

REFERENCES

- Balkus Jr., K.J., Munoz, T., and Gimón-Kinsel, M.E. (1998) Preparation of zeolite UTD-1 films by pulsed laser ablation: evidence for oriented crystal growth. Chem. Materials, 10(2), 464-466
- Berenguer-Murcia, Á., Morallón, E., Cazorla-Amorós, D., and Linares-Solano, Á. (2003) Preparation of thin silicalite-1 layers on carbon materials by electrochemical methods. Microporous and Mesoporous Materials, 66, 331-340.
- Bonaccorsi, L., Proverbio, E. (2003) Microwave assisted crystallization of zeolite A from dense gels. Journal of Crystal Growth, 247(4), 555-562.
- Breck, D.W. (1974). Zeolite Molecular sieves: Structure, Chemistry and Use. New York: Wiley
- Dutta, B.K., and Sikda, S.K. (1996) Pervaporation: principles and applications. Separation and Purification Methods, 25(2), 131-224.
- Feigen, E.J.P., Martens, J.A. and Jacobs, P.A.(1999) Ertl, G., Knozinger, H. and Weitkamp, J. (eds). Wiley-VCH : Weinheim, Hydrothermal zeolite synthesis. In Preparation of Solid Catalysts.
- Gallego-Lizon, T., Edwards, E., Lobiundo, G., and Freitas dos Santos, L. (2002) Dehydration of water/*t*-butanol mixtures by pervaporation: comparative study of commercially available polymeric, microporous silica and zeolite membranes. Journal of Membrane Science, 197(2), 309-319.
- Gora, L., Sterletzky, K., Thompson, R.W., and Phillis, G.D.J. (1997) Study of the crystallization of zeolite NaA by quasi-elastic light-scattering spectroscopy and electron microscopy. Zeolite, 18, 119.
- Gora, L., and Thompson, R.W. (1997) Controlled addition of aged mother liquor to zeolite NaA synthesis solution. Zeolite, 18(2), 132-141.
- Hoof, V.V., Dotremont, C., and Buekenhoudt, A. (2006) Performance of Mitsui NaA type zeolite membranes for the dehydration of organic solvents in comparison with commercial polymeric pervaporation membranes. Separation and Purification Technology, 48(3), 304-309.

- Huang, A., Lin, Y.S., and Yang, W.S. (2004) Synthesis and properties of A-type zeolite membranes by secondary growth method with vacuum seeding. Journal of Membrane Science, 245(1), 41-51.
- Huang, A. , Yang, W.S. (2007) Hydrothermal synthesis of uniform and dense NaA zeolite membrane in the electric. Microporous and Mesoporous Materials, Article In Press.
- Jafar, J., and Budd, M. (1997) Separation of alcohol/water mixtures by pervaporation through zeolite NaA membranes. Microporous Materials, 12, 305-311
- Koegler, J.H., Van Bekkum H., Jansen J.C. (1997) Growth model of oriented crystals of zeolite Si-ZSM-5. Zeolites, 19, 262-269.
- Kuanchertchoo, N., Kulprathipanja, S., Aungkavattana, P., Atong, P., Hemra, K., Rirksomboon, T. and Wongkasemjit, S. (2006) Preparation of uniform and nano-sized NaA zeolite using silatrane and alumatrane precursors. Applied Organometallic Chemistry, 20, 775-783.
- Kusakabe, K., Kuroda, T., Murata, A., and Morooka, S. (1997) Formation of a Y-type zeolite membrane on a porous α -alumina tube for gas separation. Ind. Eng. Chem. Res., 36(3), 649-655.
- Mintova, S., and Bein, T. (2001) Microporous films prepared by spin-coating stable colloidal suspensions of zeolites. Advanced Materials, 13(24), 1880-1883.
- Mintova, S., Hedlund, J., Valchev, V., Schoeman, B., and Sterte, J. (1998) ZSM-5 films prepared from template free precursors. Journal of materials Chemistry, 8(10), 2217-2227.
- Morigami, Y., Kondo, M., Abe, J., Kita, H., and Okamoto, K. (2001). The first large-scale pervaporation plant using tubular-type module with zeolite NaA membrane. Separation and Purification Technology, 25(2), 251-260.
- Mohammadi, T., Pak, A. (2002) Making zeolite A membrane from kaolin by electrophoresis. Microporous and Mesoporous Materials, 56, 81-88.
- Renso, F. (1998). Zeolites as tailor-made catalysts: Control of the crystal size. Catalysis Today, 41,37-40.
- Ruthven, D.M. (1984) Principles of Adsorption and Adsorption Process. New York: Wiley.

