J Adv Chem Eng 2018, Volume: 08
DOI: 10.4172/2090-4568-C1-006

5th World Congress on
Chemical Engineering and Catalysis
August 28-29, 2018 | Paris, France

Investigation on the interaction and adsorption mechanism of HDS catalyst metals (Mo and Ni) on alumina and modified alumina supports

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In the present work, Studies on the kinetics of adsorption of molybdenum and nickel, which are used as active metals in hydrotreating catalysts, were completed using four different supports (i.e., γ - Al2O3 , SiO2 - Al2O3, TiO2 – Al2O3, and ZrO2 – Al2O3). The effects of pH and temperature of the impregnation solution on the extent of adsorption of these metals on different supports were studied. Adsorption isotherm measurements for Mo and Ni were also made using different supports. A theoretical model to simulate the adsorption isotherm of Mo was developed. Good agreement between the experimental and predicted values for Mo adsorption was observed for all four supports (γ- Al2O3, SiO2 – Al2O3, TiO2 – Al2O3 and ZrO2 - Al2O3) used in the studies. The important results and conclusions are as follows: The pH of the impregnation solutions used for loading the active metals (Mo and Ni) on the support surface by adsorption had a remarkable effect on the uptake of the metals; Adsorption occurred by electrostatic interaction between the OH groups on the support surface and the molybdate or Ni ions in the solution; The extent of Mo adsorption on different supports decreased in the following order at a given pH (5.1): γ – Al2O3 > ZrO2 – Al2O3 > TiO2 – Al2O3 > SiO2 – Al2O3; The amount of nickel adsorption was highest for SiO2 – Al2O3 and lowest for γ – Al2O3.

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