



REFERENCES

- Agag, T. and Takeichi, T. (2007) High-molecular-weight AB-type benzoxazines as new precursors for high-performance thermosets. Journal of Polymer Science: Part A: Polymer Chemistry, 45, 1878-1888.
- A.J. Bird, D.L. Trimm, (1983) Carbon molecular sieves used in gas separation membranes, Carbon, 21, 177.
- Anson, M., Marchese, J., Garis, E., Ochoa, N., and Pagliero, C. (2004) ABS copolymer-activated carbon mixed matrix membranes for CO₂/CH₄ separation. Journal of Membrane Science, 243, 19-28.
- Brunovska, Z., Liu, J. P., and Ishida, H. (1999) 1,3,5-triphenylhexahydro-1,3,5-triazine - active intermediate and precursor in the novel synthesis of benzoxazine monomers and oligomers. Macromolecular Chemistry and Physics, 200(7), 1745-1752.
- Burke, W.J., Bishop, J.L., Glennie, E.L.M., and Bauer, W.N. (1965) A new aminoalkylation reaction. Condensation of phenols with dihydro-1,3-oxazines. Journal of Organic Chemistry, 30(10), 3423-3427.
- Centeno, T.A., Vilas, J.L., and Fuertes, A.B. (2004) Effects of phenolic resin pyrolysis conditions on carbon membrane performance for gas separation, Journal of Membrane Science, 228, 45-54.
- Chaisuwan, T., Komolwanich, T., Luangsukrer, S. and Wongkasemjit, S. (2010) Removal of heavy metals from model wastewater by using polybenzoxazine aerogel. Desalination, 256(1), 108-114.
- Chung, T.S., Jianga, L.Y., Lia, Y., and Kulprathipanj, S. (2007). Mixed matrix membranes (MMMs) comprising organic polymers with dispersed inorganic fillers for gas separation. Progress in Polymer Science, 32, 483-507.
- Clarkson, C.R. and Bustin, R.M. (1999) Binary gas adsorption-desorption isotherms: effect of moisture and coal composition upon carbon dioxide selectivity over methane. International Journal of Coal Geology, 42, 241-271.
- Dunkers, J. and Ishida, H. (1995) Vibrational assignments of N,N-bis(3,5-dimethyl-2-hydroxybenzyl)methylamine in the fingerprint region. Spectro-

- chimica Acta Part A: Molecular and Biomolecular Spectroscopy, 51, 1061-1074.
- Ghosh, N. N., Kiskan, B., and Yagci. Y. (2007) Polybenzoxazines - new high performance thermosetting resins: Synthesis and properties. Progress in Polymer Science, 32(11), 1344-1391.
- Gregg, S.J., Sing, K.S.W. (1982) Adsorption, Surface Area and Porosity, 2nd ed., Academic Press, New York.
- Gruszkiewicz, M.S., Naney, M.T., Blencoe, J.G., Cole, D.R., Pashin, J.C. and Carroll, R.E. (2009) Adsorption kinetics of CO₂, CH₄, and their equimolar mixture on coal from the Black Warrior Basin, West-Central Alabama. International Journal of Coal Geology, 77, 23–33.
- Hashemifard, S.A., Ismaila, A.F. and Matsuura, T. (2011). Mixed matrix membrane incorporated with large pore size halloysite nanotubes (HNTs) as filler for gas separation: Morphological diagram. Chemical Engineering Journal, 172, 581-590.
- He, X., Hagg, M.B. (2010) Hollow fiber carbon membranes: investigations for CO₂ capture, Journal of Membrane Science, doi:10.1016/j.memsci.2010.10.070.
- Holly, F.W., and Cope, A.C., (1944) Condensation products of aldehydes and ketones with o-aminobenzyl alcohol and o-hydroxybenzylamine. Journal of American Chemical Society, 66(11), 1875-1879.
- Hosseini, S.S., and Chung, T.S. (2009) Carbon membranes from blends of PBI and polyimides for N₂/CH₄ and CO₂/CH₄ separation and hydrogen purification. Journal of Membrane Science, 328, 174-185.
- Ismail, A.F., and David, L.I.B. (2001) A review on the latest development of carbon membranes for gas separation. Journal of Membrane Science, 193, 1-18.
- Ishida, H., and Rodriguez, Y. (1995) Curing kinetics of a new benzoxazine based phenolic resin by DSC. Abstracts of Papers of the American Chemical Society, 210, 273.
- Ishida, H. and Allen, D. (1996) Physical and mechanical characterization of near-zero shrinkage polybenzoxazines. Journal of Polymer Science: Part B: Polymer Physics, 34, 1019–1030.

