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APPENDICES

APPENDIX A

SAMPLE OF CALCULATION

A-1 Calculation of Si/Al Atomic Ratio for ZSM-5

The calculation is based on weight of Sodium Silicate ($\text{Na}_2\text{O} \cdot \text{SiO}_2 \cdot \text{H}_2\text{O}$) in G2 and S2-solution.

M.W. of Si	=	28.0855
M.W. of SiO_2	=	60.0843
Weight percent of SiO_2 in Sodium Silicate	=	28.5
M.W. of Al	=	26.9815
M.W. of AlCl_3	=	133.3405
Weight percent purity of AlCl_3	=	97

For example, to prepare ZSM-5 at Si/Al atomic ratio of 20
Using Sodium Silicate 69 g with 45g of water as G2-solution

$$\begin{aligned} \text{mole of Si used} &= \frac{\text{wt}(\%)}{100} \times \frac{(M.W. \text{Si})}{(M.W. \text{SiO}_2)} \times \frac{(1\text{mol})}{(M.W. \text{Si})} \\ &= 69 \times \frac{28.5}{100} \times \frac{1}{60.0843} \\ &= 0.3273 \end{aligned}$$

Si/Al atomic ratio = 20

$$\begin{aligned} \text{Mole of } \text{AlCl}_3 \text{ required} &= 0.3273/20 = 0.0164 \text{ mole} \\ \text{Amount } \text{AlCl}_3 &= 0.0164 \times 133.34(100/97) \\ &= 2.2496 \text{ g} \end{aligned}$$

which used in G1,S1 solution

A-2 Calculation of the amount of metal ion-exchange ZSM-5

For example determine the amount of silver into catalyst = 0.2 wt%

The catalyst use = x g

So that

$$\frac{Ag}{(x + Ag)} = \frac{0.2}{100}$$

$$100 * Ag = (1)(x + Ag)$$

$$(100 - 1)Ag = 0.2x$$

thus $Ag = \frac{0.2x}{(100 - 1)} \text{ g}$

A-3 Calculation of total acid sites

For example, 3.5% Ag-ZSM-5 Si/Al 22, total acid site (at first peak) is calculated from the following step.

1. Conversion of total peak area to peak volume

Conversion factor from Micromeritics Chemisorb 2750 is equal to 0.0224 ml/area unit. Therefore, total peak volume is derived from

$$\begin{aligned}\text{Total peak volume} &= 0.0224 \times \text{total peak area (at first peak)} \\ &= 0.0224 \times 409.0780 \\ &= 9.1633 \text{ ml}\end{aligned}$$

2. Calculation for adsorbed volume of 15% NH₃

$$\begin{aligned}\text{adsorbed volume of 15\% NH}_3 &= 0.15 \times \text{total peak volume(at first peak)} \\ &= 0.15 \times 9.1633 \text{ ml} \\ &= 1.3745 \text{ ml}\end{aligned}$$

3. Total acid sites are calculated from the following equation

$$\text{Total acid sites} = \frac{(\text{Adsorbed volume, ml}) \times 101.325 \text{ Pa}}{\left(8.314 \times 10^{-3} \frac{\text{Pa} \cdot \text{ml}}{\text{K} \cdot \mu\text{mol}}\right) \times 298 \text{ K} \times (\text{weight of catalyst, g})}$$

For 3.5% Ag-ZSM-5 sample, 0.1030 g of this one was measured, therefore

$$\begin{aligned}\text{Total acid sites} &= \frac{1.3745 \text{ ml} \times 101.325 \text{ Pa}}{\left(8.314 \times 10^{-3} \frac{\text{Pa} \cdot \text{ml}}{\text{K} \cdot \mu\text{mol}}\right) \times 298 \text{ K} \times (0.1030 \text{ g})} \\ &= 545.7556 \mu\text{mol H}^+/\text{g}\end{aligned}$$

VITA

Mr. Waroon Vimolsathit was born in Bangkok, Thailand, on November, 1980. He received his Bachelor Degree of Engineering from the Department of Chemical Engineering, King Mongkut's University of Technology Thonburi in 2002. He continued his Master's Study at Chulalongkorn University in 2002.

