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APPENDICES

APPENDIX A

Differential Scanning Calorimeter

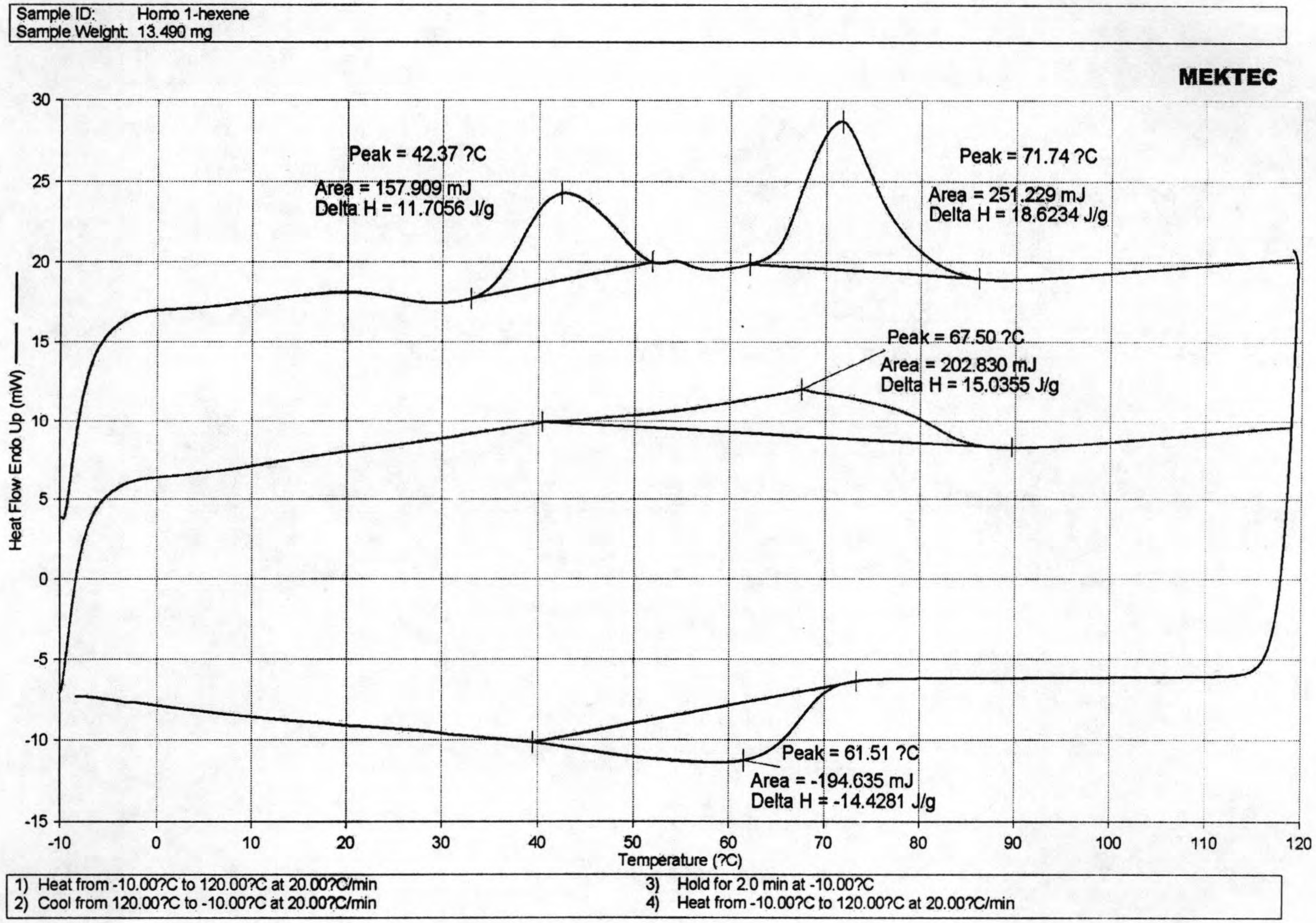

Figure A-1. DSC curve of LLDPE-homogenoeus at Al/Zr = 1135

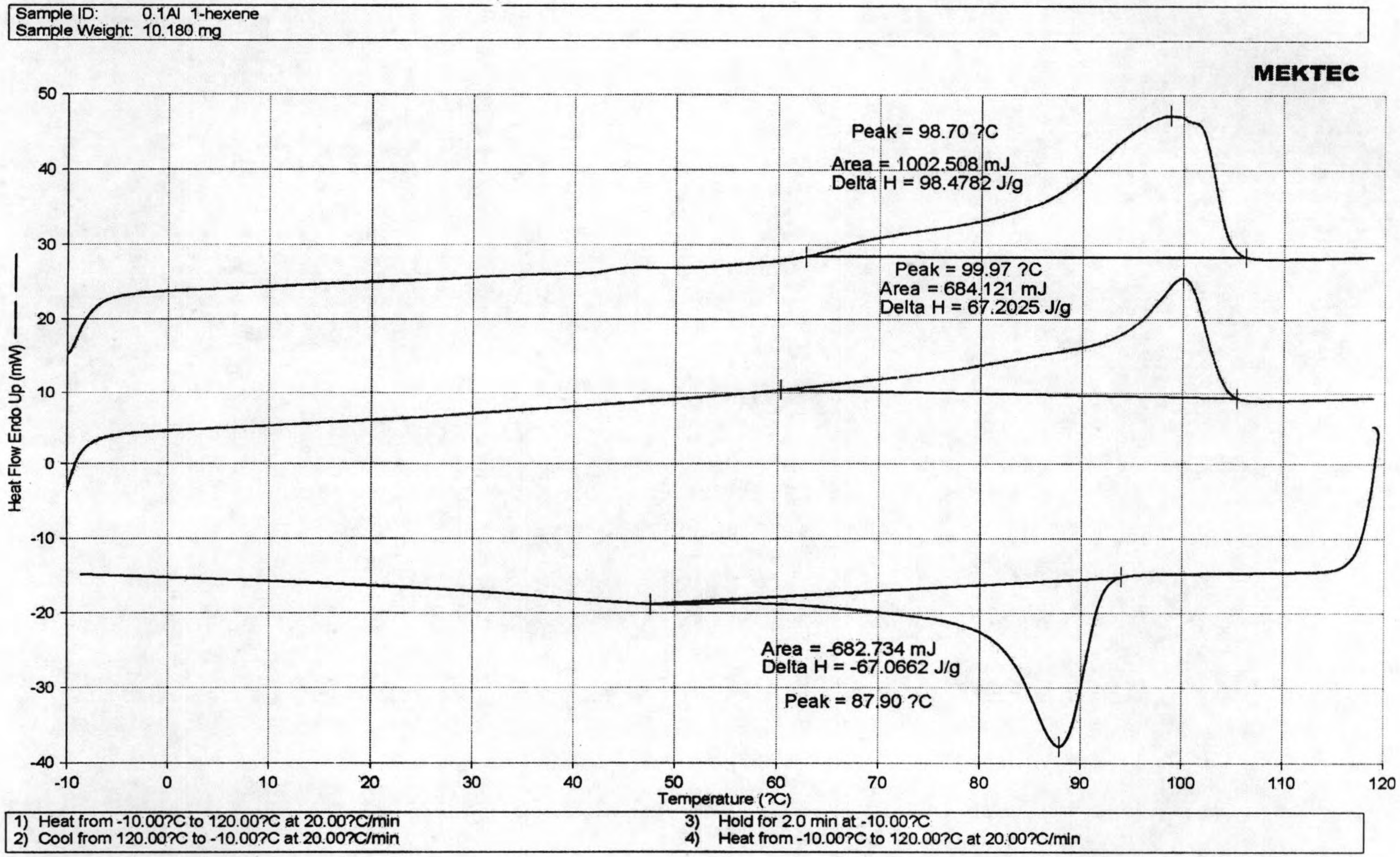