- Job, N., They, A., Pirard, R., Marien, J., Kocon, L., Rouzaud, J., Beguin, F., Pirard, J. (2005) Carbon aerogels, cryogels and xerogels: Influence of the drying method on the textural properties of porous carbon materials. Carbon, 43, 2481–2494.
- Katanyoota, P., Chaisuwan, T., Wongchaisuwat, A., and Wongkasemjit, S. (2010) Novel polybenzoxazine-based carbon aerogel electrode for supercapacitors. Materials Science and Engineering B, 167, 36-42.
- Kim, J.H., Ha, S.Y., Nam, S.Y., Rhim, J.W., Baek, K.H., and Lee, Y.M. (2001) Selective permeation of CO₂ through pore-filled polyacrylonitrile membrane with poly(ethylene glycol). Journal of Membrane Science, 186, 97-107.
- Kim, Y.Y., Park, H.B., Lee, and Y.M. (2004) Carbon molecular sieve membranes derived from thermally labile polymer containing blend polymers and their gas separation properties, Journal of Membrane Science. 243 (2004) 9–17.
- Krishna, R., and Baten, J.Van. (2007) Using molecular simulations for screening of zeolites for separation of CO₂/CH₄ mixtures. Chemical Engineering Journal, 133, 121-131.
- Lorjai, P., Chaisuwan, T., and Wongkasemjit, S. (2009) Porous structure of polybenzoxazine-based organic aerogel prepared by sol–gel process and their carbon aerogels. Journal of Sol-Gel Science and Technology, 52(1), 56-64.
- Li, J., Wang, S., Nagai, K., Nakagawa, T., and Mau, A.W. (1998) Effect of polyethyleneglycol (PEG) on gas permeabilities and permselectivities in its cellulose acetate (CA) blend membranes. Journal of Membrane Science, 138, 143-152.
- Li, Y., and Guan, H.M., Chung, T.S., and Kulprathipanja, S. (2006) Effect of novel silane modification of zeolite surface on polymer chain rigidification and partial pore blockage in polyethersulfone (PES)–zeolite A mixed matrix membranes. Journal of Membrane Science, 275, 17-28.
- Li, Y., and Chung, T.S. (2007) Novel Ag⁺-zeolite/polymer mixed matrix membranes with a high CO₂/CH₄ selectivity. AIChE. Journal, 53(3), 610-616.

