

Y

Si/Al

*

...

(// // //)

(XRF)

(XRD)

Si/Al

NaY

BET XRD

(BET)

(SEM)

Y

Si/Al

Si/Al

Si/Al

m²/g

Y

Y

Y

Y
Y

/ Si/Al

Y

/ Si/Al

Y

FCC
Si/Al

(FCC)

FCC

Y Si/Al

[]

Y

FCC

Si/Al Y
(USY) Y

(Si/Al)

FCC

Y

[]

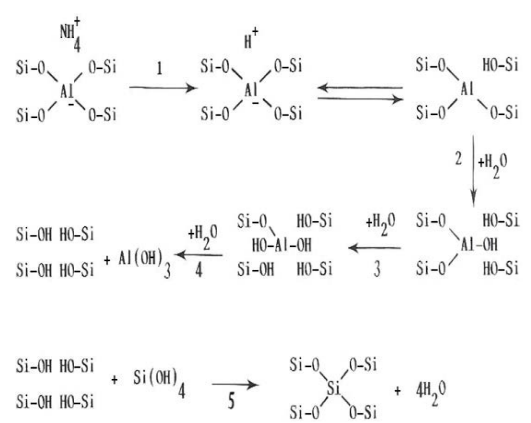
Y

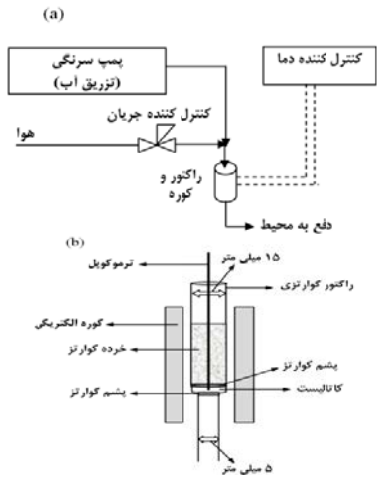
[]

/

(Si/Al)

[]
 Y
 Si/Al Si/Al Si- °C
 O-Al
 []
 (XRF)
 (XRD) (SEM)
 (BET) Y
 / Si/Al Y
 []
) ()
) Y
 : ()
 / Na₂O: Al₂O₃: SiO₂: H₂O ()
 (Merck) []
 (Riedel-de Haën)
 (Merck) ()
)
 () () (°C
 :
 / Na₂O: Al₂O₃: SiO₂: H₂O ()
 () []
 :
 / Na₂O: Al₂O₃: SiO₂: H₂O ()
 PTFE []





$\text{Na}_2\text{O}:\text{Al}_2\text{O}_3:\text{H}_2\text{O}$
 $\text{Na}_2\text{O}:\text{Al}_2\text{O}_3:\text{SiO}_2:\text{H}_2\text{O}$ ()

pH
 NaY
 (Merck)

(AA)

(XRD)

Y
 USY
 Å CuKα₂) X'Pert
 θ (λ= /
 (C_R) / °/min
 (a₀)
 ASTM D3942 ASTM D3906
 () () () ()

XRD

() []
 :Si/Al= /
 N_{Al}= / (a₀ /) ()
 () []
 Si/Al= /

(USY) Y
 °C/min

°C

() ()

$N_{Al} = \frac{1}{a_0} \left(\frac{1}{a_0} \right)$ ()

(BET)

Si/Al= /

(Quantachrome) CHEMBET-3000

Si/Al= /

°C

% N₂/He

Y :

Si/Al= /

Y zeolite (Si/Al=1.69)	Al ₂ O ₃	SiO ₂
Wt%	22.50	44.66

(TCD)

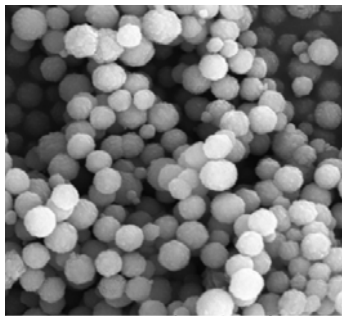
Y :

Si/Al= /

Y zeolite (Si/Al=2.44)	Al ₂ O ₃	SiO ₂
Wt%	15.38	44.39

(SEM)