Figure A-2. DSC curve of LLDPE-nanocomposites with 0.1 g of nano-Alumina

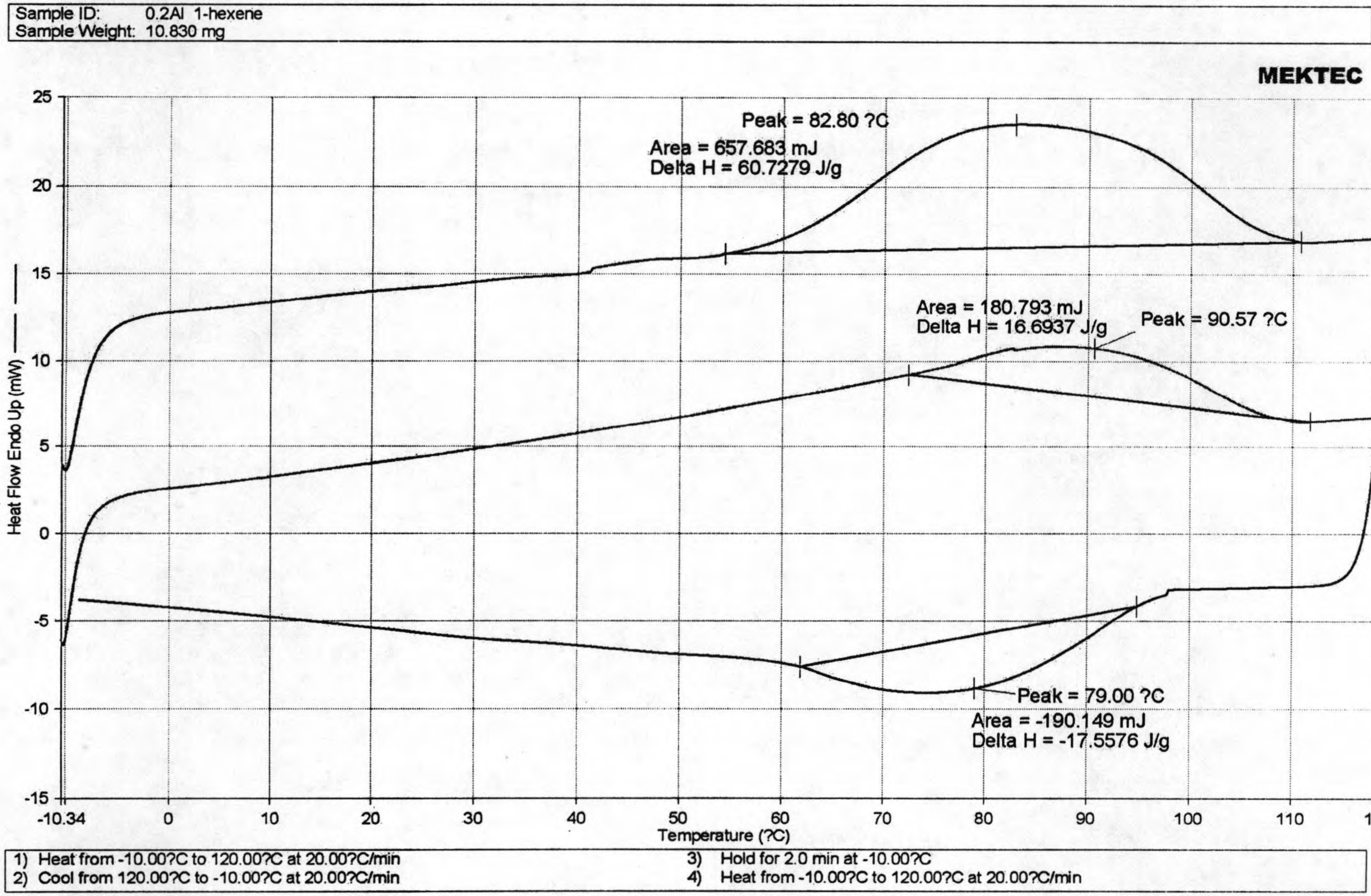

Figure A-3. DSC curve of LLDPE-nanocomposites with 0.2 g of nano-Alumina

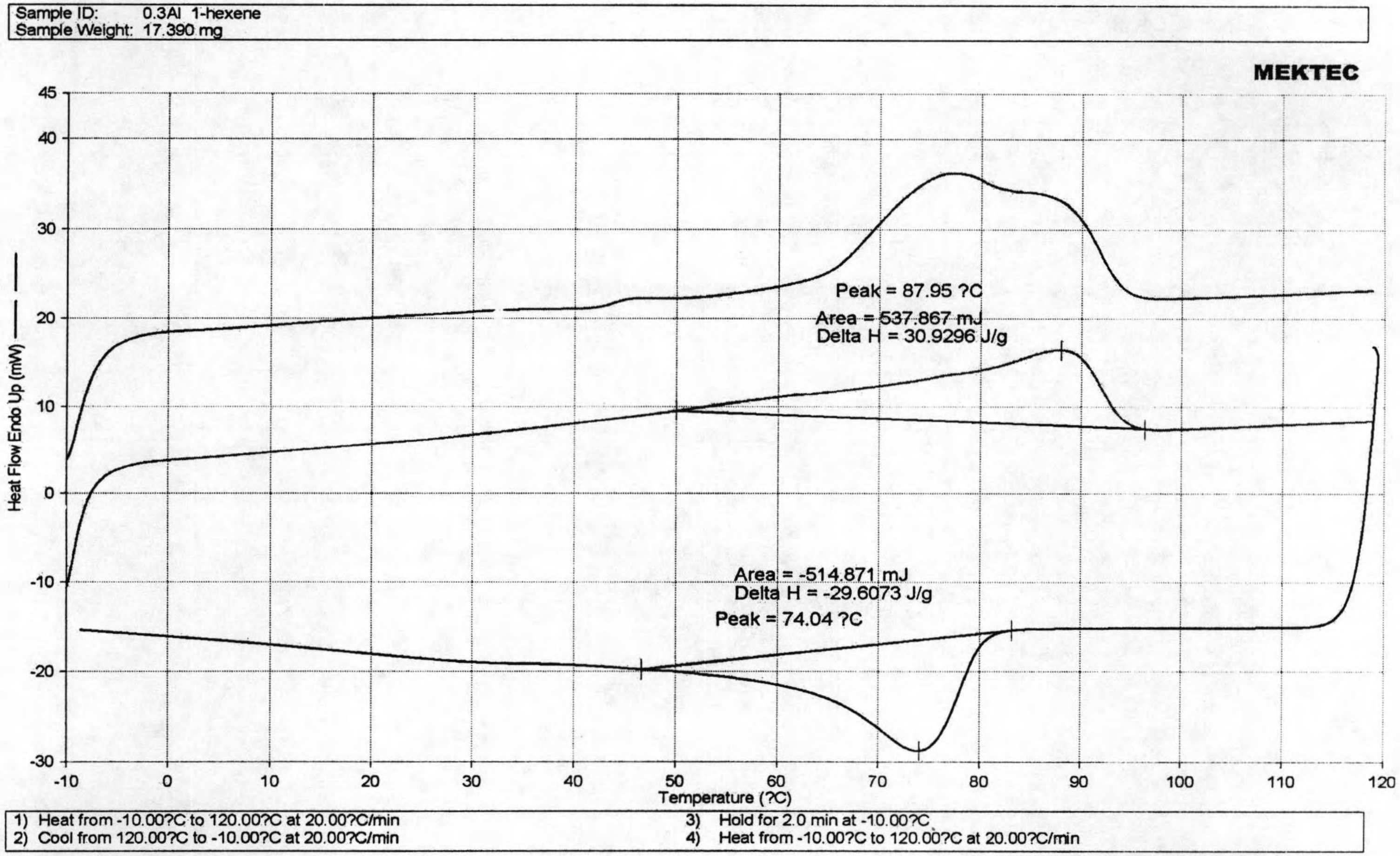

Figure A-4. DSC curve of LLDPE-nanocomposites with 0.3 g of nano-Alumina

