STUDIES ON M-ZEOLITES (M=Fe, Cu) AND SOME OF THEIR CATALYTIC CONVERSION REACTIONS

PhD (DISSERTATION)

MAY NWE WIN

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF YANGON
MYANMAR

MAY, 2005

ABSTRACT

Synthetic zeolites, MFI type ZSM-5 have been prepared and characterized to be used as catalytic converters. The zeolites were prepared from indigenous raw materials such as clay, pumice and commercially available chemicals by using hydrothermal conditions at an ambient pressure and at the temperature of 160°C. The actual percent yield of zeolite from clay (Kyaukpadaung) was 72.02%, from pumice (Mt. Poppa) was 70.07% and from the commercial BDH chemicals was 74.36%. The mole ratio of silica (SiO_2) to alumina (Al_2O_3) in these zeolites as determined by the conventional method was 11.57 pertaining to clay, 13.42 as regard to pumice and 14.65 as relevant to commercial BDH chemicals respectively. The experimental mole ratios of SiO_2:Al_2O_3 were all found to be above 10:1. This mole ratio conformed the predicted mole ratio pertaining the catalytic conversion properties rather than sorption properties as cited in the literature else where. The synthetic zeolites in the protonic forms (H-zeolites) were characterized by XRD, FT-IR, TG-DTA and SEM techniques. In addition, supported M- zeolites (M=Fe and Cu) were also prepared by solid state ion exchange method and characterized by appropriate modern instrumental techniques including ESR spectroscopy. It was observed that the metals were dispersed as well as impregnated in the zeolite structures. The supported metal zeolites: namely; BDH derived zeolite ZSM-5 (BUZ), clay derived zeolite ZSM-5 (CUZ), pumice derived zeolite ZSM-5 (PUZ), iron supported zeolite ZSM-5 from BDH chemical (Fe-BUZ), iron supported zeolite ZSM-5 from clay mineral (Fe-CUZ), iron supported zeolite ZSM-5 from pumice mineral (Fe-PUZ), copper supported ZSM-5 from BDH chemical (Cu-BUZ), copper supported ZSM-5 from clay mineral (Cu-CUZ) and copper supported ZSM-5 from pumice mineral (Cu-PUZ), were synthesized and employed as catalytic converters in the programmed

studies of two different catalytic reactions such as selective catalytic reduction reaction (SCR) of NOx molecules and ethanol to gasoline (ETG) conversion reaction. It was found that in SCR reaction using NOx molecules as a model gas mixture, 90-95% of NOx gas mixture was reduced. In the ETG process, approximately 50% of ethanol was converted to other aliphatic and aromatic hydrocarbons (branched and straight chains). The products of ethanol to gasoline process (ETG) identified by GC-MS clearly indicated that the gasoline like products were formed.

Keywords: M-zeolites, Catalytic conversion reaction, SCR reaction, ETG process