- Schoeman, B.J., Sterte, J., and Otterstedt, J.E. (1994) Colloidal zeolite suspensions. Zeolites, 14(2), 110-116.
- Shah, D., Bhattacharyya, D., Mangum, W., and Ghorpade, A. (2000) Pervaporation of pharmaceutical waste streams and synthetic mixtures using water selective membranes. Environmental Progress, 18(1), 21-29.
- Slangen, P.M., Jansen, J.C., and Bekkum, H. van (1997) The effect of ageing on the microwave synthesis of zeolite NaA. Microporous Materials, 9(6), 259-265.
- Tsutsumi, K. and Yamazaki, S. (2000) Synthesis of A-type zeolite membrane using a plate heater and its formation mechanism. Microporous and Mesoporous Materials, 37, 67-80.
- Wijnen, P.W.J.G., Beelen, T.P.M., Santen, R.A. van. IN (1994) : H.E. Bergna(Ed.), The Colloidal Chemistry of Silica, Advances in Chemistry Series, No.234, Washington, DC. : American Chemical Society, (1994). 517-531.
- Xomeritakis, G., Nair, S., and Tsapatsis, M. (2000) Transport properties of alumina-supported MFI membranes made by secondary (seeded) growth. Microporous and Mesoporous Materials, 38(1), 61-73.
- Xu, X., Bao, Y., Song, C., Yang, W., Liu, J. and Lin, L. (2004) Microwave assisted hydrothermal synthesis of hydroxyl-sodalite zeolite membrane. Microporous and Mesoporous Materials, 75, 173-181
- Xu, X.C., Yang, W.S., Liu, J., and Lin, L.W. (2001) Synthesis of NaA zeolite membranes from clear solution. Microporous and Mesoporous Materials, 43(3), 299-311.
- Xu, X.C., Yang, W.S., Liu, J., and Lin, L.W. (2001) Synthesis of NaA zeolite membrane by microwave heating. Separation and Purification Technology, 25(2), 241-249.
- Xu, X.C., Yang, W.S., Liu, J., and Lin, L.W. (2001) Synthesis and perfection evaluation of NaA zeolite membrane. Separation and Purification Technology, 25(3), 475-485.
- Zah, J., Krieg, H.M., and Breytenbach, J.C. (2006) Layer development and growth history of poly crystalline zeolite A membrane synthesized from a clear solution. Microporous and Mesoporous Materials, Article in press, 141-150

- Zah, J., Krieg, H.M., and Breytenbach, J.C. (2006) Pervaporation and related properties of time-dependent growth layers of zeolites NaA on structured ceramic supports. Journal of Membrane Science, Article in press.
- Zhang, X.F., Wang, J.Q., Yin, D.H. and Liu, C.H. (2001) Synthesis of ZSM-5 zeolite membrane and its influencing factors by a novel method. Chinese Journal of catalyst, 21(5), 451.
- Zimmerman, C.M., Singh, A., and Korous, W.J. (1997) Tailoring mixed matrix composite membranes for gas separations. Journal of membrane Science, 137(1), 145-154.

APPENDICES

Appendix A Preparation of Precursor Solution for NaA membrane synthesis



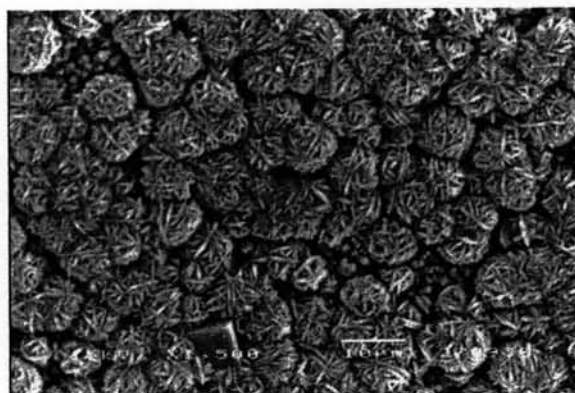
M.W.	60	78	40	18
Calculation for preparing 200 ml of precursor solution				
	5 x 60	2 x 78	50 x 2 x 40	1000 x 18
	1	<u>2 x 78</u>	<u>50 x 2 x 40</u>	<u>1000 x 18</u>
		5 x 60	5 x 60	5 x 60
	1	0.52	13.3	60
(x 3.33)	3.33	1.733	44.44	200
Weight(g)	3.33	1.733	44.44	-
Vol.(ml)	-	-	-	200