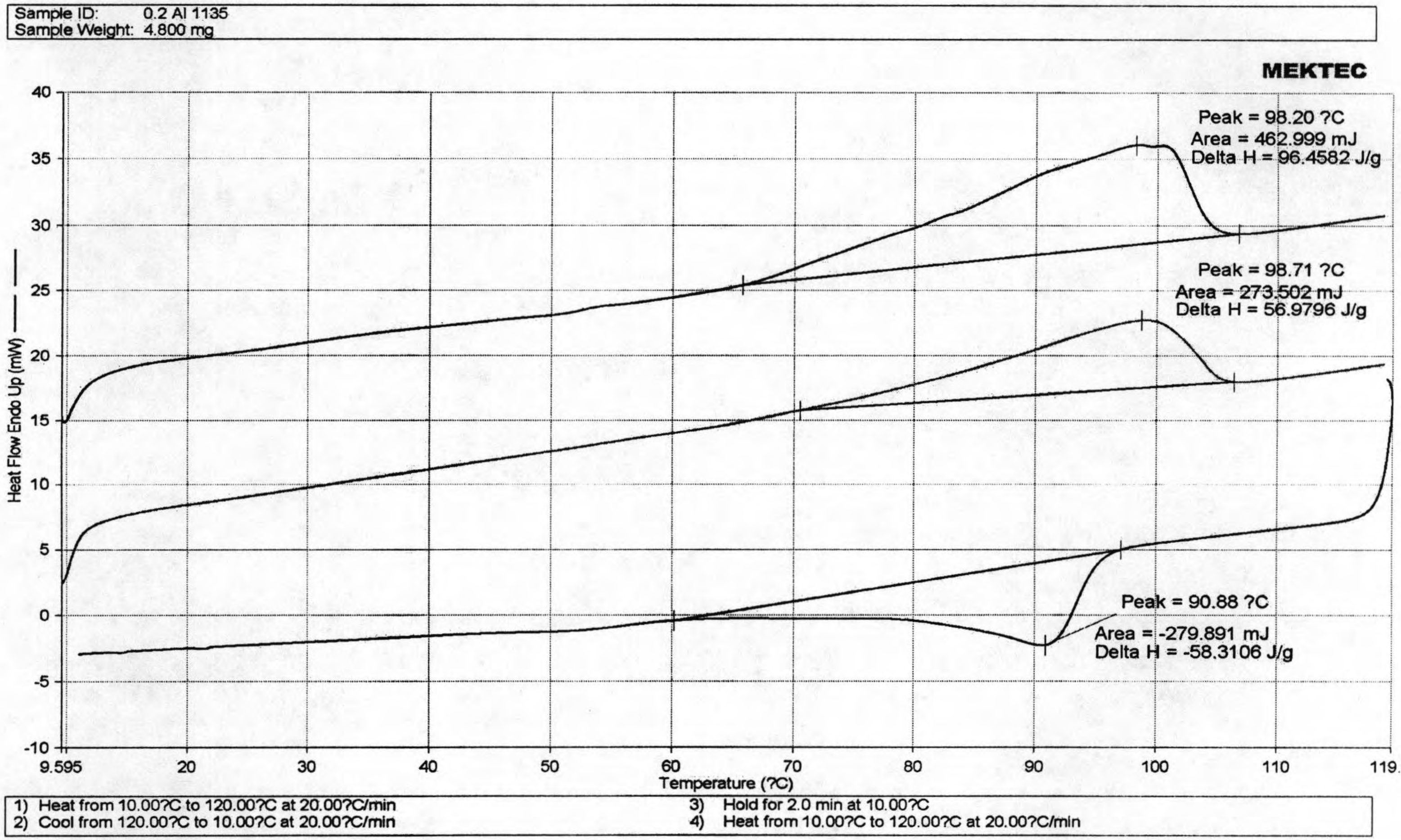

Figure A-5. DSC curve of LLDPE-nanocomposites with 0.2g of nano-Alumina (fixed ratio of Al/Zr)

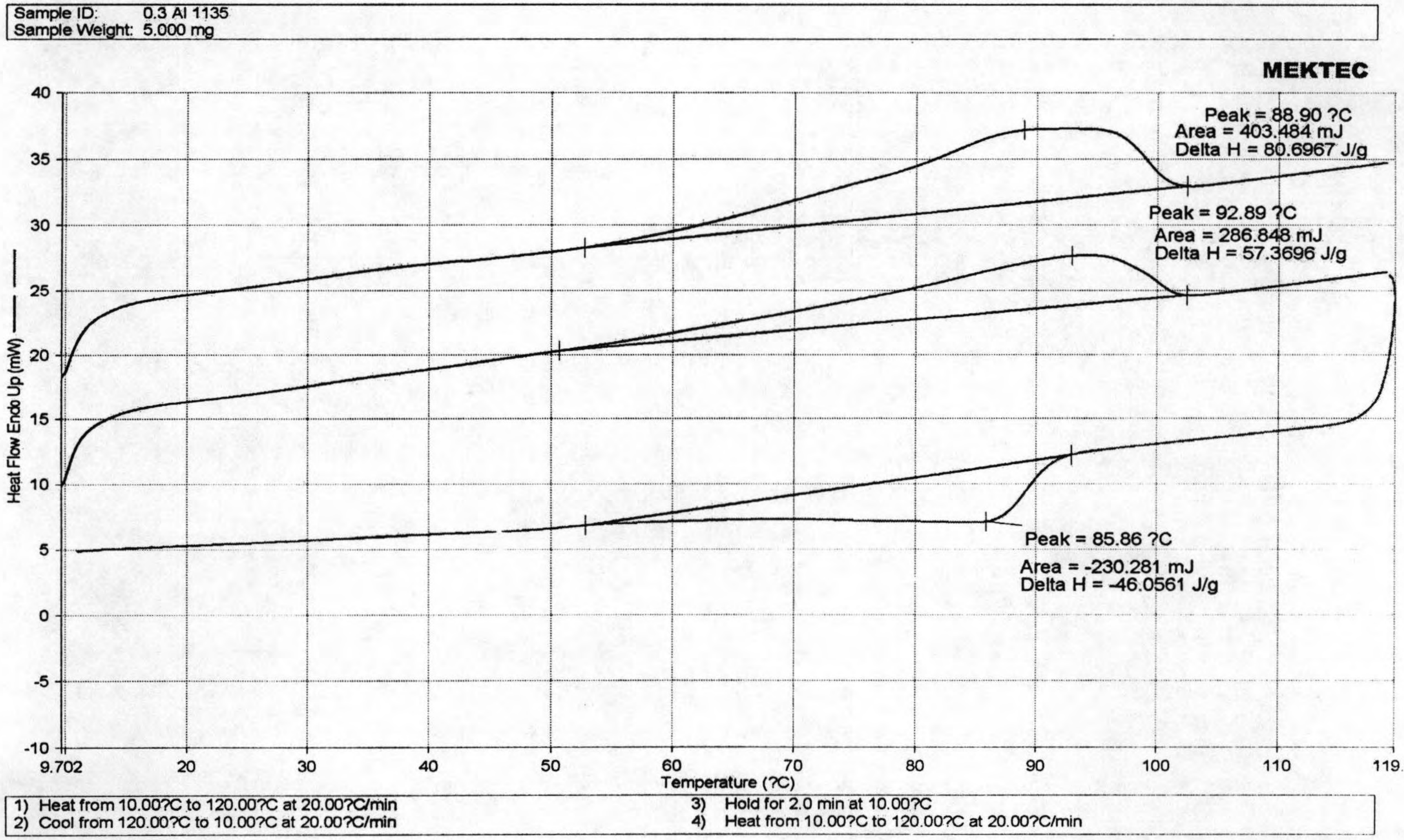

Figure A-6. DSC curve of LLDPE-nanocomposites with 0.3 g of nano Alumina (fixed ratio of Al/Zr)

