REFERENCES

Alt, H. "The Heterogenization of Homogeneous Metallocene Catalysts for Olefin Polymerization", **Journal of The Chemical Society; Dalton Transactions** (1999): 1703-1709.

Alt, H. G. and Köppl, A. "Effect of the Nature of Metallocene Complexes of Group IV Metals on Their Performance in Catalytic Ethylene and Propylene Polymerization", **Chemical Reviews** 100 (2000): 1205-1221.

Altamura, P. and Grassi, A. "Crystalline Alternating Sequences Indentified in Ethylene-co-norbornene Polymers Produced by the $(\eta^5\text{-}C_2B_5H_{11})Zr(NEt_2)_2$ $(NHEt_2)$-Al^iBu_3 Catalyst", **Macromolecules** 34 (2001) : 9197-9200.

Amornsit, M and Phetsom, A., **Principles and Techniques of Instrumental Analysis**, Chuanpim printing (1991) : 139-182.

Arndt, M. and Beulich, I. "C_1-symmetric Metallocene for Olefin Polymerization,1, Catalytic performance of $[MeC(3\text{-}^{tert}BuCp)(Flu)]ZrCl_2$ in ethane/norbornene copolymerization", **Macromolecular Chemistry and Physics** 199 (1998): 1221-1232.

Arndt, M. and Beulich, I. "Microstructure of Ethene/Norbornene Copolymers", **Macromolecules** 32 (1999) : 7335-7343.

Barron, A. R.; Mason, M. R.; Smith, J. M., and Bott, S.G. "Hydrolysis of Tri-tert-butylaluminum: The First Structural Characterization of Alkylalumoxanes $[(R_2Al)_2O]_n$ and $(RAlO)_n$", **Journal of the American Chemical Society** 115 (1993): 4971-4984.

Barron, A.R.; Koide, Y. and Bott, S.G. "Alumoxanes as Cocatalysts in The Palladium-catalyzed Copolymerization of Carbonmonoxide and Ethylene: Genesis of A Structure-activity Relationship", **Organometallics** 15 (1996) : 2213-2226.

Bergström, C.H. and Seppälä, J.V. "Effect of Polymerizaion Conditions When Making Norbornene-Ethylene Copolymers Using the Metallocene Catalyst Ethylene Bis(indenyl) Zirconium Dichloride and MAO to Obtain High Glass Transition Temperatures", **Journal of Applied Polymer Science** 63 (1997): 1063-1070.

Bergström, C.H.; Väänänen, T.L.J. and Seppälä, J.V. "Influence of Polymerization Conditions on Microstructure of Norbornene-Ethylene Copolymers Made Using

Metallocene Catalysts and MAO", **Journal of Applied Polymer Science** 63 (1997): 1071-1076.

Bergström, C.H.; Ruotoistenmäki, J.; Aitola, E.T. and Seppälä, J.V. "Influence of the Polymerization Conditions on the Impact Properties of Metallocene-Catalyzed Copolymers of Ethylene and Aryl-Substituted Norbornenes with Low Exo/Endo Ratios", **Journal of Applied Polymer Science** 77 (2000): 1108-1117.

Bergström, C.H.; Sperlich, B.R.; Ruotoistenmäki, J. and Seppälä, J.V. "Investigation of the Microstructure of Metallocene-Catalyzed Norbornene-Ethylene Copolymers Using NMR Spectroscopy", **Journal of Applied Polymer Science** 36 (1998): 1633-1638.

Britto, M.L.; Galland, G.B.; dos Santos, J.H. and Forte, M.C. "Copolymerization of Ethylene and 1-Hexene with $Et(Ind)_2ZrCl_2$ in Hexane", **Polymer** 42 (2001) : 6355-6361.

Chen, E. Y. X. and Marks, T. J. "Cocatalysts for Metal-Catalyzed Olefin Polymerization: Activators, Activation Processes, and Structure-Activity Relationships", **Chemical Reviews** 100 (2000): 1391-1434.

Chien, J.C.W. and He, D. "Olefin Copolymerization with Metallocene Catalysts. III. Supported Metallocene/Methylaluminoxane Catalyst for Olefin Copolymerization", **Journal of Polymer Science: Part A: Polymer Chemistry** : 29 (1991) 1603-1607.

Chien, J.C.W.; Ready, T.E.; Day, R.O. and Raush, M.D. "(η^5-Indenyl) trichlorotitanium. An Improved Syndiotactic Polymerization Catalyst for Styrene" , **Macromolecule** 26 (1993): 5822-5823.

Coates, G. W. Precise "Control of Polyolefin Stereochemistry Using Single-Site Metal Catalysts", **Chemical Reviews** 100 (2000): 1223-1252.

Collins, S. and Kelly, W.M. "The Microstructure of Poly(cyclopentene) Produced by Polymerization of Cyclopentene with Homogeneous Ziegler-Natta Catalysts" **Macromolecule** 25 (1992): 233-237.

Do Couto Junior, P.A.; Nele, M. and Coutinho, F.M.B. "Study on Ethylene Polymerization by Homogeneous Cp_2ZrCl_2/Methylaluminoxane Catalyst system", **European Polymer Journal** 38(2002): 1471-1476.

Ekizoglou, N.; Thorshaug, K.; Cerrada, M.L.; Benavente, R.; Pérez, E. and Pereña J.M. "Influence of the Molecular Weight on the Thermal and Mechanical

Properties of Ethylene/Norbornene Copolymers", **Journal of Applied Polymer Science** 89 (2003) : 3358-3363.

Estrada J. M. V., and Hamielec A. E. Modeling of Ethylene Polymerization with Cp_2ZrCl_2/MAO Catalyst. **Polymer** 35 (1994) : 808-818.

Ferro, D.R.; Provasoli, A.; Tritto, I. and Boggioni, L. "The Conformational Characteristics of Ethylene-Norbornene Copolymers and Their Influence on the ^{13}C-NMR Spectra", **Macromolecules** 32 (1999) : 6697-6706.

Fischer, D.; Jungling, S. and Mulhaupt, R. "Donor-Modified and Acceptor-Modified Metallocene-Base Homogeneous Ziegler-Natta Catalysts", **Makromolekulare Chemie-Macromolecular Symposia** 66 (1993) : 191-202.

Gassman, P.G. and Callstrom, M.R. "Isolation, and Partial Characterization by XPS, of Two Distinct Catalysts in the Ziegler-Natta Polymerization of Ethylene", **Journal of the American Chemical Society** 109 (1987) : 7875-7876.

Giannetti, E.; Nicolett, G. M. and Mazzocchi, R. "Homogeneous Ziegler-Natta Catalysis II. Ethylene Polymerization by IVB Transition Metal Complexes/Methyl-aluminoxane Catalyst Systems", **Journal of Polymer Science: Polymer Chemistry Edition** 23 (1985) : 2117-2134.

Gupta, V. K.; Satish, S. and Bhardwaj, I. S. "Metallocene Complexes of Group 4 Elements in the Polymerization of Monoolefins", **Journal of Molecular Science–Reviews in Macromolecular Chemistry and Physics** C34 (3) (1994): 439-514.

Herfert, H.; Montag, P. and Fink, G. "Elementary Processes of The Ziegler Catalysis.7. Ethylene, Alpha-Olefin and Norbornene Copolymerization with The Stereorigid Catalyst Systems ipr[FluCp]$ZrCl_2$/MAO and $Me_2Si[Ind]_2ZrCl_2$/ MAO", **Makromolekulare Chemie-Macromolecular Chemistry and Physics** 194 (1993) : 3167-3182.

Hlatky, G.G.; Turner, H.W. and Eckman, R.R. "Ionic, Base-Free Zirconocene Catalysts for Ethylene Polymerization", **Journal of the American Chemical Society** 112 (1989) : 2728-2729.

Imanishi, Y. and Naga, N. "Recent Developments in Olefin Polymerizations with Transition Metal Catalysts", **Progress in Polymer Science** 26 (2001) : 1147-1198.

Ioku, A.; Hasan, T.; Shiono, T. and Ikeda, T. "Effect of Cocatalysts on Propene Polymerization with [*t*-BuNSiMe$_2$(C$_5$Me$_4$)]TiMe$_2$", **Macromolecular Chemistry and Physics** 203 (2002): 748-755.

Janiak, C. and Lassahn, P.G. "Metal Catalysts for The Vinyl Polymerization of Norbornene", **Journal of Molecular Catalysis A: Chemical** 166 (2001):193-209.

Jeong, B.-G.; Nam, D.-W.; Hong, S.-D.; Lee, S.-G.; Park, Y.-W. and Song, K.-H. "Influence of Process Parameters on Ethylene-Norbornene Copolymers Made by Using [2,2'-Methylenebis(1,3-dimethylcyclopentadienyl)]-Zirconium Dichloride and MAO", **Korean Journal of Chemical Engineering** 20 (2003) : 22-26.