CAMSCAN MV2300 SEM
(Instruments Oxford)



(XRF)

SiO₂

XRF

Al₂O₃

XRD XRF

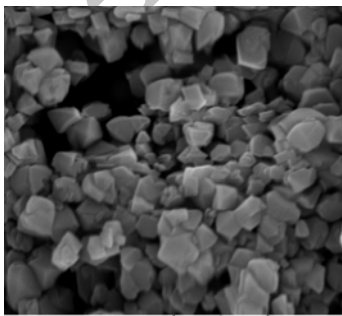
(PHILIPS) PW2404

Y :

Si/Al=1.69

(XRF)

Y



() ()

(Al₂O₃)

(SiO₂)

XRF

Y

Si/Al

/

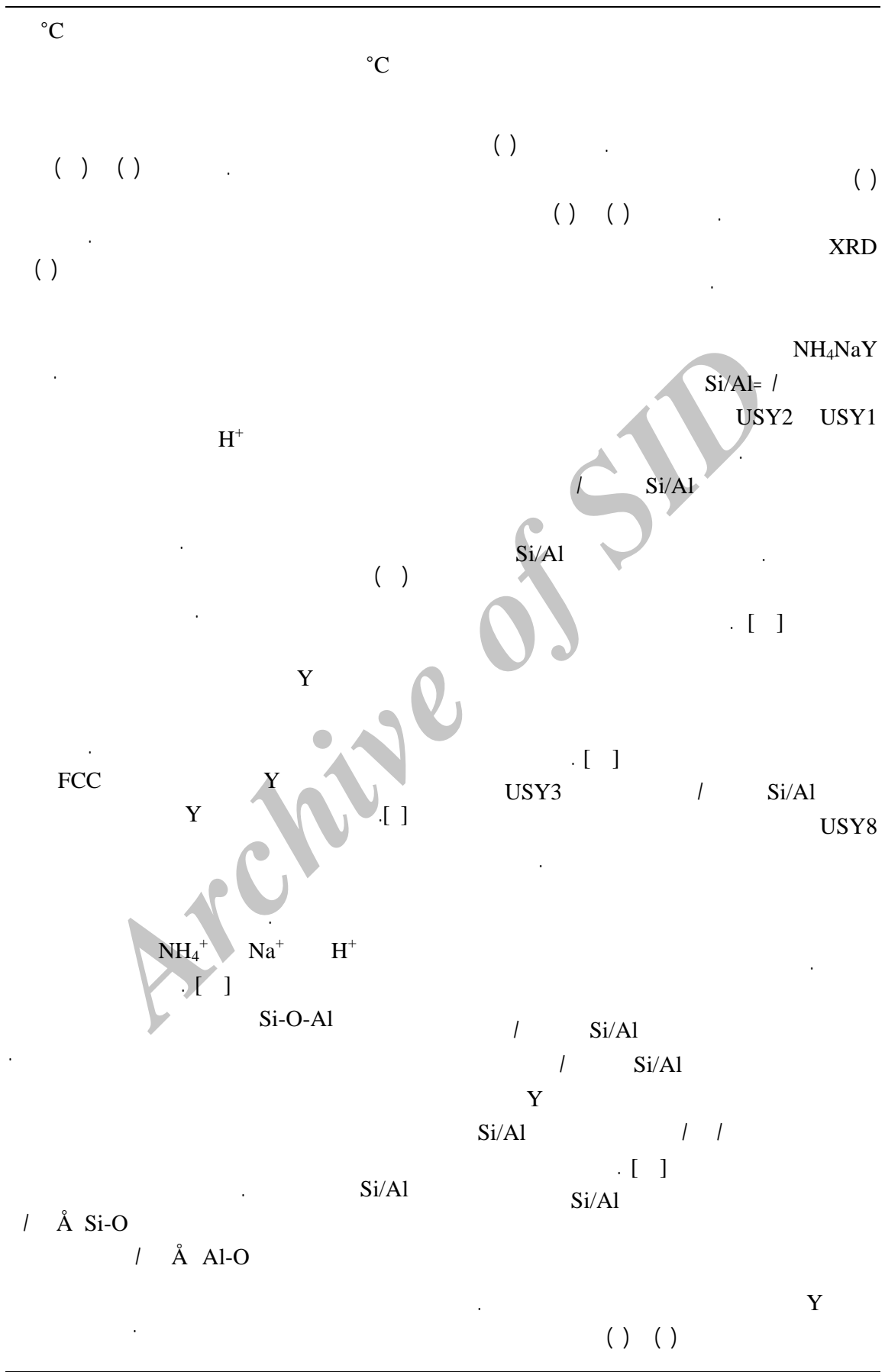
Si/Al

Y

Y :