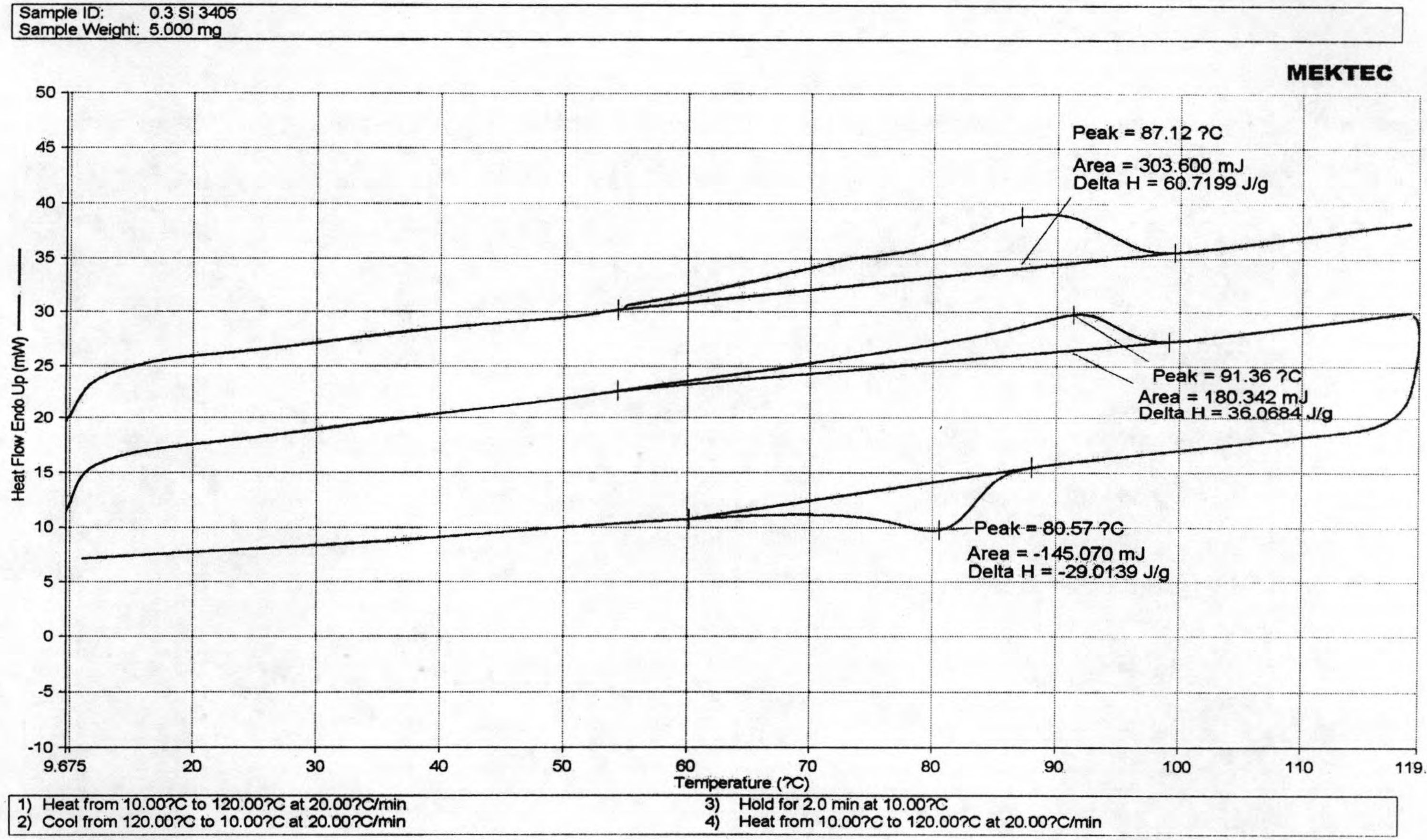

Figure A-7. DSC curve of LLDPE-nanocomposites with 0.3 g of nano-silica

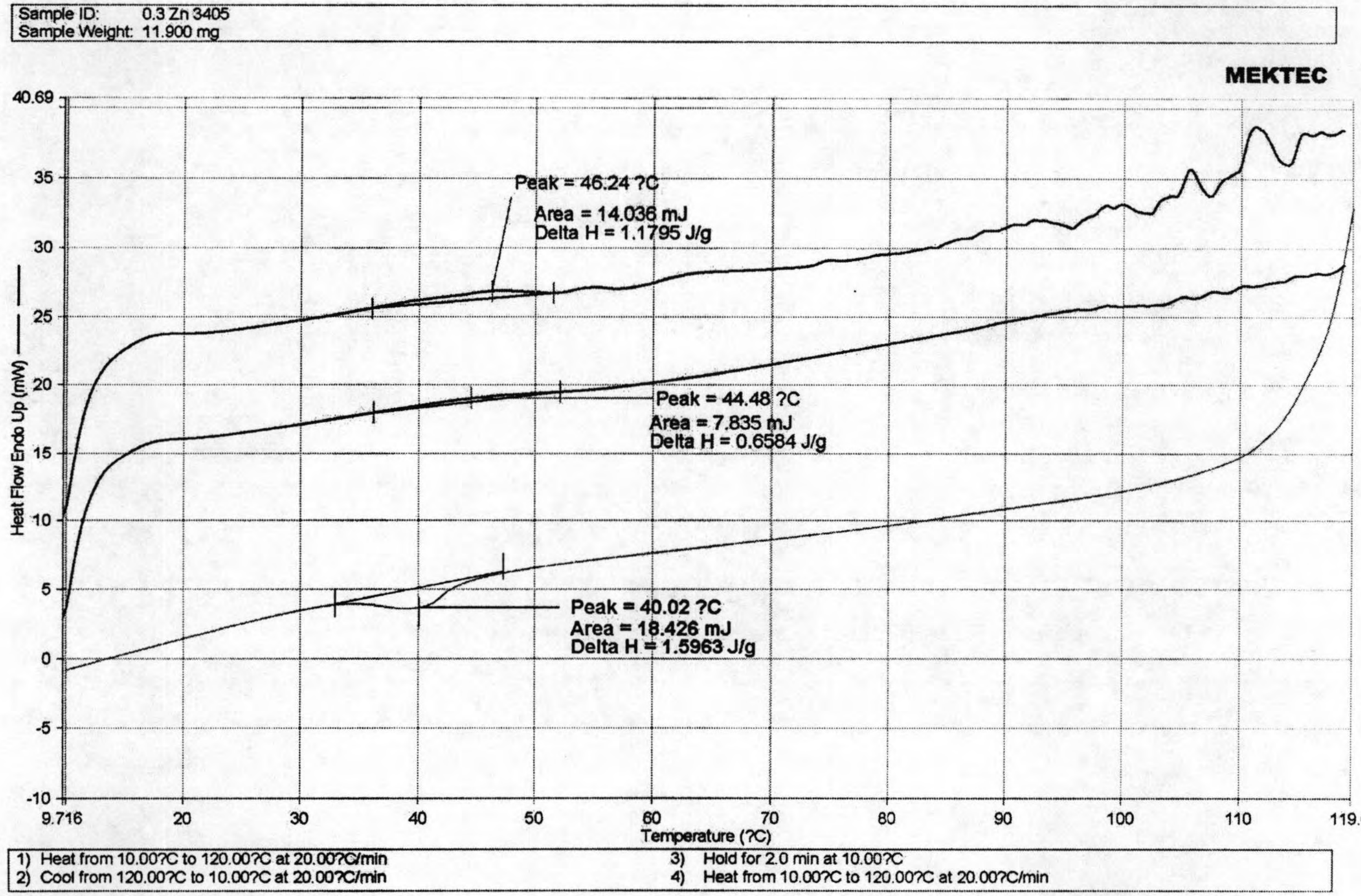

Figure A-8. DSC curve of LLDPE-nanocomposites with 0.3 g of nano-ZnO

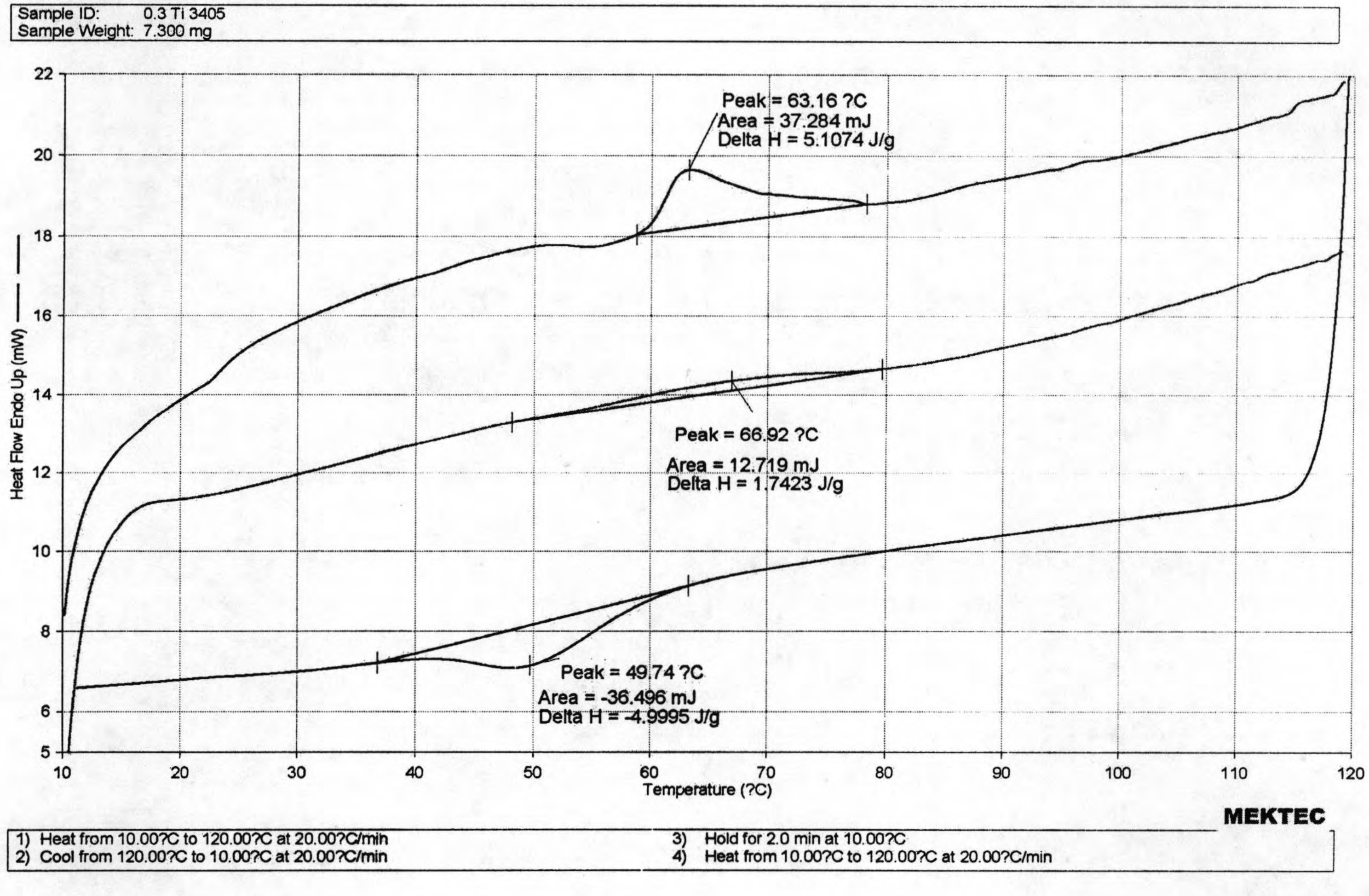

Figure A-9. DSC curve of LLDPE-nanocomposites with 0.3 g of nano-TiO_2

APPENDIX B