Kaminsky, W. "New Polymers by Metallocene Catalysis", **Macromolecular Chemistry and Physics** 197 (1996): 3907-3945.

Kaminsky, W., **Metalorganic Catalysts for Synthesis and Polymerization**, Springer (1999) : 3-13.

Kaminsky, W. "Polymerization Catalysis", **Catalysis Today** 62 (2000): 23-34.

Kaminsky, W. and Laban, A. "Metallocene Catalysts", **Applied Catalysis A: General** 222 (2001): 47-61.

Kaminsky, W.; Lenk, S.; Scholz, V.; Roesky, H.W. and Herzog, A. "Fluorinated Half-Sandwich Complexes as Catalysts in Syndiospecific Styrene Polymerization", **Macromolecules** 30 (1997): 7647-7650.

Kaminsky, W. and Noll, A. "Copolymerization of norbornene and ethene with homogenous zirconocenes/methylaluminoxane catalysts", **Polymer Bulletin** 31 (1993) : 175-182.

Kaminsky, W.; Rabe, O.; Schauwienold, A.-M.; Schupfiner, G.U.; Hanss, J. and Kppf, J. "Crystal Structure and Propene Polymerization Characteristics of bridged-Zirconocene Catalysts", **Journal of Organometallic Chemistry** 497 (1995) : 181-193.

Kaminsky, W. and Spiehl, R. "Copolymerization of cycloalkenes with ethylene in presence of chiral zirconocene catalysts", **Macromolecular Chemistry** 190 (1989) : 515-526.

Koivumaki, J. and Seppala, J. V. "Comparison of ethylene-propylene copolymers obtained with Ti, V, and Zr catalyst systems", **Polymer Bulletin** 31 (1993): 441-448.

Kravchenko, R., and Waymouth, R. M. "Ethylene-Propylene Copolymerization with 2-Arylindene Zirconocenes", **Macromolecules** 31 (1998): 1-6.

Lee, B.Y.; Kim, Y.H.; Won, Y.C.; Han, J.W.; Suh, W.H.; Lee, I.S.; Chung, Y.K. and Song, K.H. "Synthesis of [2,2'-Methylenebis(1,3-dimethylcyclopentadienyl)]-Zirconium Dichloride and Its Reactivity in Ethylene-Norbornene Copolymerization", **Organometallics** 21 (2002): 1500-1503.

Long, N. J., **Metallocenes: An introduction to sandwich complexes,** London: Blackwell Science., (1998) : 227-235.

Naga, N. and Imanishi, Y. "Copolymerization of Ethylene and Cycopentene with Zirconocene Catalysts: Effects of Ligand Structure of Zirconocenes", **Macromolecular Chemistry and Physics** 203 (2002): 159-165.

Naga, N. and Imanishi, Y. "Copolymerization of Ethylene and 1,5-Hexadiene with Zirconocene Catalysts", **Macromolecular Chemistry and Physics** 203 (2002): 771-777

Naga, N., Ohbayashi, Y., and Mizunuma, K. "Study of molecular size in ethylene-propene copolymerization with zirconocene and hafnocene catalysts", **Macromolecular Rapid Communication** 18 (1997): 837-851.

Ottani, S., and Porter, R. S. A Calorimetric Investigation on High Molecular Weight Polyethylene Reactor Powders. **Journal of Polymer Science: Part B: Polymer Physics** 29 (1991): 1179-1188.

Resconi, L.; Bossi, S. and Abis, L. "Study on the Role of Methylalumoxane in Homogeneous Olefin Polymerization", **Macromolecules** 23 (1990): 4489-4491.

Resconi, L.; Piemontesi, F.; Franciscono, G.; Abis, L. and Fiorani, T. "Olefin Polymerization at Bis(pentamethylcyclopentadienyl) Zirconium and Hafnium Centers-Chain-Transfer Mechanisms", **Journal of the American Chemical Society** 114 (3) (1992): 1025-1032.

Ruchatz, D. and Fink, G. "Ethene-Norbornene Copolymerization Using Homogeneous Metallocene and Half-Sandwich Catalysts: Kinetics and Relationships between Catalyst Structure and Polymer Structure. 1. Kinetics of the Ethene-Norbornene Copolymerization Using the [(Isopropylidene)(η^5-inden-1-η^5-cyclopentadienyl)] zirconium Dichloride/Methylaluminoxane Catalyst", **Macromolecules** 31 (1998): 4669-4673

Scheirs, J. and Kaminsky, W., **Metallocene-Based Polyolefins: Preparation, Properties and Technology**, Volume 1, John Wiley & Sons., (1999): 3-102.

Siedle, A.R.; Newmark, R.A.; Lamanna, W.M. and Schroepfer, J.N. "Exchange Reactions Between Dialkylzirconocene and Alkylaluminium Compounds", **Polyhedron** 114 (1990) : 301-308.

Sinn, H. Proposals for Structure and Effect of Methylaluminoxane Based on Mass Balances and Phase Separation Experiments. **Macromolecular Symposia** 97 (1995): 27-52.

Tritto, I.; Boggioni, L.; Sacchi, M. C.and Locatelli, P. "Cyclic Olefin Polymerization and Relationships between Addition and Ring Opening Metathesis Polymerization", **Journal of Molecular Catalysis A:Chemical** 133 (1998) : 139-150.

Tritto, I.; Boggioni, L.; Sacchi, M. C.; Locatelli, P.; Ferro, D.R. and Provasoli, A. "Ethylene-Norbornene Copolymers Prepare with Metallocene-based Catlysts : New Sequence Assingments by ^{13}C-NMR", **Macromolecular Rapid Communication** 20 (1999) : 279-283.

Tritto, I.; Marestin, C.; Boggioni, L.; Sacchi, M. C.; Brintzinger, H.-H. and Ferro, D.R. "Stereoregular and Stereoirregular Alternating Ethylene-Norbornene Copolymers", **Macromolecules** 34 (2001): 5770-5777

Tritto, I.; Mealares, C.; Sacchi, M. C. and Locatelli, P. "Methylaluminoxane: NMR Analysis, Cryoscopic Measurements and Cocatalytic Ability in Ethylene Polymerization", **Macromolecular Chemistry and Physics** 198 (1997): 3963-3977.

Tsi, W.M. and Chien, J.C.W. "Silolene-bridge Zirconocenium Polymerization Catalysts", **Journal of Polymer Science: Part A: Polymer Chemistry** : 32 (1994) 149-158.

Xie, T.; Mcauley, K.B.; Hsu, J.C.C. and Bacon, D.W. "Gas Phase Ethylene Polymerization: Production Processes, Polymer Properties, and Reactor Modeling", **Industrial & Engineering Chemistry Research** 33 (1994): 449-479.

Yang, X.; Stern, C.L. and Marks, T.J. "Cation-like Homogeneous Olefin Polymerization Catalysts Based upon Zirconocene Alkyls and Tris(pentafluorophenyl) borane", **Journal of the American Chemical Society** 113 (1991) : 3623-3625.

Yaws, C.L., **Chemical Properties Handbook**, McGraw-Hill, (1999) : 340-363.

Young, M.-J.; Chang, W.-S. and M. Ma, C.-C. "Polymerization Kinetics and Modeling of A Metallocene Cyclic Olefin Copolymer System", **European Polymer Journal** 39 (2003) 165-171.

Ystenes, M.; Eilertsen, J.L.; Ott, M.; Rytter, E. and Stovneng, J.A. "Experimental and Theoretical Investigations of The Structure of Methylaluminoxane (MAO) Cocataysts for Olefin Polymerization", **Journal of Polymer Science: Part A: Polymer Chemistry** 38 (2000) : 3106-3127.

Zucchini, U.; Dallocco, T. and Resconi, L. "Ziegler-Natta Catalysis for The Polyolefin Industry Present Status and Perspectives", **Indian Journal of Technology** 31 (1993) : 247-262.

