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**ICEEM/02 – ENVIRONMENTAL ENGINEERING
SECTION**

“Treatment Technologies for Gaseous Fluxes”

**SURFACE CHEMISTRY STUDIES ON MOLYBDENA–
ALUMINA CATALYST**

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Abstract

Molybdena-alumina (Mo/Al₂O₃) catalysts are widely used in the chemical and petrochemical industry because of their great importance in hydrogenation and hydrodesulfuration processes. Hydrogenation of heavy distillates can convert aromatics (benzene) into naphthenes (cyclohexane), which are cleaner-burning compounds and have less hazardous impact. Mildly reduced molybdena-alumina catalyst at 773 up to 973 K is suitable only for hydrogen-deuterium exchange of benzene, but for higher extent of catalyst reduction (at 1073-1173K) deuteration (hydrogenation) products of benzene can be observed. This research has been focused on the monitoring the surface active sites of Mo/Al₂O₃ catalyst after pretreatment in hydrogen at 773 and 1173 K by Fourier Transform Infrared (FTIR) spectroscopic method. Presence of Al³⁺_{tet} (IR band at 2234 cm⁻¹), Mo⁵⁺ (2205cm⁻¹), Mo²⁺ (2050cm⁻¹), possibly Mo⁴⁺, Mo³⁺ together with Al³⁺_{oct} (broad peak at 2191cm⁻¹) and Al-OH (2150cm⁻¹) species was confirmed by low temperature (78K) adsorption of CO molecules after reduction of catalyst at 773K. Increasing the reduction temperature from 773 to 1173K diminishes Mo⁵⁺ and increases the population of Mo²⁺, Mo⁰ (2025 and 1991cm⁻¹) species. The disappearance of the band corresponding to physically adsorbed CO (at 2150 cm⁻¹) for the catalyst reduced at higher temperature supports the idea of occurrence of the dehydroxylation process. FTIR results are in agreement with the catalytic test, where the activity of catalyst for deuterium exchange of benzene decreases with increase extent of reduction of molybdena-alumina catalyst and with the extent of dehydroxylation of the catalyst.

Keywords: molybdena-alumina catalyst, hydrotreating, FTIR CO adsorption

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