Nuclear Magnetic Resonance

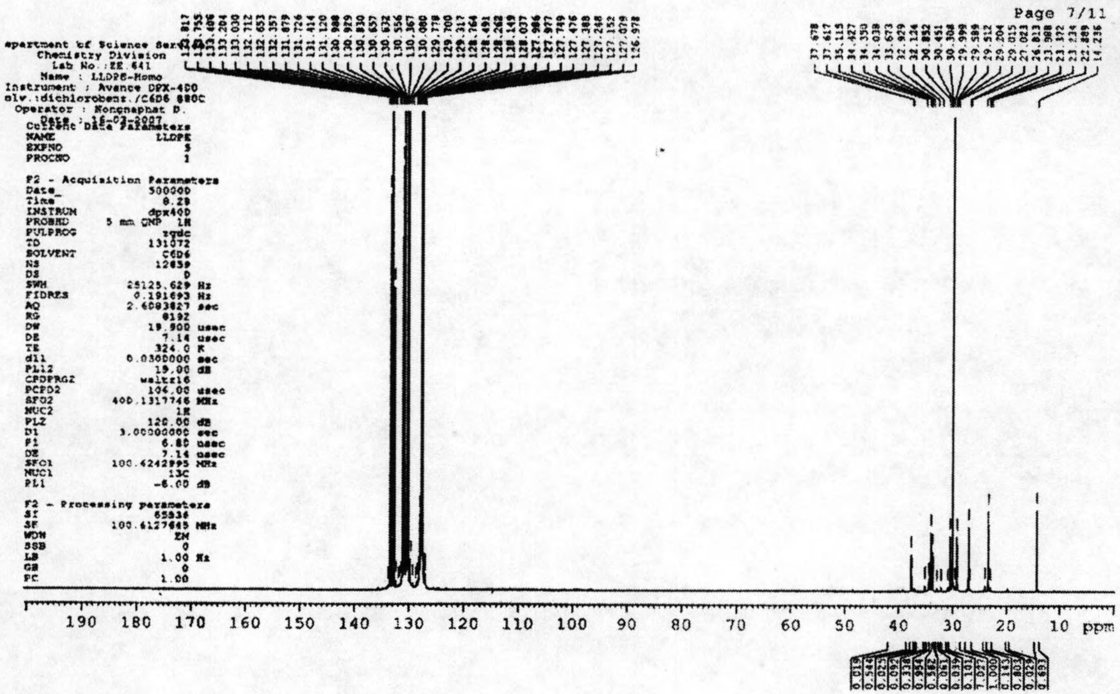

Figure B-1. ^{13}C-NMR spectrum of LLDPE with 1-hexene

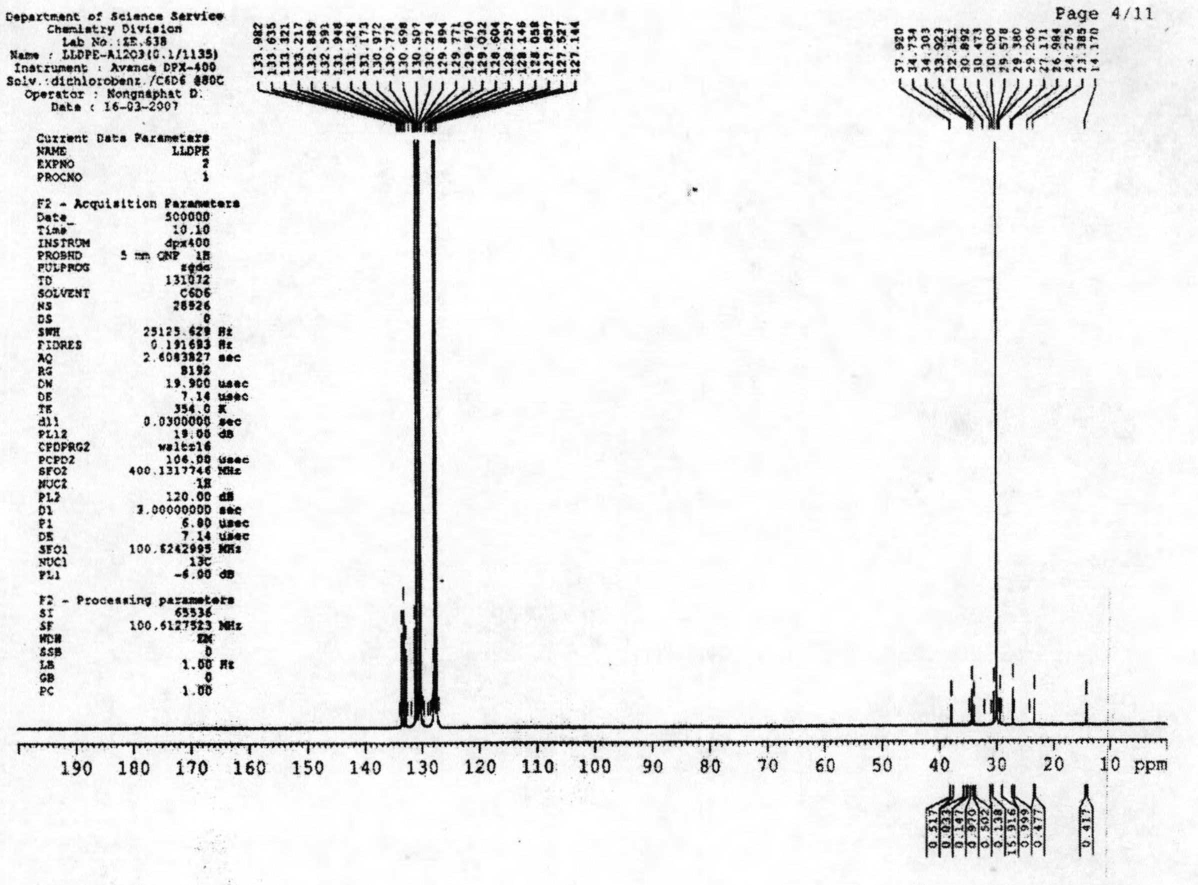

Figure B-2. ^{13}C-NMR spectrum of LLDPE-nanocomposites with 0.1g of nano-Alumina

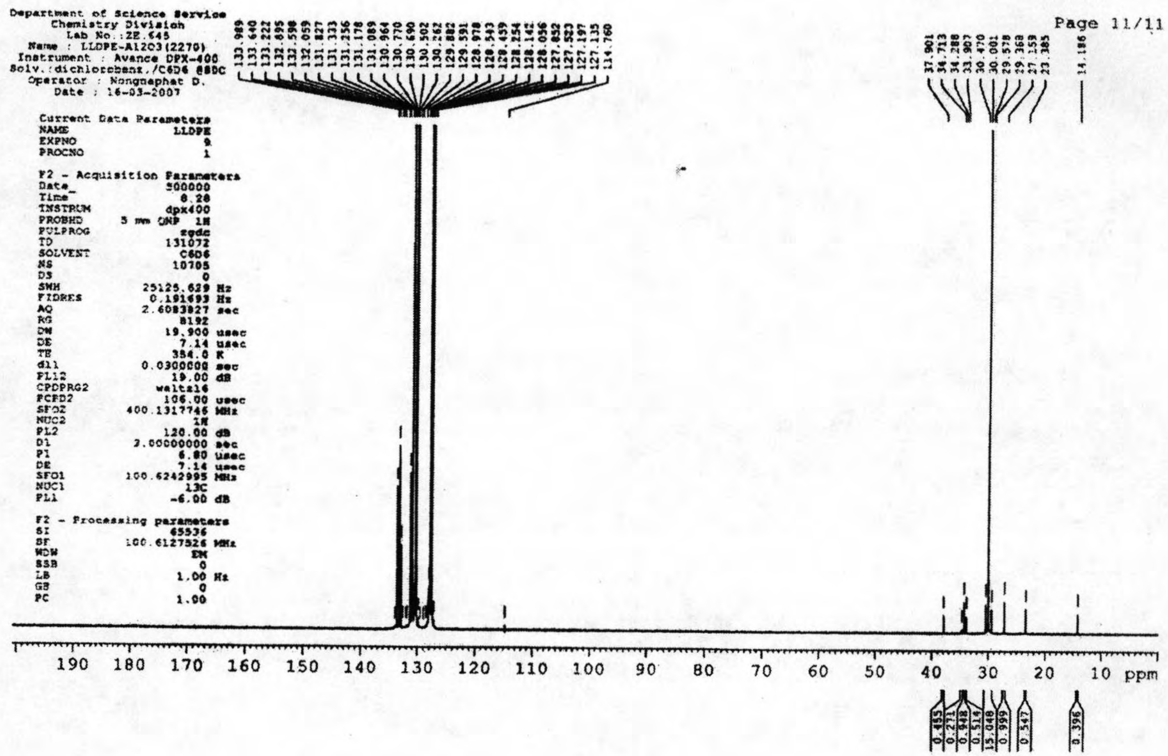

Figure B-3. ^{13}C-NMR spectrum of LLDPE-nanocomposites with 0.2 g of nano- Alumina