APPENDICES

APPENDIX A

NUCLEAR MAGNETIC RESONANCE

A.1. Triad Distribution of ethylene/norbornene copolymer and norbornene insertion calculated from ^{13}C-NMR spectrum

Table A.1. The assignment of ^{13}C-NMR spectrum of the ethylene/norbornene copolymer

Assignts	Chemical shift (ppm)	Sequence type	Sequences	Ref.
C2/C3	47.6-48.3	Dyad	NENNE	Tritto *et al.*(1999)
C1/C4	42.0-42.6	Alternative	NENEN	Tritto *et al.*(1998)
C7	31.9-33.5	Dyad, Isolated	NENNE,EENEE	Tritto *et al.*(2000)
C5/C6+CH_2	28.5-31.2	Dyad, Isolated, Alternative	NENNE, EENEE, NENEN	Tritto *et al.*(1999) Ferro *et al.*(1999)

The norbornene content in the copolymers were calculated from the ^{13}C-NMR spectrum by the following equation (Tritto *et al.*, 2001) ;

$$mol\%NB = \frac{[2I_{C7} + I_{C1-C4} + I_{C2-C3}]\frac{1}{3}}{I_{C5-C6+CH_2}} \times 100$$

$I_{C5/C6+CH2}$ were calculated from signals between 26 and 30 ppm; I_{C7} from the signals between 30 and 32 ppm; I_{C1-C4} from the signals between 31 and 41 ppm and I_{C2-C3} from the signals between 45 and 49 ppm. Where $I_{C2/3}$, $I_{C1/4}$ and I_{C7} are the peak intensities of C2/3, C1/4 and C7 carbons in norbornene units, and I_{CH2} is the summation of those of ethylene carbon and C5/6 carbons as shown Figure A-1

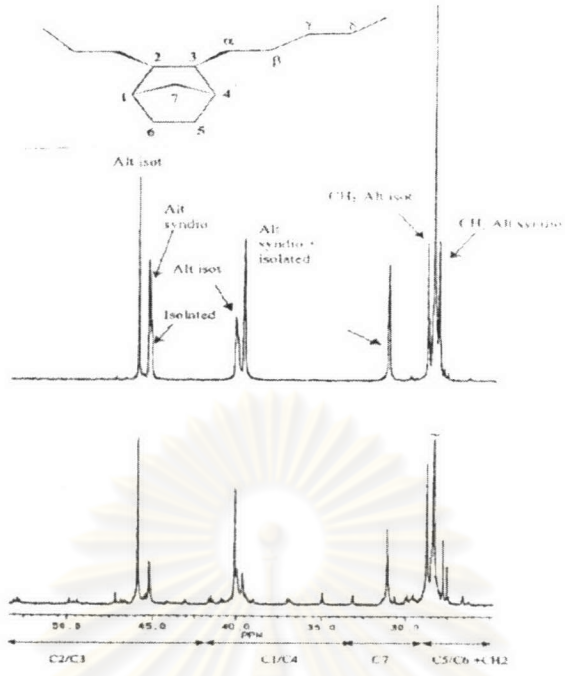

Figure A-1. ^{13}C-NMR spectrum of Ethylene/Norbornen copolymer (Tritto *et al.*, 2001)

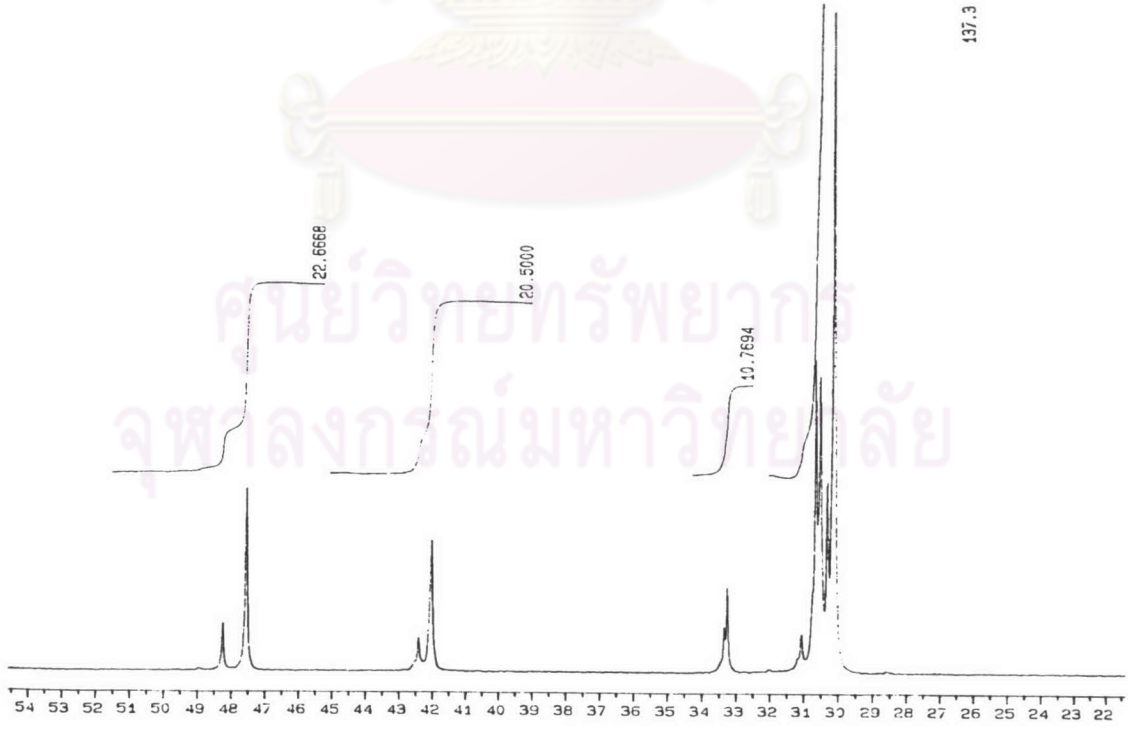

Figure A-2. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer perform in toluene for 15 min (Table 4.6.)

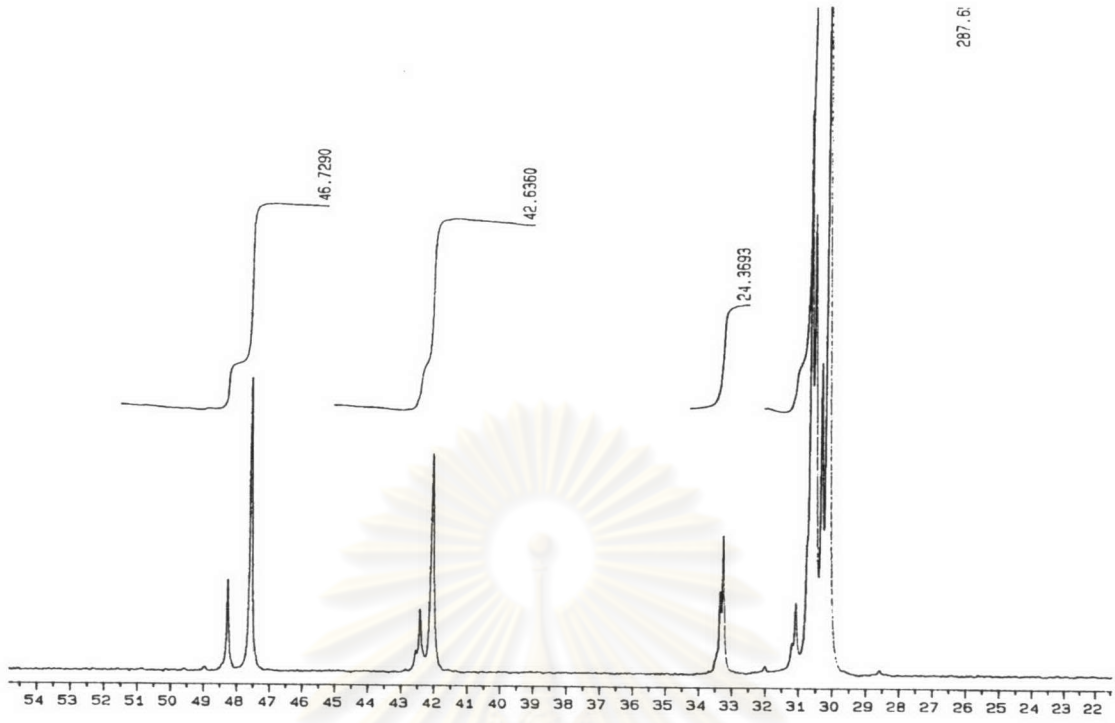

Figure A-3. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer perform in toluene for 30 min (Table 4.6.)

