

CHAPTER II

LITERATURE REVIEWS

Beta zeolite was first synthesis by Wadlinger et al. [8] in 1967. The $\text{SiO}_2/\text{Al}_2\text{O}_3$ molar ratio of the synthesised frame work in the range 10-200.

Joaquir Perez-Pariente et al. [16] studied the efficiency of the synthesis of Beta zeolite and the chemical composition of crystals. It was very difficult to effectively synthesize siliceous crystal of Beta zeolite. From aluminum-rich gels ($\text{SiO}_2/\text{Al}_2\text{O}_3 = 30$), high yield of Beta zeolite could easily be obtained, whereas from siliceous gels ($\text{SiO}_2/\text{Al}_2\text{O}_3 = 900$), Beta zeolite was found in small amount. And the crystals were enriched in aluminium. This synthesis insufficiency was due to the inefficiency use of silicon, the mother liquor always being exhausted in aluminium at the end of the crystalization. The incorporation of silicon in Beta zeolite could be improved by several means. When ethanol was kept in the system, when aluminium was excluded from the gel particles, or when the synthesis temperature was increased from 373 to 393 K, reasonable yields of siliceous Beta zeolite crystals were obtained.

L. Bonetto et al. [17] studied Beta zeolite as catalysts for gas-oil cracking. The optimized Beta zeolite produced more liquified petroleum gas alkenes and a relatively high i-butane yield that are useful for methyl test butyl ether and alkylation gasoline production. Beta zeolite synthesized within a narrow crystal size distribution around 0.40 μm . shown an optimum behavior from the point of view of gas-oil cracking activity and selectivity. The feasibility of synthesising pure zeolite bata in high yields using silica gel as the source of SiO_2 was studied by Ramawath N. Bhat and Rajiv

Kumar [18]. It had been shown that pure phase zeolite crystals could be obtained using silica gels of high surface area. Optimum values for OH^-/SiO_2 and Na^+/SiO_2 molar ratios are required for efficient crystallization of Beta zeolite.

M.A. Cambor and J.Perez-Pariente [19] studied the effect of Na and K ions in crystallization of Beta zeolite. The crystallization rate and crystal size of Beta zeolite made from K and Na containing gels had been shown to be dependent on the total alkali content and the molar fraction of each cation. The crystal size of final product increased with the K content of the gel. The surface of the crystal was shown to be enriched in Aluminum because of the increasing of pH during crystallization.

Elodie Bourgeat-Lami et al. [20] studied the state of aluminium in Beta zeolite. Exchange of the protons by ammonium by reaction of the zeolite with aqueous salt solution at 80°C retransformed 6-coordinated aluminium into 4-coordinated aluminium and removed some aluminium from the solid. It was proposed that the introduction of protons in the lattice of Beta zeolite severely disturbed the coordination of some framework aluminium atoms. In the presence of water the distorted sites might feature an octahedral symmetry or undergo hydrolysis of the Al-O bonds. Partially hydrolysed aluminium sites would account for the various hydroxylated species evidenced by infra-red and for the NMR invisible aluminium.

Keyi Tao et al. [21] studied the hydration of propene to isopropanol over Beta zeolite. Beta zeolite showed high reactivity and intensity in the hydration of propene. Under gentle reaction condition (total pressure = 2.0 MPa, reaction temperature =

173°C, water : propene mole ratio =0.7), the yield of IPA was from 9% to 10%. For Beta zeolite, the hydration activity was related to its acidity. The active center is the weak Bronsted acid center. High-temperature steaming and strong acid-exchange were harmful to the activity of catalyst in the hydration of propene, while high pressure was beneficial to it.

Li-Jen Leu et al, [22] studied the synthesis of Beta zeolite and catalytic isomerization of hexane over Pt/H-beta catalysts. The best synthesis conditions found were : $\text{SiO}_2/\text{Al}_2\text{O}_3 = 26-70$, $\text{H}_2\text{O}/\text{Al}_2\text{O}_3 < 800$, $(\text{TEA})_2\text{O}/\text{Al}_2\text{O}_3 > 2.0$, crystallization temperature 403-443 K, and crystallization time 50-270 h. The activation energies of crystallization and nucleation were calculated to be $E_C = 15.2$ kcal/mol and $E_n = 7.0$ kcal/mol.