Remark: For Al_2O_3 and Na_2O , $\text{Al}(\text{OH})_3$ and NaOH were used as starting materials, respectively

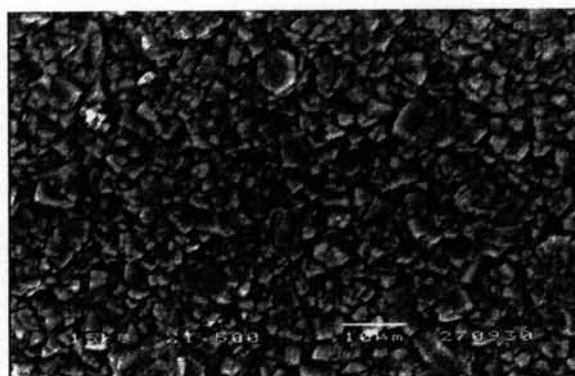
Appendix B Preparation of Precursor Solution for NaA seed synthesis

	SiO ₂	Al ₂ O ₃	3Na ₂ O	410 H ₂ O
M.W.	60	78	40	18
Calculation for preparing 12 ml of precursor solution				
	60	2 x 78	3 x 2 x 40	410 x 18
	<u>60</u>	<u>2 x 78</u>	<u>3 x 2 x 40</u>	<u>410 x 18</u>
	60	60	60	60
	1	2.6	4	123
(x 1/10.25)	0.0975	0.2536	0.3902	12
Weight(g)	0.0975	0.2536	0.3902	-
Vol.(ml)	-	-	-	12

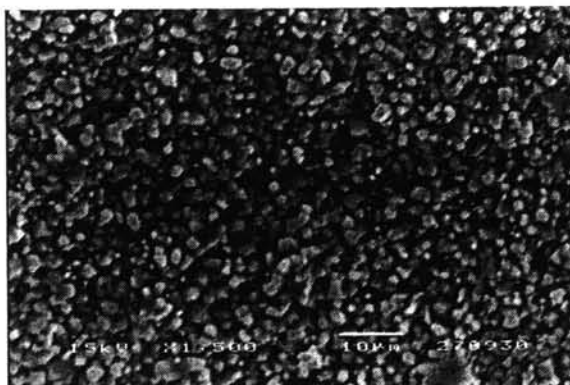
Appendix C SEM Micrographs of the Seed Suspension Solution taken from the Top Part after Settled Down for a Certain Time and Removed Out