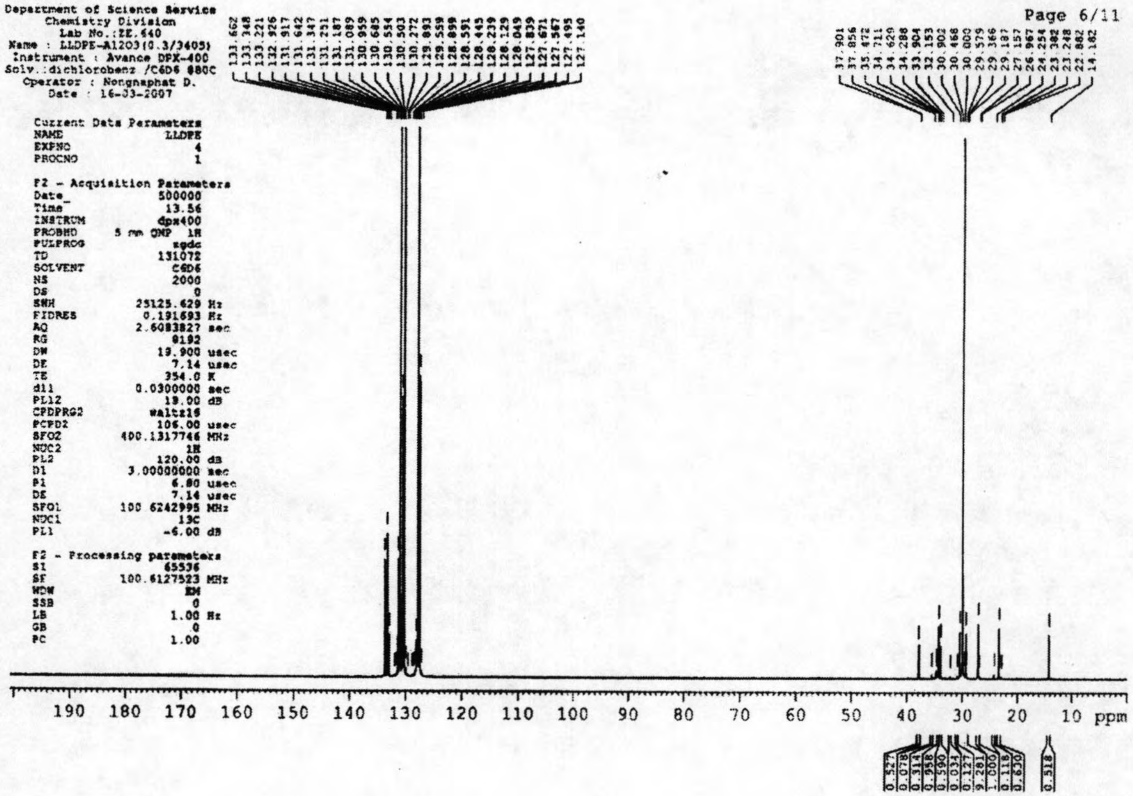

Figure B-4. ^{13}C-NMR spectrum of LLDPE-nanocomposites with 0.3 g of nano- Alumina

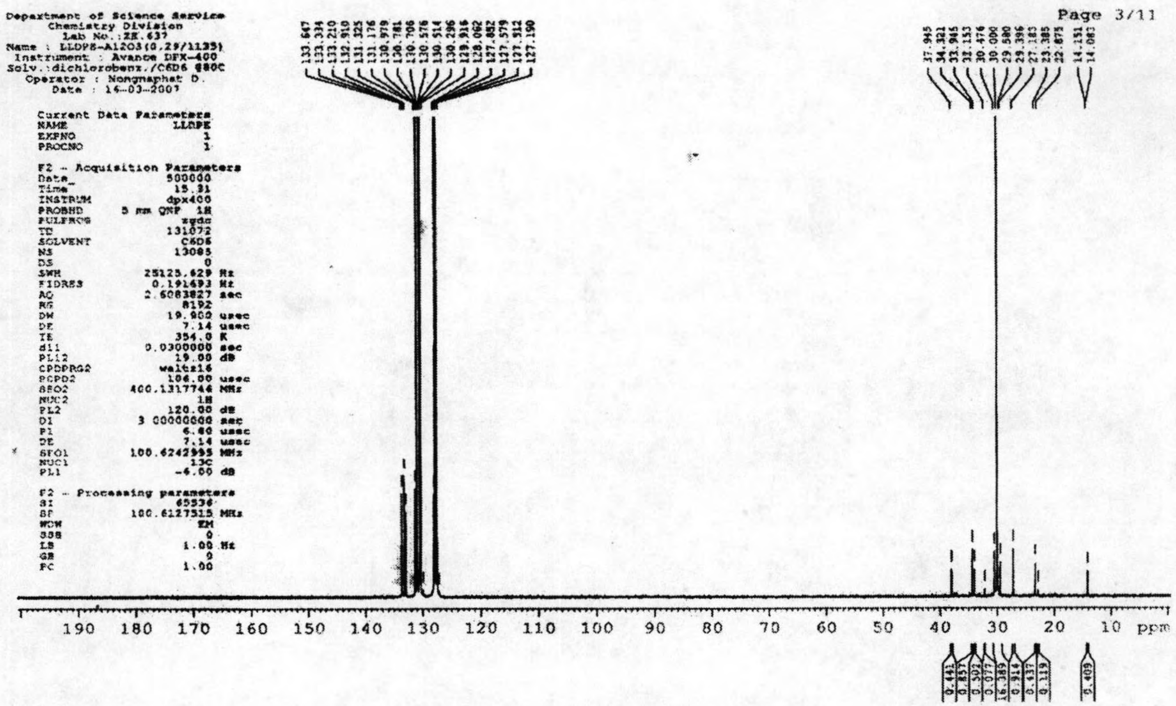

Figure B-5. ^{13}C-NMR spectrum of LLDPE-nanocomposites with 0.2 g of nano-Alumina fixed $[Al]_{d\text{-}MMAO}$ / [Zr] = 1135

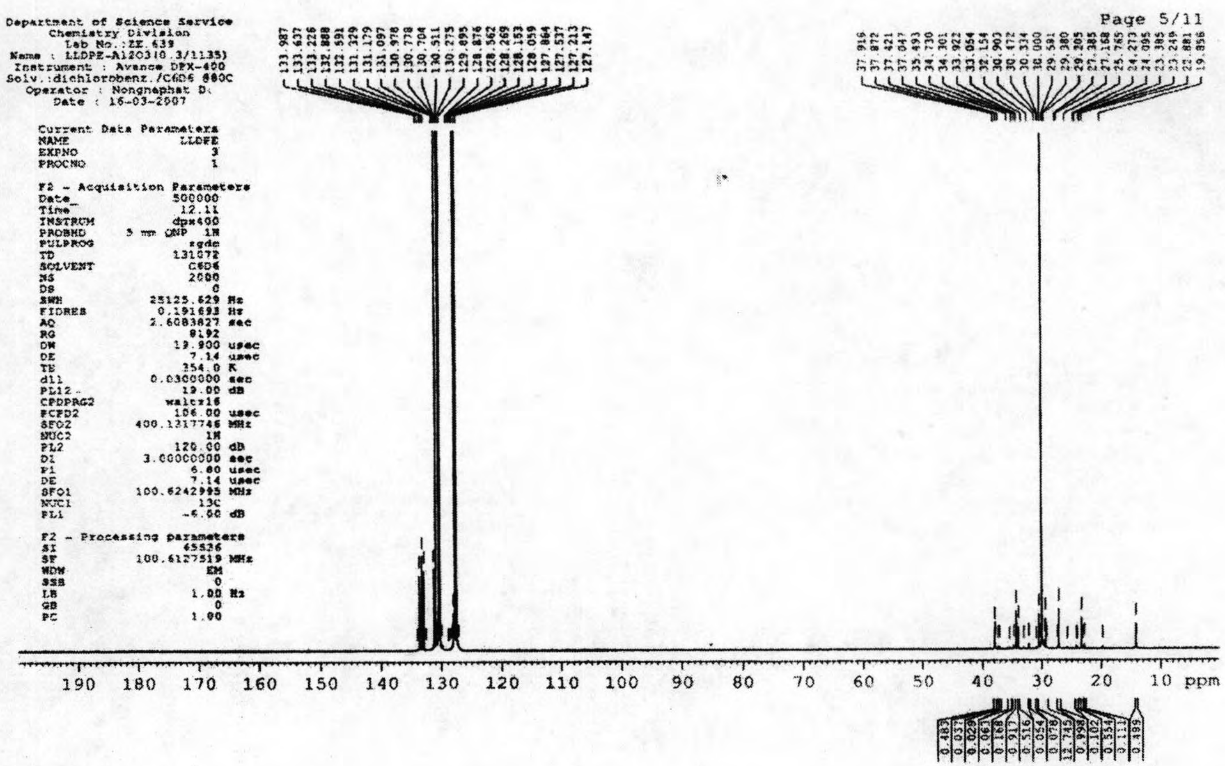

Figure B-6. ^{13}C-NMR spectrum of LLDPE-nanocomposites with 0.3 g of nano-Alumina fixed $[Al]_{d\text{-}MMAO}$ / $[Zr]$ = 1135