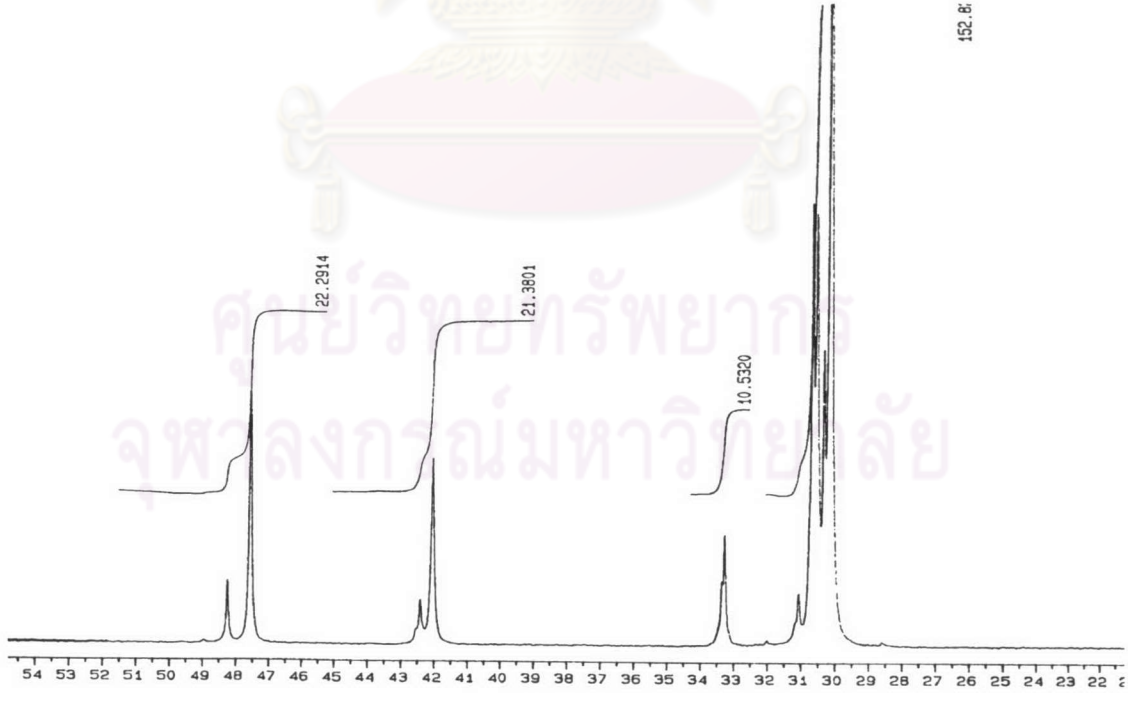

Figure A-4. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer perform in toluene for 60 min (Table 4.6.)

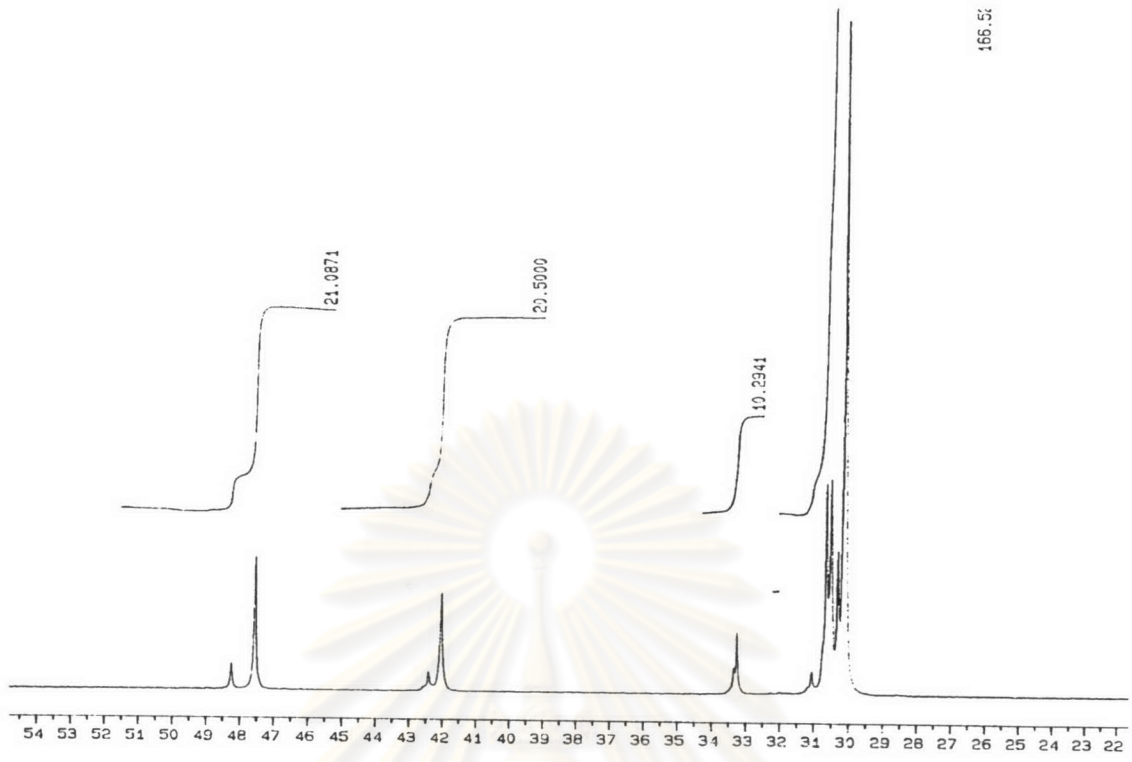

Figure A-5. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer perform in toluene for 120 min (Table 4.6.)

Figure A-6. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer perform in xylene for 15 min (Table 4.6.)

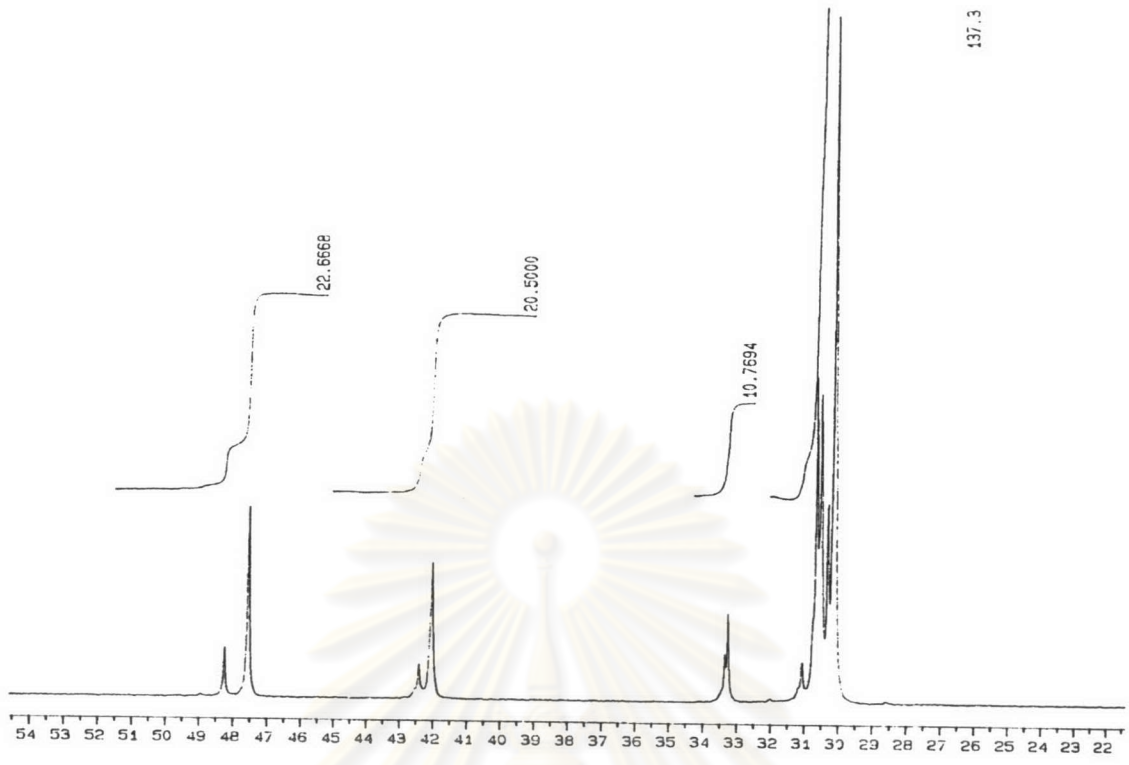

Figure A-7. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer perform in xylene for 30 min (Table 4.6.)