Si/Al=2.44

(SEM)



:

Sample	Liquid water flow (ml/hr)	Final temperature (°C)	Steaming time at final temperature (min)
USY1	26.8	475	60
USY2	26.8	600	60
USY3	26.8	600	30
USY4	26.8	600	60
USY5	2.6	600	60
USY6	26.8	700	30
USY7	26.8	700	60
USY8	2.6	700	60

Y

:

Sample	N _{Al}	Si/Al (Atomic ratio)	C _R (%)	a ₀ (Å)
NH ₄ NaY(Si/Al=1.69)	71	1.69	100	24.8
NH ₄ NaY(Si/Al=2.44)	56	2.44	100	24.76
USY1	47	3.1	16	24.6
USY2	---	---	Amorphous	---
USY3	34	4.7	85	24.55
USY4	21	8.1	81	24.43
USY5	42	3.6	83	24.63
USY6	23	7.3	68	24.45
USY7	14	12.3	68	24.37
USY8	27	6.2	78	24.49

XRD

()

NH₄NaY

θ

θ

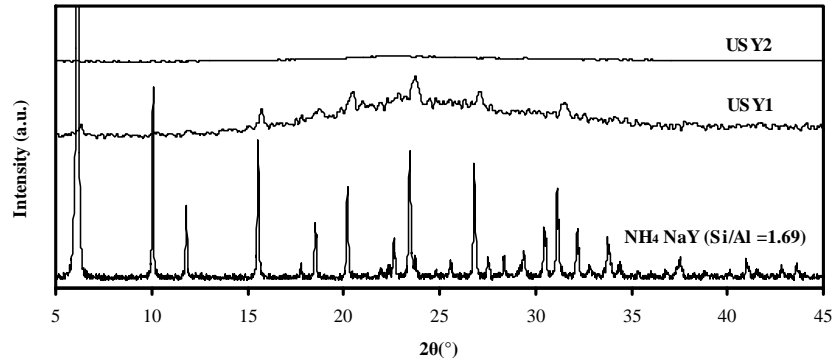
()

()

Si/Al

USY8

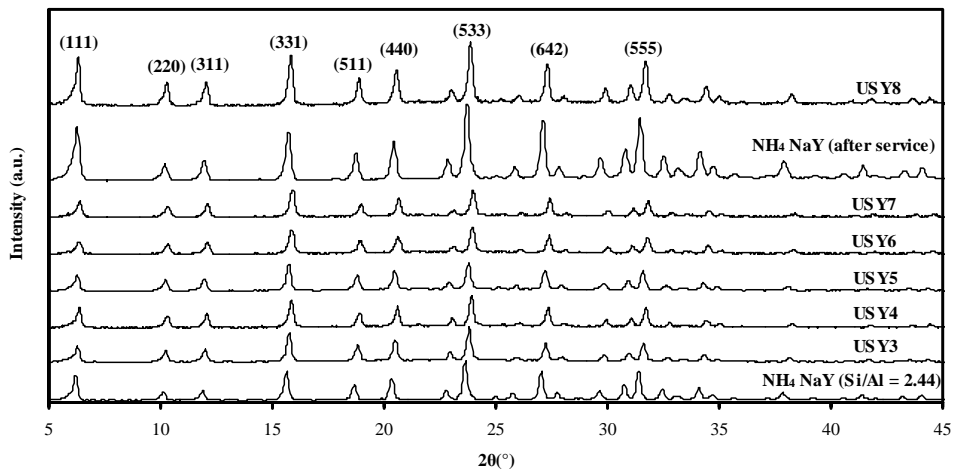
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USY2 USY1

