Identification of Proximal and Isolated Aluminum Heteroatoms in Zeolites by Infrared Spectroscopy

Melanie A. Brunet-Torres, Philip Kester, and Rajamani Gounder
Department of Chemical Engineering, University of Puerto Rico-Mayagüez
Charles D. Davidson School of Chemical Engineering, Purdue University

ABSTRACT

High demand for energy production and limited fossil fuel reserves are two factors that motivate intense research for new alternative energy resources. While we are still far from completely moving to renewable energy solutions, a new solution that replaces crude oil and coal with shale gas is currently under investigation. For this modern technology, new zeolite catalysts need to be developed for the conversion of light hydrocarbons gases to liquid transportation fuels. These catalysts are of special interest in the production of liquid fuels since they exhibit high reaction rates, molecular sieving properties and selectivity behavior. In this work, the effect of sequential ion exchange on the K⁺/Al ratio of ZSM-5, CHA and FER zeolites was investigated. This was done using a 0.5M KNO₃ solution to exchange NH₄ ions with K⁺ ions on the zeolite framework. CHA zeolites used in this work were synthesized and characterized using X-ray diffraction. On the other hand, atomic adsorption spectroscopy was used to determine the K⁺/Al ratio on ZSM-5, FER and CHA zeolites. Our results show that the potassium uptake on the zeolite does not change significantly with sequential ion exchange.

KEYWORDS

Heterogeneous Catalysis, Zeolites, Infrared Spectroscopy, Oligomerization