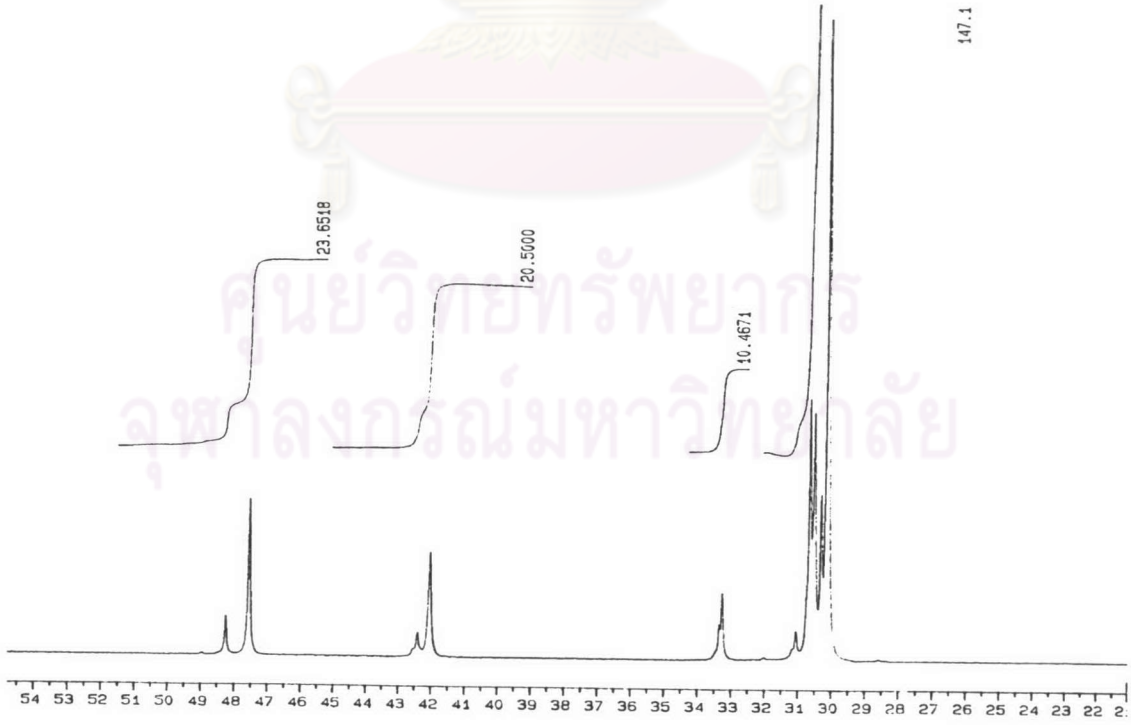

Figure A-8. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer perform in xylene for 60 min (Table 4.6.)

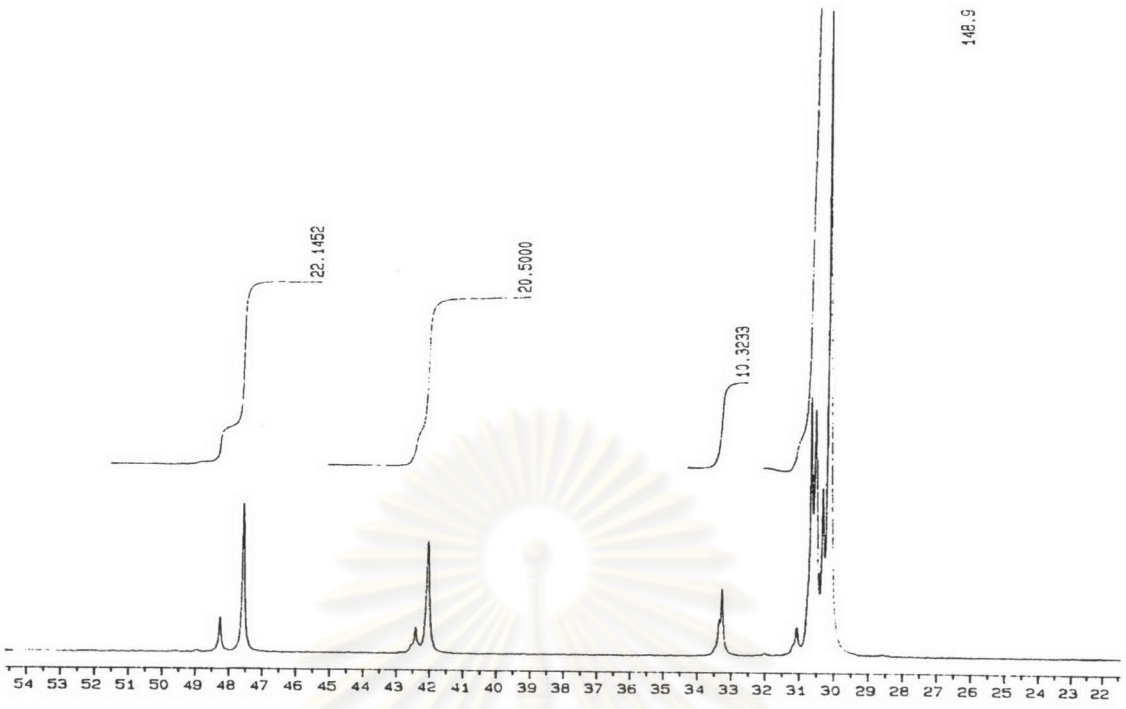

Figure A-9. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer perform in xylene for 120 min (Table 4.6.)

Figure A-10. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.1M of NB (Table 4.8.)

Figure A-11. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with $(n\text{-BuCp})_2ZrCl_2$, 0.1M of NB (Table 4.8.)

Figure A-12. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with Cp_2ZrCl_2 , 0.1M of NB(Table 4.8.)

Figure A-13. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with Cp_2TiCl_2 , 0.1M of NB (Table 4.8.)

Figure A-14. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.033M of NB (Table 4.9.)

Figure A-15. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.047M of NB (Table 4.9.)

Figure A-16. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.067M of NB (Table 4.9.)

Figure A-17. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.133M of NB (Table 4.9.)

Figure A-18. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.2M of NB (Table 4.9.)

Figure A-19. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.247M of NB (Table 4.9.)

Figure A-20. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.3M of NB (Table 4.9.)

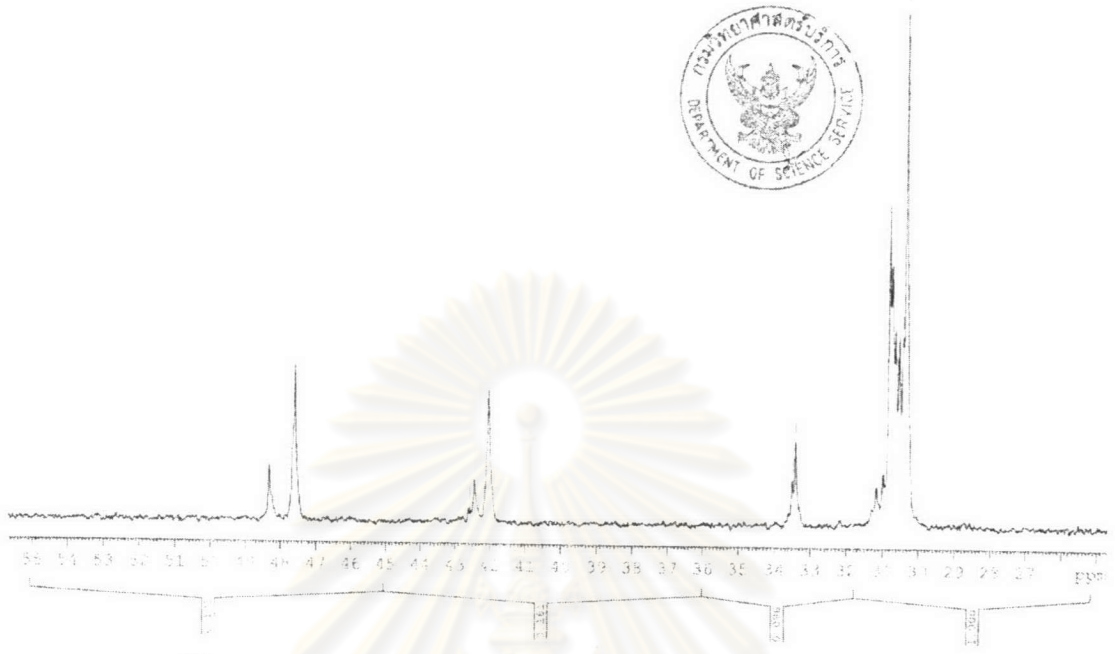

Figure A-21. ^{13}C-NMR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.4M of NB (Table 4.9.)

