A series of catalysts, NiSO₄/SiO₂, for ethylene dimerization were prepared by the impregnation method using aqueous solution of nickel sulfate. Although SiO₂ without NiSO₄ was inactive as catalyst for ethylene dimerization, the SiO₂ with NiSO₄ exhibited catalytic activity even at room temperature. The catalytic activities were correlated with the acidity of catalysts measured by the ammonia chemisorption method. The addition of Al₂O₃ enhanced the acidity, thermal property, and catalytic activities of catalysts, due to the interaction between Al₂O₃ and SiO₂ and due to consequent formation of Al-O-Si bond. The high catalytic activity of NiSO₄/SiO₂-Al₂O₃ was closely correlated with the increase of acidity and acid strength due to the addition of Al₂O₃ and NiSO₄. The sample having 15-20 wt% of NiSO₄ and calcined at 400-500 °C for 1.5 h exhibited maxima for catalytic activity and acidity. In view of IR results of CO adsorbed on NiSO₄/SiO₂-Al₂O₃, it is concluded that the active sites responsible for ethylene dimerization consist of a low-valent nickel, Ni⁺, and an acid.