

Adsorptive desulfurization of diesel fuel using Ni-exchanged ZSM-5

N. Dif¹, F. Benaliouche¹, B. Boukoftane¹, and Y. Boukoberine¹

¹Ecole Militaire Polytechnique, BP17 - 16046 Bordj El-Bahri, Algiers, Algeria.
dif.nabi@gmail.com

Abstract. ZMS-5 zeolite was loaded with nickel using two different methods, solid and liquid state ion exchange. X-ray fluorescence (XRF) and atomic absorption spectrometry (SAA) measurements revealed that the Ni loading levels depended strongly on the modification technique. The X-ray diffraction (XRD) and N₂ sorption characterizations indicated good conservation of the initial structure and texture of zeolite after modification. The total pore volume and specific surface area decreased with the increasing of nickel amount. Adsorptive desulfurization tests under mild conditions was conducted in batch experiments using a model diesel fuel containing thiophenic form of sulfur compounds and a real diesel fuel with a total sulfur content of 231 ppmw and 600 ppmw, respectively. The total sulfur in the sample was determined before and after desulfurization tests using XRF. The results showed that thiophene removal from model fuel is highly dependent on the amount of Ni. The adsorption capacities were 2.50 and 1.08 mg/g for Ni-ZSM-5-S and Ni-ZSM-5-L. While, the sulfur adsorption capacities of real diesel fuel increased to 3.02 and 2.66 mg/g respectively. The use of thermogravimetry–differential thermogravimetry (TG-DTG) to study thiophene retention indicates clearly that very strong chemically interactions exist between the adsorbate and adsorbent.

Keywords: Desulfurization, adsorption, ZSM-5 type zeolite, thiophene.