APPENDIX B

DIFFERENTIAL SCANNING CALORIMETRY

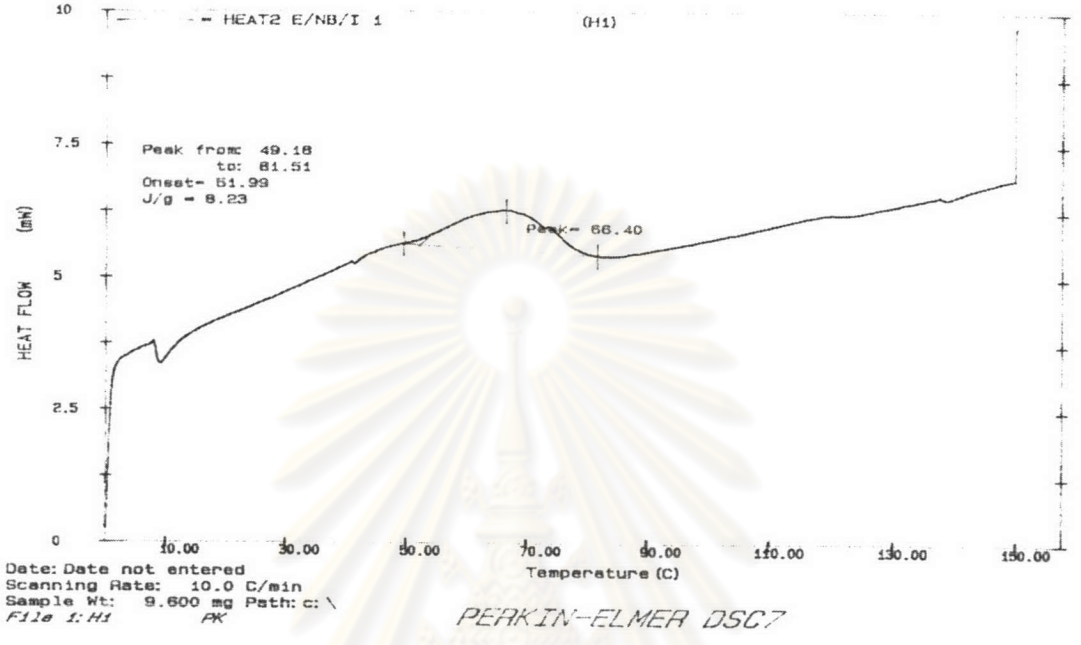

Figure B-1. DSC curve of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$, 0.1M of NB (Table 4.8.)

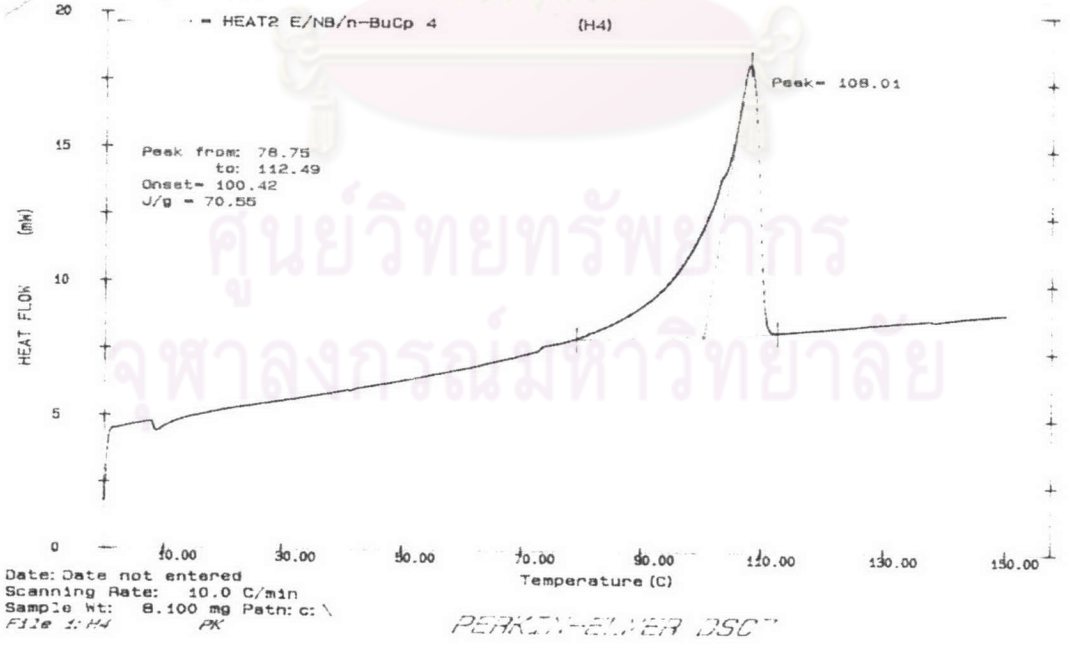

Figure B-2. DSC curve of Ethylene/Norbornene copolymer produced with (n-BuCp)$_2$ZrCl$_2$, 0.1M of NB (Table 4.8.)

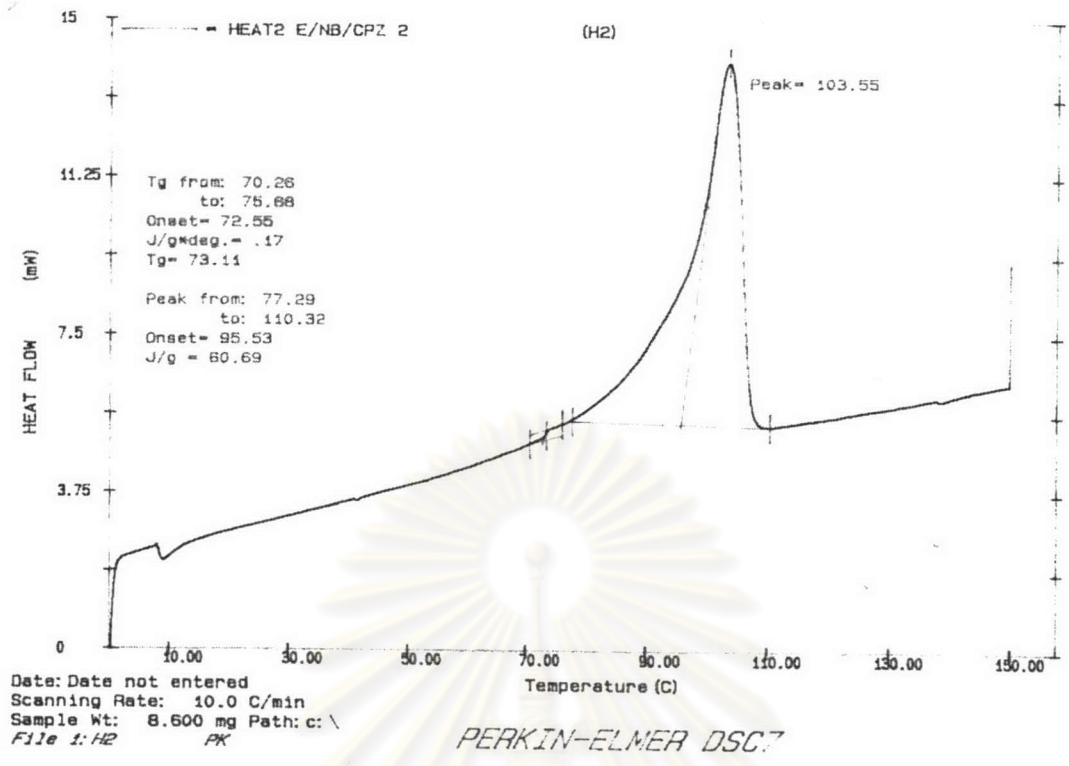

Figure B-3. DSC curve of Ethylene/Norbornene copolymer produced with Cp_2ZrCl_2 , 0.1M of NB (Table 4.8.)