Si/Al=1.69

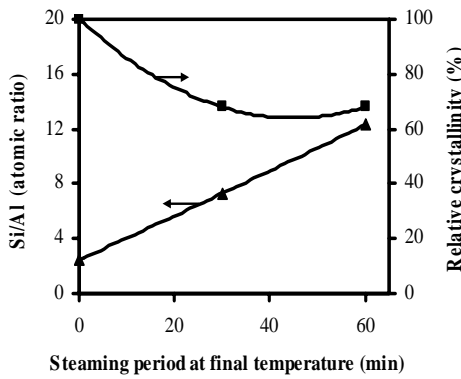
Y



USY8 USY3

Si/Al=2.44

Y

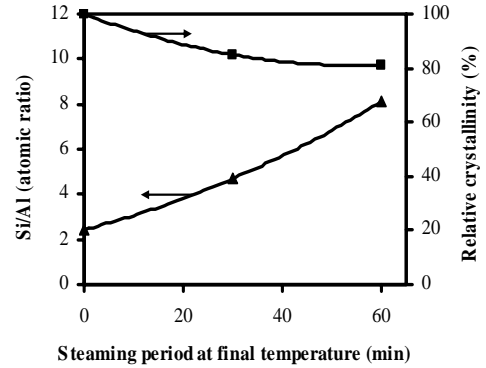


Si/Al

700 °C

Si/Al = 2.44

0.8

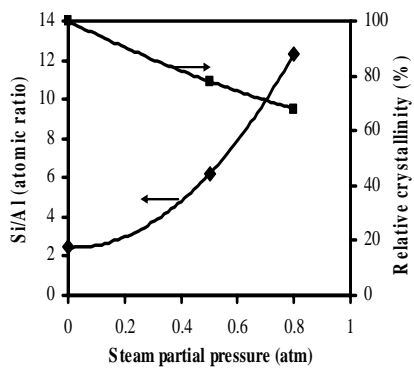


Si/Al

600 °C

Si/Al=2.44

0.8



Si/Al : _____

700 °C

Si/Al = 2.44

BET : _____

Sample	SSA (m ² /g)
Y zeolite(Si/Al=1.69)	800
USY1, USY2	Major loss of crystallinity
Y zeolite(Si/Al=2.44)	748
USY3	667
USY4	630
USY6	600
USY7	602

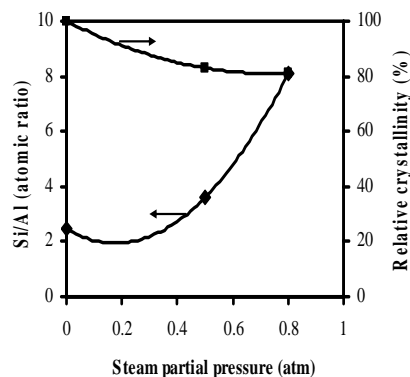
Si/Al

Si/Al

Y

Y

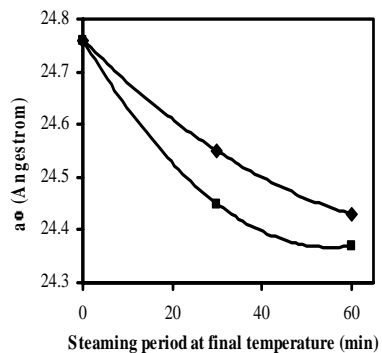
Y



Si/Al : _____

600 °C

Si/Al = 2.44



(a₀) : _____

(■) 700 °C (◆) 600 °C

Si/Al = 2.44

0.8

Y

Si/Al

Si/Al

Y

1- Howard, F. R. (2000). *Handbook of commercial catalysts: Heterogeneous catalysts*. CRC Press, Florida, PP. 374.