- Liu, Y.L., Yu, J.M., and Chou, C.I. (2004). Preparation and properties of novel benzoxazine and polybenzoxazine with maleimide groups. Journal of Polymer Science, 42, 5954-5963.
- Lorjai, P., Chaisuwan, T., and Wongkasemjit, S. (2009). Porous structure of polybenzoxazine-based organic aerogel prepared by sol-gel process and their carbon aerogels. Journal of Sol-Gel Science and Technology, 52(1), 56-64.
- Low B.T., Chung, T.S. (2011) Carbon molecular sieve membranes derived from pseudo- interpenetrating polymer networks for gas separation and carbon capture, Carbon, 49, 2104-2112.
- Low, H.Y., and Ishida, H. (1999) Structural effects of phenols on the thermal and thermo-oxidative degradation of polybenzoxazines. Polymer, 4365-4376.
- Low, H.Y., and Ishida H. (2006) Improved thermal stability of polybenzoxazines by transition metals. Polymer Degradation and Stability, 91, 805-815.
- Reijerkerk, S.R., Nijmeijer, K., Ribeiro Jr., C.P., Freeman B.D., and Wessling M. (2011) On the effects of plasticization in CO₂/light gas separation using polymeric solubility selective membranes. Journal of Membrane Science, 367, 33-44.
- Rouquerol, F., Rouquerol, J., Sing, K.S.W. (1999) Adsorption by Powders and Porous Solids, Principles, Methodology and Applications, Academic press.
- Şen, D., Kalıpçılar, H., and Yilmaz, L. (2007) Development of polycarbonate based zeolite 4A filled mixed matrix gas separation membranes. Journal of Membrane Science, 303, 194-203.
- Song, C.W., Wang, T.H., Qiu, Y.H., Qiu, J.S., and Cheng, H.M. (2009) Effect of carbonization atmosphere on the structure changes of PAN carbon membranes, J. Porous Mater. 16, 197-203.
- Takeichi, T., Kano, T., and Agag, T. (2005) Synthesis and thermal cure of high molecular weight polybenzoxazine precursors and the properties of the thermosets. Polymer, 46, 12172-12180.
- Thubsuang, U., Ishida, H., Wongkasemjit, S., and Chaisuwan, T. (2012) Novel template confinement derived from polybenzoxazine-based carbon xerogels for

synthesis of ZSM-5 nanoparticles via microwave irradiation. Microporous and Mesoporous Materials, 156, 7–15

Wei, W., Qin, G.T., Hu, H.Q., You, L.B., and Chen, G.H. (2007) Preparation of supported carbon molecular sieve membrane from novolac phenol-formaldehyde resin, Journal of Membrane Science, 303, 80–85.

Wijmans, J.G., and Baker, R.W. (1995) The solution–diffusion model: a review. Journal of Membrane Science, 107, 1–21.

Vu, D.Q., Koros, W., and Miller, S.J. (2003) Mixed matrix membranes using carbon molecular sieves I. preparation and experimental results. Journal of Membrane Science, 211, 311-334

CURRICULUM VITAE

Name: Ms. Apiradee Nicharat

Date of Birth: May 3, 1988

Nationality: Thai

University Education:

2005-2009 Bachelor Degree of Polymer Science and Technology, Faculty of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand

Proceedings:

1. Nicharat, A.; Wongkasemjit, S.; and Chaisuwan, T. (2012, March 21-25) Silver Inclusion Polybenzoxazine Xerogel Membrane for CO₂/CH₄ Separation. Proceedings of the 243rd ACS National Meeting & Exposition, San Diego, CA, USA.
2. Nicharat, A.; Wongkasemjit, S.; and Chaisuwan, T. (2012, April 24) Silver Inclusion Polybenzoxazine Xerogel Membrane for CO₂/CH₄ Separation. Proceedings of the 3rd Research Symposium on Petrochemicals, and Materials Technology and the 18th PPC Symposium on Petroleum, Petrochemicals and Polymers, Bangkok, Thailand.

Presentations:

1. Nicharat, A.; Wongkasemjit, S.; and Chaisuwan, T. (2012, March 21-25) Silver Inclusion Polybenzoxazine Xerogel Membrane for CO₂/CH₄ Separation. Paper presented at the 243rd ACS National Meeting & Exposition, San Diego, CA, USA.
2. Nicharat, A.; Wongkasemjit, S.; and Chaisuwan, T. (2012, April 24) Silver Inclusion Polybenzoxazine Xerogel Membrane for CO₂/CH₄ Separation. Paper presented at the 3rd Research Symposium on Petrochemicals, and Materials Technology and the 18th PPC Symposium on Petroleum, Petrochemicals and Polymers, Bangkok, Thailand.