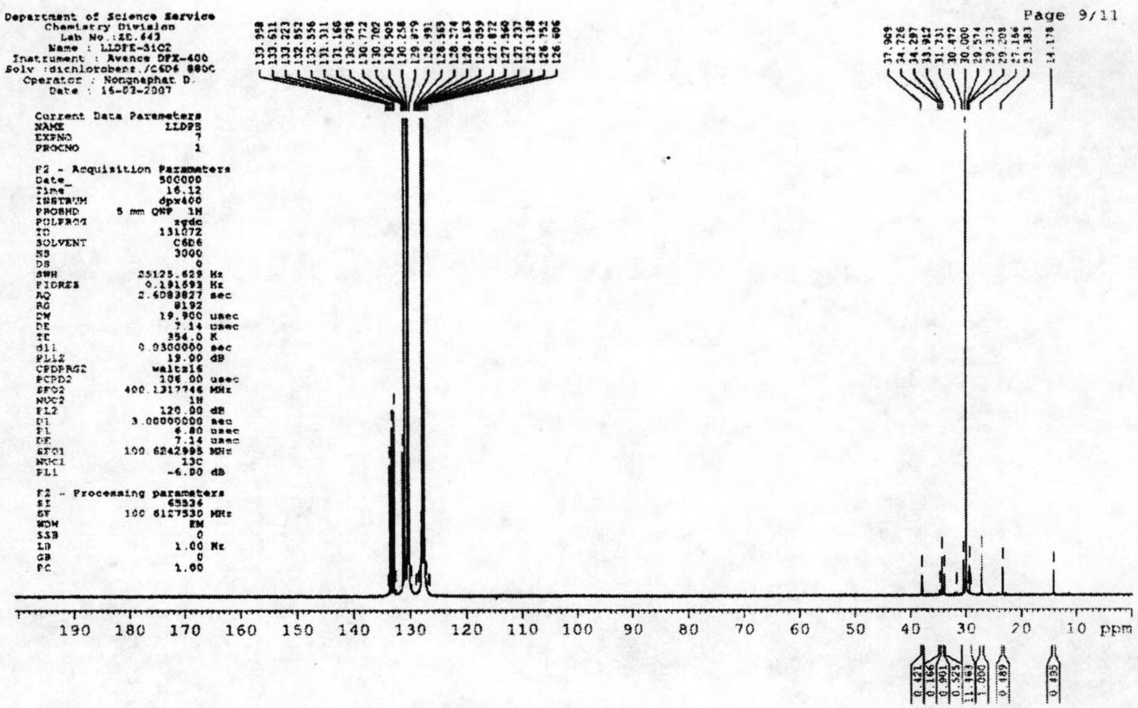

Figure B-7. ^{13}C-NMR spectrum of LLDPE-nanocomposites with 0.3g of nano-Silica

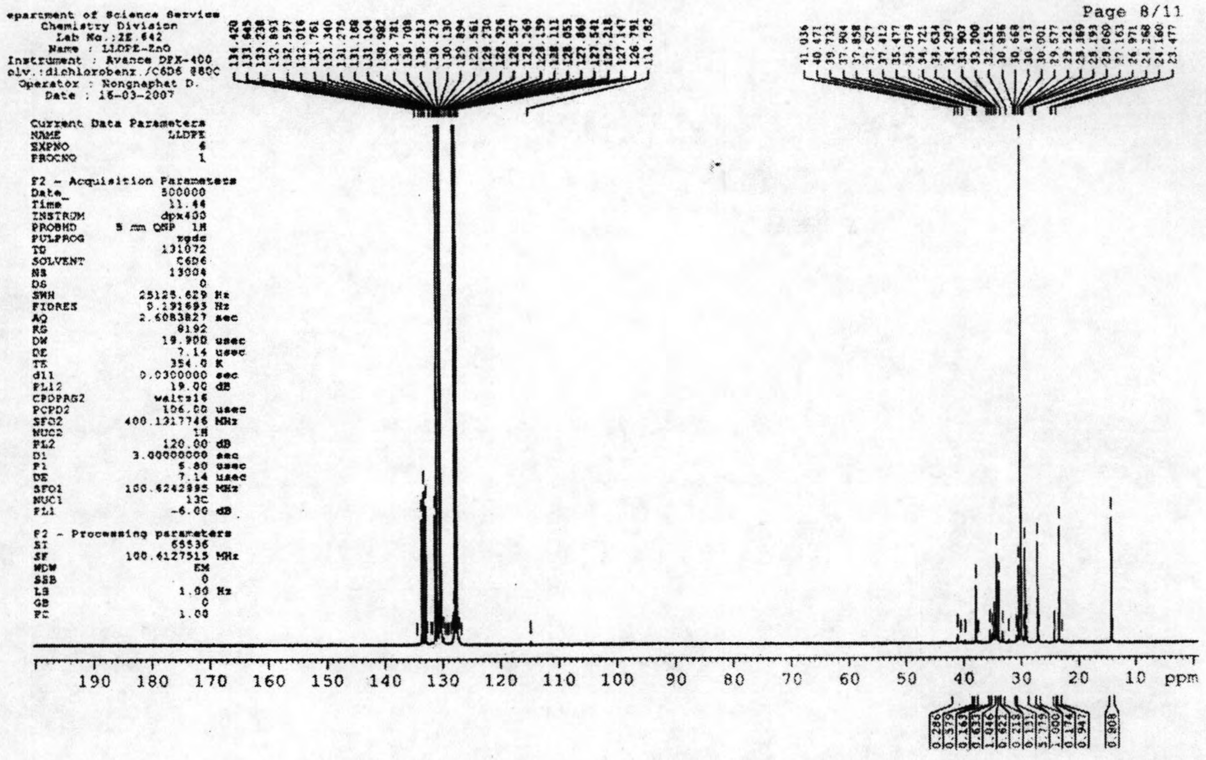

Figure B-8 ^{13}C-NMR spectrum of LLDPE-nanocomposites with 0.3g of nano-ZnO

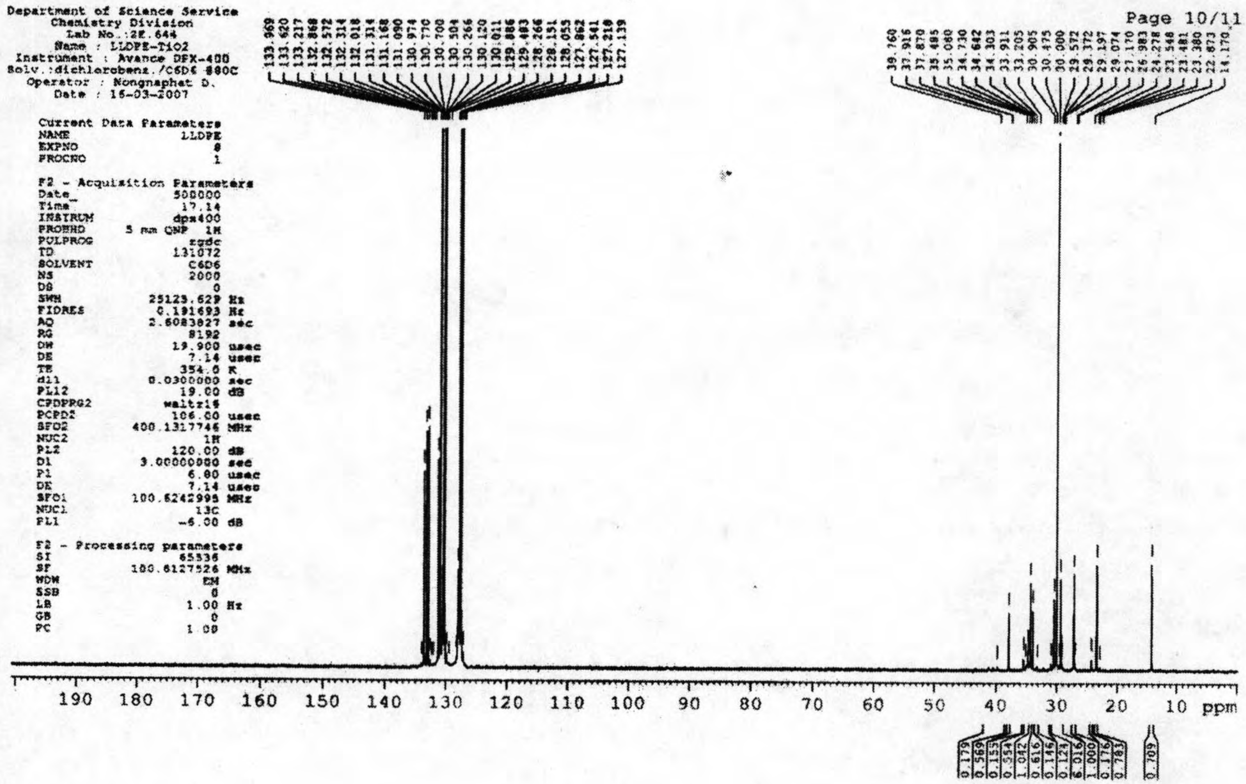

Figure B-9 ^{13}C-NMR spectrum of LLDPE-nanocomposites with 0.3g of nano-Titania

APPENDIX C

Gel Permeation Chromatrography

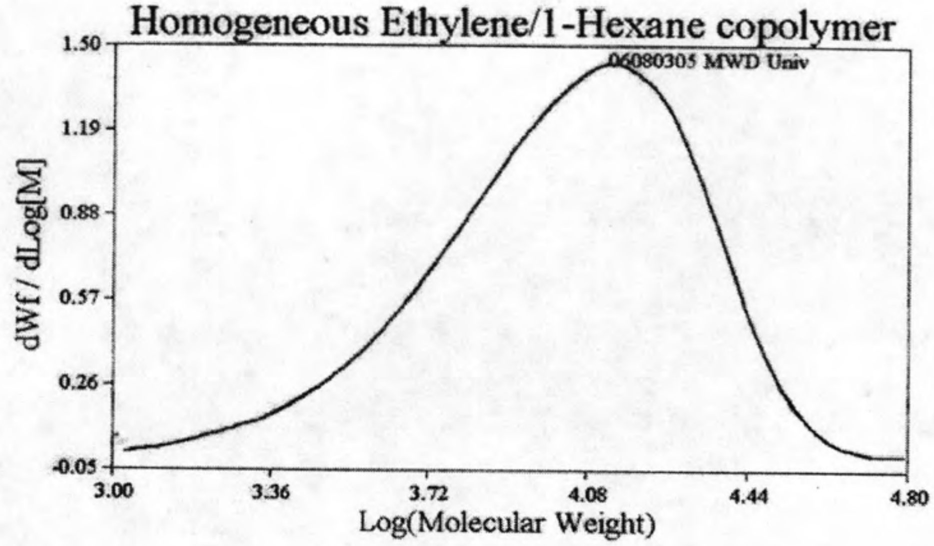

Figure C-1 : GPC curve of LLDPE homogeneous system $[Al]_{d\text{-}MMAO}/[Zr]_{cat}$=1135

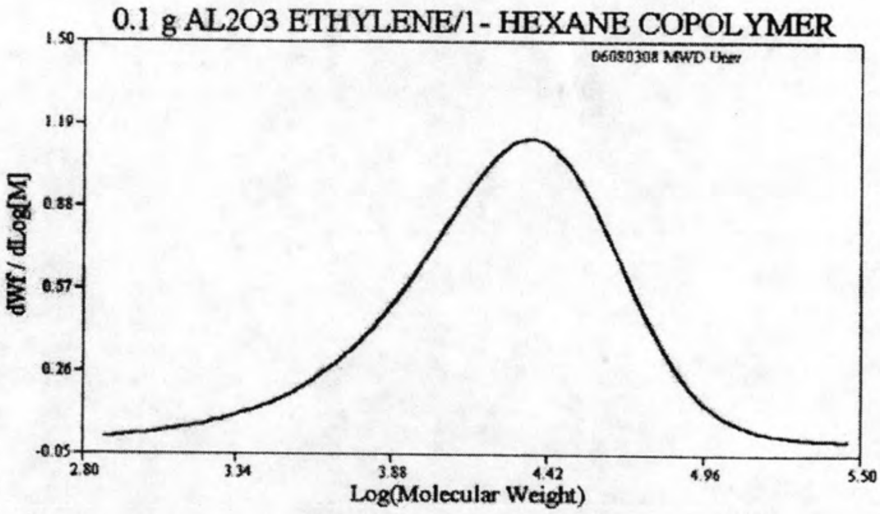