E. Blomsma, J.A. Martens and P.A. Jacobs studied the reaction mechanisms of heptane isomerization and cracking on bifunctional Pt/H-Beta zeolites. The conversion of heptane in presence of hydrogen on Pt/H-Beta zeolite occurred via a complex interplay of mono- and bimolecular bifunctional mechanisms and platinum catalysed hydrogenolysis. The metal loading, and more in particular the metal/acid balance, determined the contribution of the different reaction mechanisms and the nature of the reaction products.

La Pierre et al. [23] studied the catalytic dewaxing process Beta zeolite. It had been found that distillate feedstocks might be effectively dewaxed by isomerizing the waxy parafins without substantial cracking. The isomerization was carried out over

zeolite beta as a catalyst and might be conducted either in the presence or absence of added hydrogen. The catalyst should include a hydrogenation/dehydrogenation component such as platinum or palladium in order to promote the reactions which occur. The hydrogenation/dehydrogenation component might be used on the absence of added hydrogen to promote certain hydrogenation/dehydrogenation reactions which would take place during the isomerization.

P. Caullet et al. [24] studied the synthesis of Beta zeolite from nonalkaline fluoride aqueous aluminosilicate gels. By using an original synthesis procedure, where the hydroxide ions were replaced by fluoride anions as the mineralizing agent. They had been able to prepare Beta zeolite from near-neutral nonalkaline reaction mixtures containing diaza-1,- bicyclo [2,2,2] octane and methylamine. Full transformation of the gel into Beta zeolite required the presence of seed crystals. This Beta "F" zeolite could be directly converted by calcination into its acid form.

M.A. Cambor et al. [25] studied the influence of the synthesis conditions on the crystallization of Beta zeolite. The crystallization rate, average crystal size and crystal-size distribution of Beta zeolite had been shown to depend on the TEAOH/SiO₂ ratio, water content, and agitation of the initial gel. Both the nucleation and the crystal growth rate decreased as the SiO₂/Al₂O₃ ratio of the gel increased. The efficiency of the silicon incorporation into the zeolite was shown to decrease progressively with the decrease of the aluminium content of the initial gel.

F. Ramoa Ribeiro [2] studied the use of platinum HY zeolite and platinum H Mordenite in the hydroisomerization of n-hexane. Pt-H Mordenite has a higher isomerizing activity and selectivity for the dimethylbutanes of high octane number. The development of more active catalysts would allow the decrease of the hydroisomerization temperature and consequently to obtain a maximum yield of branched parafin.

Ramesh B. Borade and Abraham Clearfield [26] studied the characterization of acid sites in Beta and ZSM-20 Zeolites. Beta (Si/Al = 5-20) and ZSM-20 zeolites with low Si/Al ratio had been synthesized using tetraethylammonium hydrozide as an organic template, and characterized by XRD, SEM, TGA and XPS. The acidic properties of these zeolites were studied by temperature programmed desorption (TPD) of pyridine. TPD of pyridine revealed that the chemisorbed pyridine was desorbed at somewhat higher temperature from Beta zeolites as compared to ZSM-20 and/or HY zeolites.

Andrew P.E. York et al. [1] studied the molybdenum oxycarbide hydrocarbon isomerization catalysts. It was shown that the isomerization of hydrocarbon $> C_6$, with low selectivity to the cracking products and almost no aromatics formation, was now possible, even at high conversion, using a high specific surface area molybdenum oxycarbide catalyst.

From the reviews, the calculation of gel compositions of Beta zeolite was shown. The modified crystallization of Beta zeolite was also reported. Chemical

composition of gels played the role in efficiency of crystallization. It was shown that the shape-selective catalytic properties of Beta zeolite, especially in the isomerization of n-hexane, can upgrade the octane level of normal paraffins into branched paraffins.