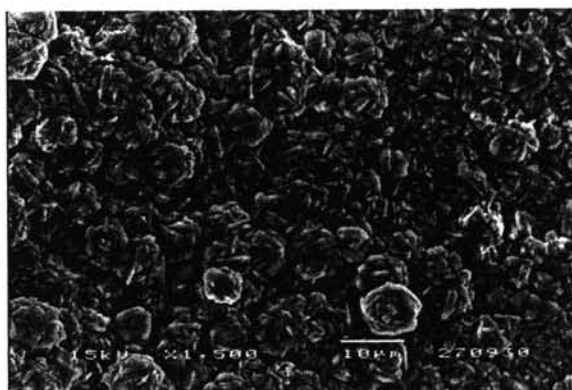
Settled down for 3 h



Settled down for 5 h

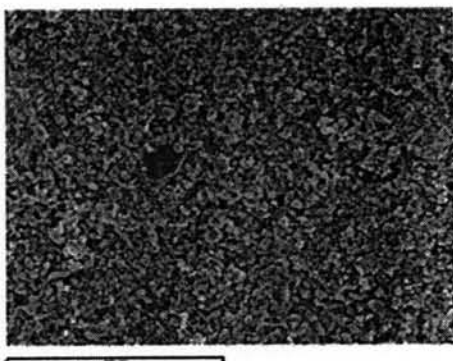


Settled down for 7 h

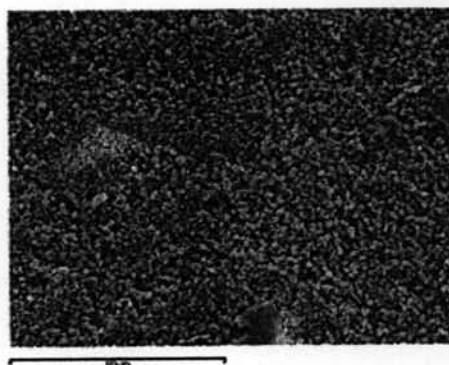


Settled down for 9 h

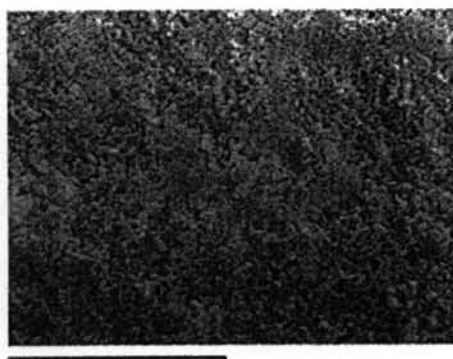
Appendix D SEM Micrographs of NaA Seed on Support after Varying Seeding Time and Using 1 g/l Seed Suspension Concentration



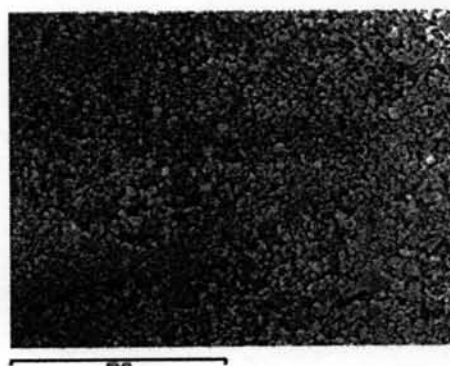
seeding time = 1 min



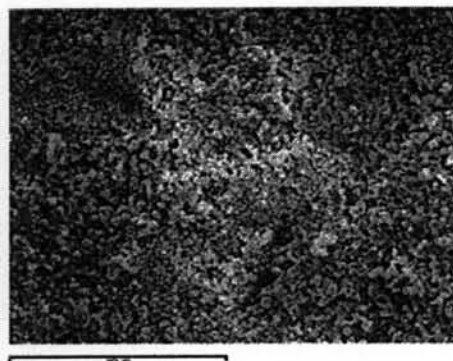
seeding time = 2 min



seeding time = 3 min

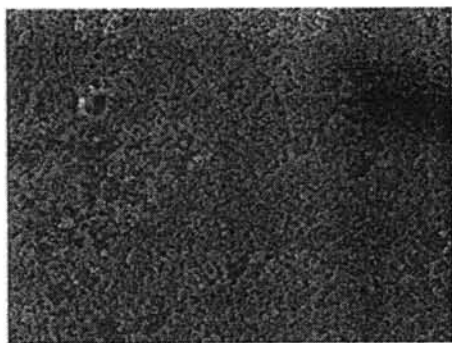


seeding time = 4 min

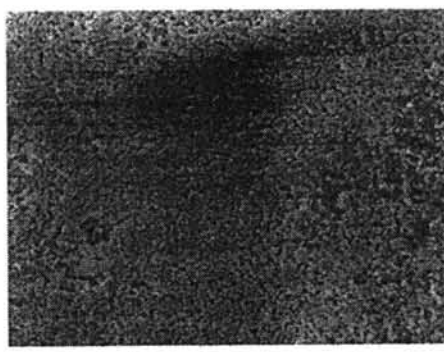


seeding time = 5 min

Appendix E SEM Micrographs of NaA Seed on Support after Varying Seeding Time and Using 2 g/l Seed Suspension Concentration