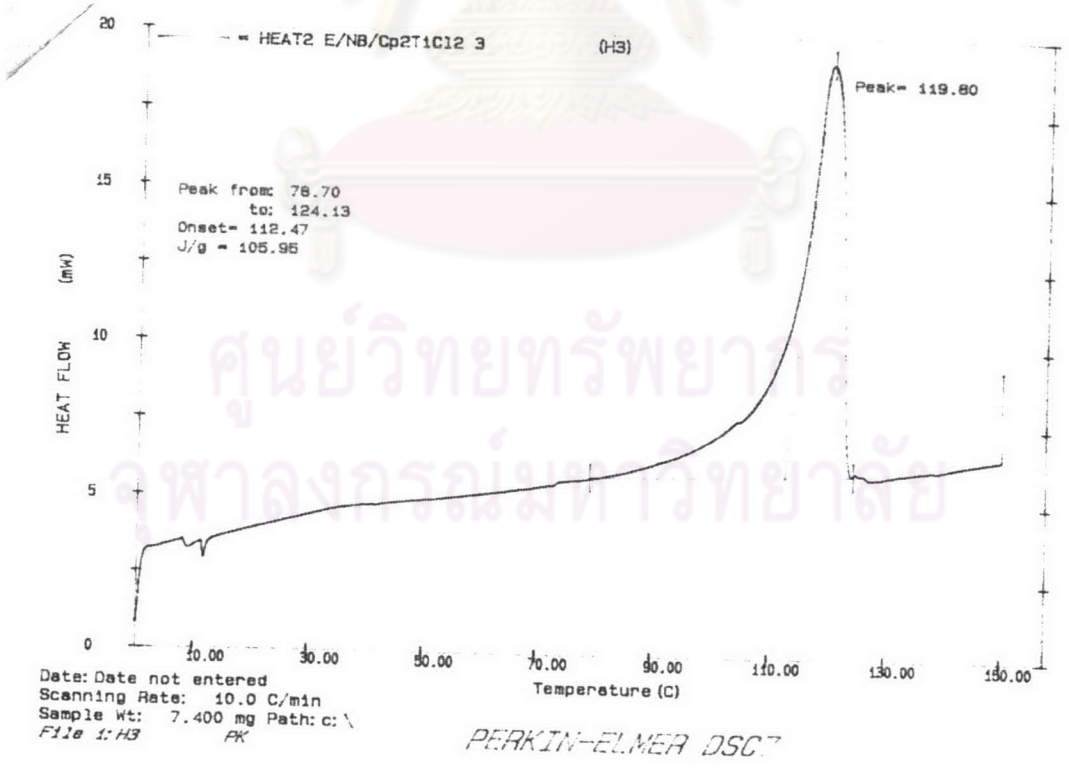

Figure B-4. DSC curve of Ethylene/Norbornene copolymer produced with Cp_2TiCl_2 , 0.1M of NB (Table 4.8.)

APPENDIX C

FOURIER TRANSFORMED INFRARED SPECTROSCOPY (FT-IR)

Table C-1. The assignment of infrared identification of polyethylene and ethylene/ norbornene copolymer (Amon and Phetsom, 1991)

Wavenumber (cm^{-1})	Assignment
720	C-H bending
1450-1475	$-CH_2$, CH_3 bending
1560-1680	C=C (cyclic)
2850-2920	$-CH_2$, CH_3 stretching

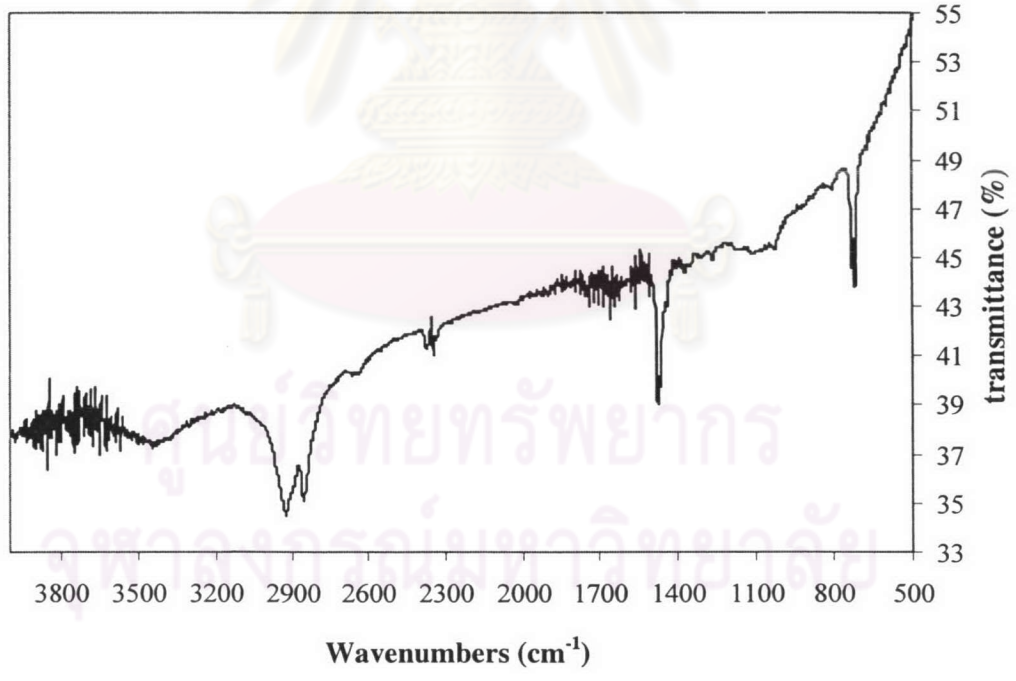

Figure C-1. IR spectrum of polyethylene produced with rac-Et[Ind]$_2$$ZrCl_2$/MAO catalyst system

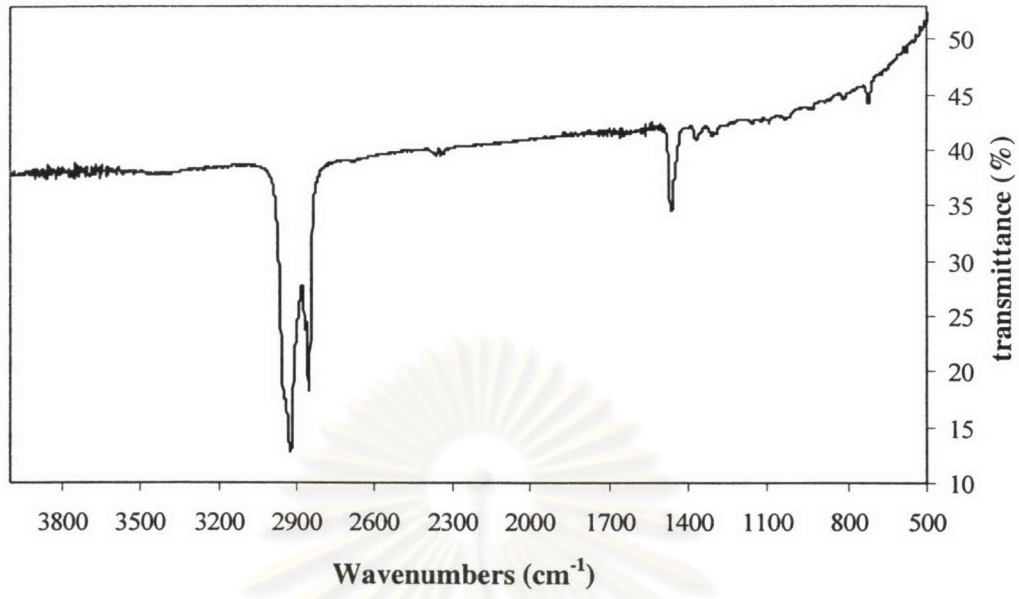

Figure C-2. IR spectrum of Ethylene/Norbornene copolymer produced with rac-Et[Ind]$_2$ZrCl$_2$/MAO , 0.247M of NB

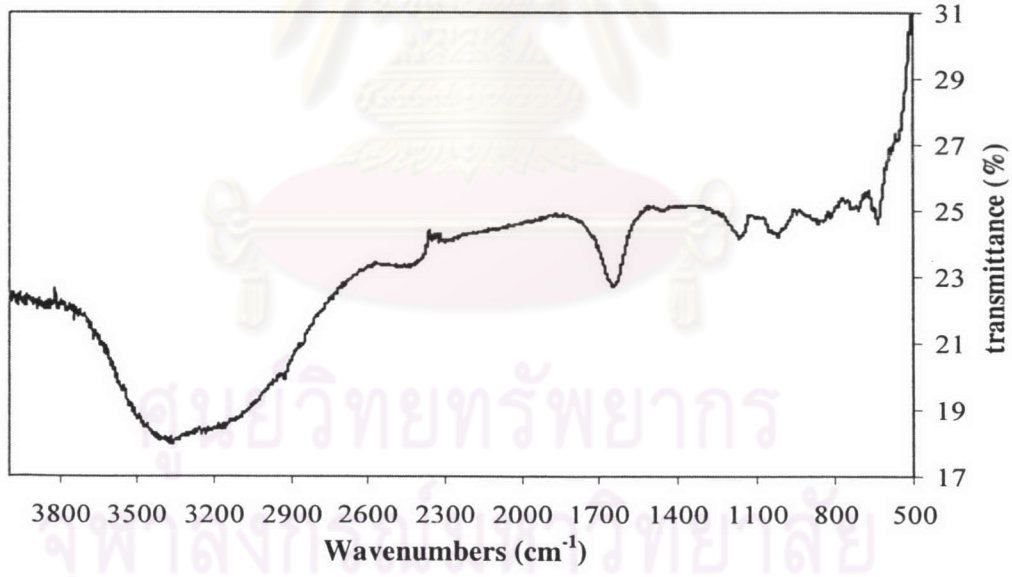

Figure C-3. IR spectrum of residual from Ethylene/Norbornene copolymerization medium in the insoluble part in hexane (0.133M of NB)