- 2- Sadeghbeigi, R. (2000). *Fluid catalytic cracking handbook*. 2nd Ed. Chapter 1, Gulf Pub. Co., Houston TX.
- 3- Yan, Z., Ma, D., Zhuang, J., Liu, X., Han, X., Bao, X., Chang, F., Xu, L. and Liu, Z. (2003). "On the acid-dealumination of USY zeolite: a solid state NMR investigation." *J. Mol. Catal. A*, Vol. 194, PP. 153–167.
- 4- Beyer, H. K. (2001). "Dealumination techniques for zeolites." H.G. Karge, J. Weitkamp eds., Springer-Verlag, Berlin, Germany, PP. 213-223.
- 5- Tonetto, G., Ferreira, M. L. and de Lasa, H. (2004). "Steam promoted mesoporosity in USY zeolites: structural properties and 1,2,4 TMB reactivity." *J. Mol. Catal. A*, Vol. 216, PP. 83–99.
- 6- Peters, A. W., Cheng, W. C., Shatlock, M., Wormsbecher, R. F. and Habib, E. T. (1990). *Guidelines for mastering the properties of molecular sieves*. D. Bartholeuf et al. eds., Plenum Press, New York, PP. 365.
- 7- Beltrán, F. H., Moreno-Mayorga, J. C., de Lourdes Guzmán-Castillo, M., Navarrete-Bolaños, J., González-González, M. and Handy, B. E. (2003). "Dealumination–aging pattern of REUSY zeolites contained in fluid cracking catalysts." *Appl. Catal. A*, Vol. 240, PP. 41–51.
- 8- Barrer, R. M. (1982). *Hydrothermal Chemistry of Zeolites*, Academic Press Inc, London.
- 9- Maher, P. K., Hunter, F. D. and Scherzer, J. (1971). "Crystal structures of ultrastable faujasites." *Adv. Chem. Ser.*, Vol. 101, PP. 266-278.
- 10- Von Ballmoos, R. (1981). "The ¹⁸O-exchange method in zeolite chemistry." Salle and Sauerlander, Frankfurt am main, PP.185.
- 11- Wang, Q. L., Giannetto, G., Torrealba, M., Perot, G., Kappenstein, C. and Guisnet, M. (1991). "Dealumination of zeolites II. Kinetic study of the dealumination by hydrothermal treatment of a NH₄NaY zeolite." *J. Catal.*, Vol. 130, PP. 459-470.
- 12- Stach, H., Lohse, U., Tham, H. and Schirmer, W. (1986). "Adsorption equilibria of hydrocarbons on highly dealuminated zeolites." *Zeolites*, Vol. 6, PP. 74.
- 13- Klinowski, J., Thomas, J. M., C. Fyfe, A. and Gobbi, G. C. (1982). "Monitoring of structural changes accompanying ultrastabilization of faujasitic zeolite catalysts." *Nature*, Vol. 296, PP. 533-536.
- 14- Robson, H. (2001). *Verified synthesis of zeolitic materials*, Elsevier, Amsterdam, PP. 156–158.
- 15- Breck, D. W. and Flanigen, E. M. (1968) "Molecular sieves" *Soc. Chem. Ind.*, London, PP. 47-61.
- 16- Sohn, J. R., DeCanio, S. J., Lunsford, J. H. and O'Donnell, D. J. (1986). "Determination of framework aluminum content in dealuminated Y-type zeolites: a comparison based on unit cell size and wavenumber of i.r. bands." *Zeolites*, Vol. 6, PP. 225.
- 17- Kim, J. T., Kim, M. C., Okamoto, Y. and Imanaka, T. (1989). "Acid attack theory of dealumination in cation-exchanged faujasite." *J. Catal.*, Vol. 115, PP. 319-325.
- 18- Dutartre, R., Charles de Mnrval, L., Di Renzo, F., McQueen, D., Fajula, F. and Schulz, P. (1996). "Mesopore formation during steam dealumination of zeolites: influence of initial aluminum content and crystal size." *Microporous Mater.* Vol. 6, PP. 311-320.
- 19- Sombatchaisak, S., Prasertthdam, P., Chaisuk, C. and Panpranot, J. (2004). "An alternative correlation equation between particle size and structure stability of H-Y zeolite under hydrothermal treatment conditions." *Ind. Eng. Chem. Res.*, Vol. 43, PP. 4066-4072.
- 20- Triantafillidis, C. S., Vlessidis, A. G. and Evmiridi, N. P. (2000). "Dealuminated H-Y zeolites: influence of th degree and the type of dealumination method on the structural and acidic characteristics of H-Y zeolites." *Ind. Eng. Chem. Res.*, Vol. 39, PP. 307-319.