seeding time = 1 min



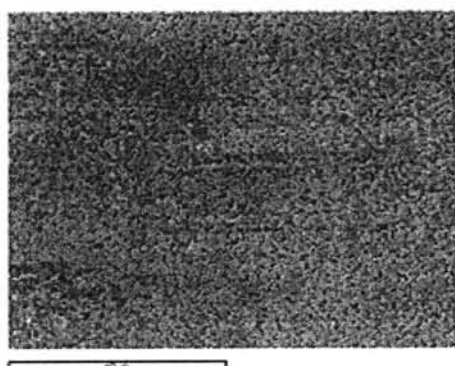
seeding time = 2 min



seeding time = 3 min

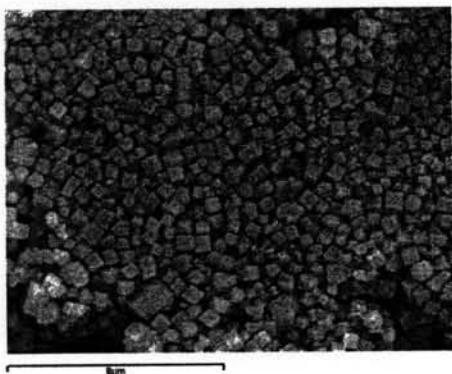


seeding time = 4 min

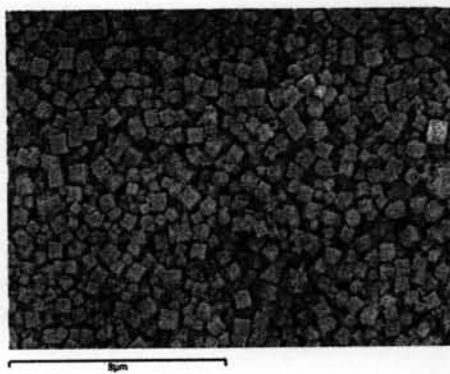


seeding time = 5 min

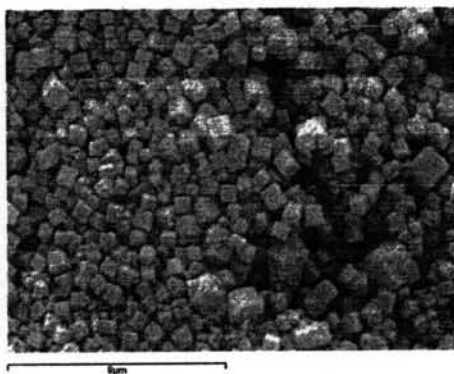
Appendix F SEM Micrographs of NaA Seed on Support after Varying Seeding Time and Using 3 g/l Seed Suspension Concentration



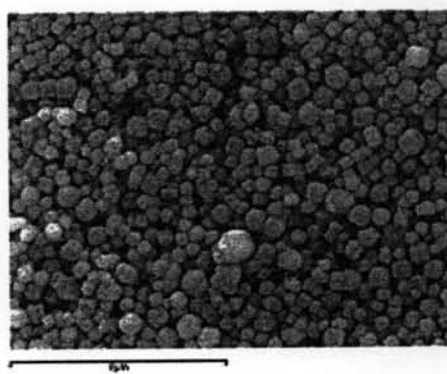
seeding time = 1 min



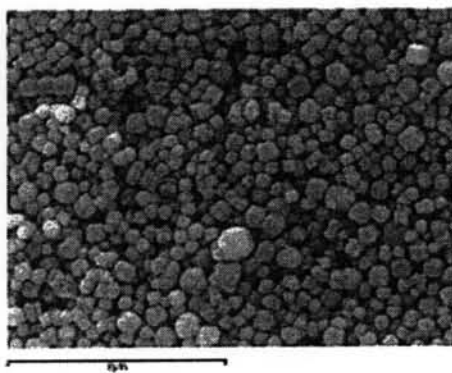
seeding time = 2 min



seeding time = 3 min



seeding time = 4 min



seeding time = 5 min

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3. Suwanpredee, R., Kuanchertchoo, N., Kulprathipanja, S., Aungkavattana, P., Atong, D., Hemra, K., Riarksomboon, T. and Wongkasemjit, S. (2007, May 10-13) Effects of Synthetic Parameters and Synthetic Method on the Zeolite Membrane Formation. Paper presented at The 5th China International Conference on High-Performance Ceramics, Tsinghua University, Shangsha, China