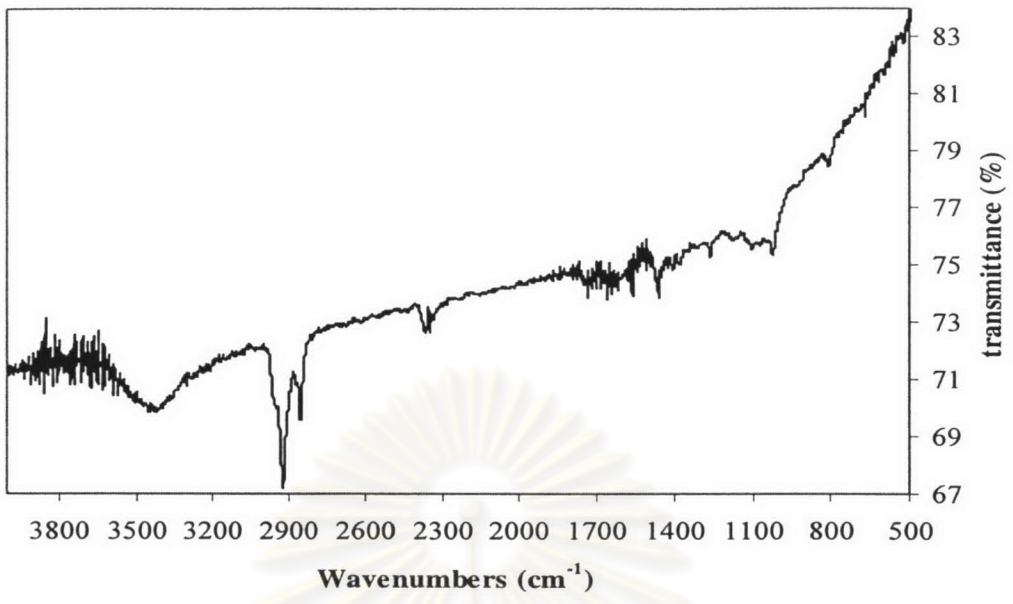

Figure C-4. IR spectrum of residual from Ethylene/Norbornene copolymerization medium in the soluble part in hexane (0.133M of NB)

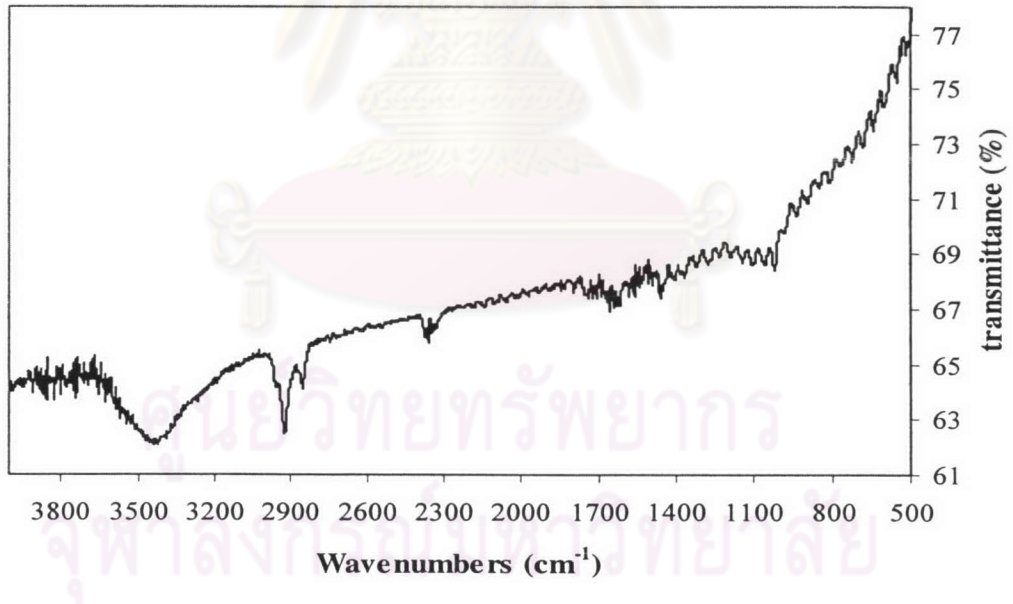

Figure C-5. IR spectrum of residual from Ethylene/Norbornene copolymerization medium in the soluble part in hexane (0.2M of NB)

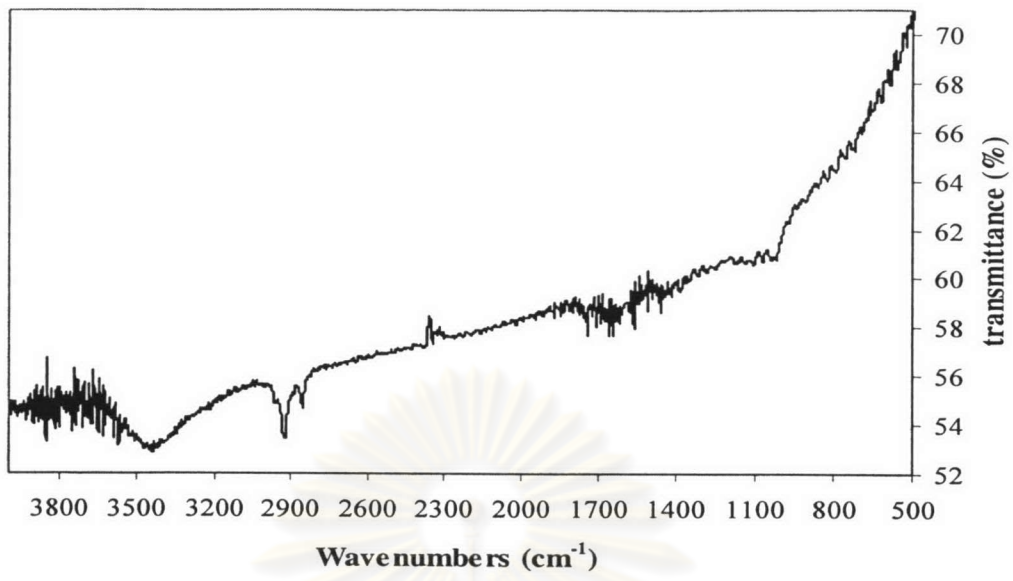

Figure C-6. IR spectrum of residual from Ethylene/Norbornene copolymerization medium in the soluble part in hexane (0.3M of NB)

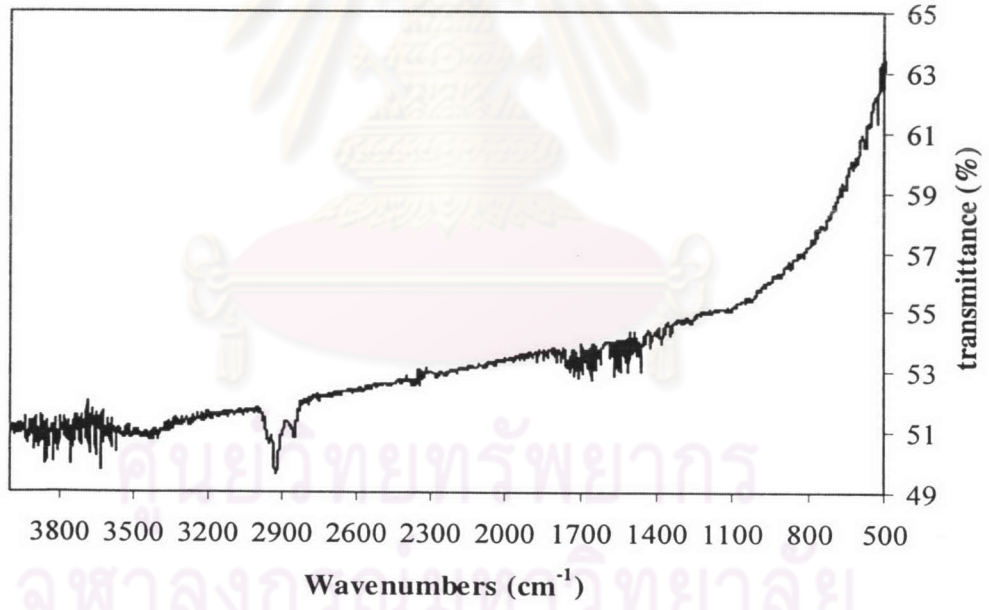

Figure C-7. IR spectrum of residual from Ethylene/Norbornene copolymerization medium in the soluble part in hexane (0.4M of NB)

VITAE

Miss Apiradee Khotdee was born in Bangkok, Thailand, on April 1, 1978. She received the degree of Bachelor of Science (Chemistry) from King's Mongkut University of Technology Thonburi on May 2000. She continued in Master Degree of Engineering from the Department of Chemical Engineering, Chulalongkron University on June 2001.