Figure C-2 : GPC curve of LLDPE/nano-alumina composite at $[Al]_{d\text{-}MMAO}/[Zr]_{cat}$=2270, catalyst precursor= 0.1 g

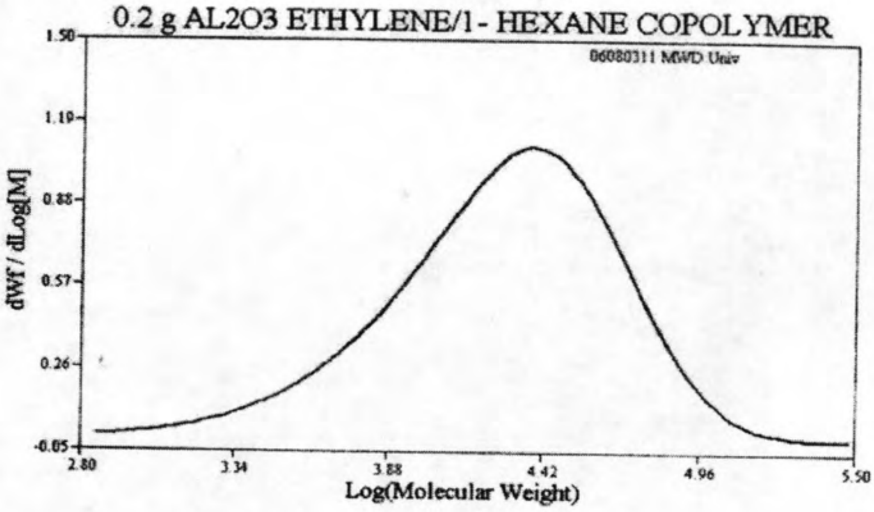

Figure C-3 : GPC curve of LLDPE/nano-alumina composite at $[Al]_{d\text{-}MMAO}/[Zr]_{cat}$=2270, catalyst precursor= 0.2 g

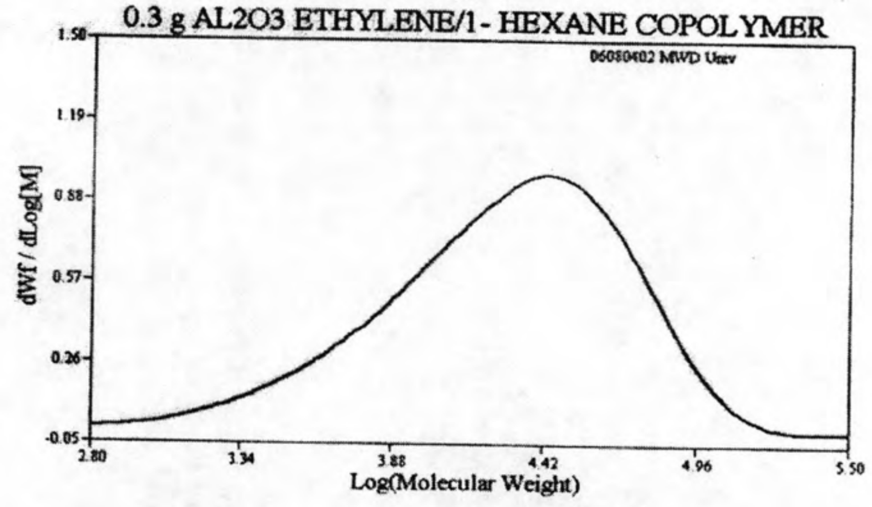

Figure C-4 : GPC curve of LLDPE/nano-alumina composite at $[Al]_{d\text{-}MMAO}/[Zr]_{cat}$=3405, catalyst precursor= 0.3 g

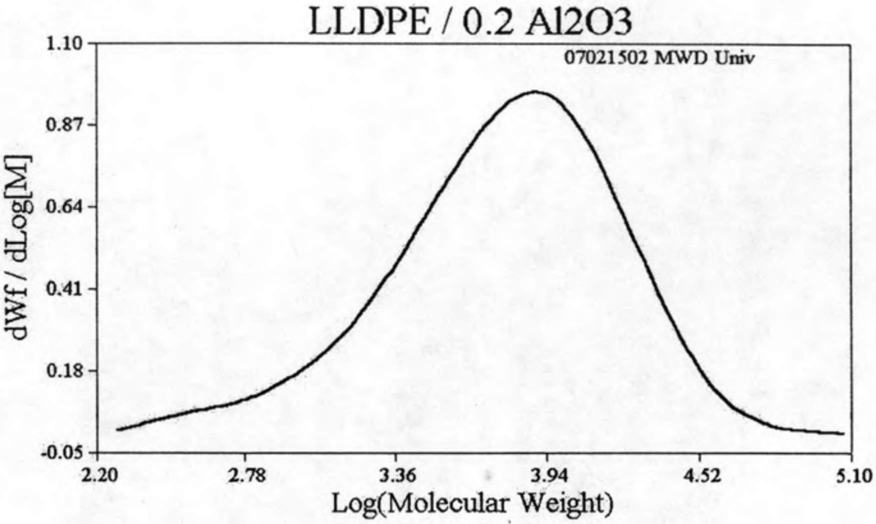

Figure C-5 : GPC curve of LLDPE/nano-alumina composite at $[Al]_{d\text{-}MMAO}/[Zr]_{cat}$=1135, catalyst precursor= 0.2 g

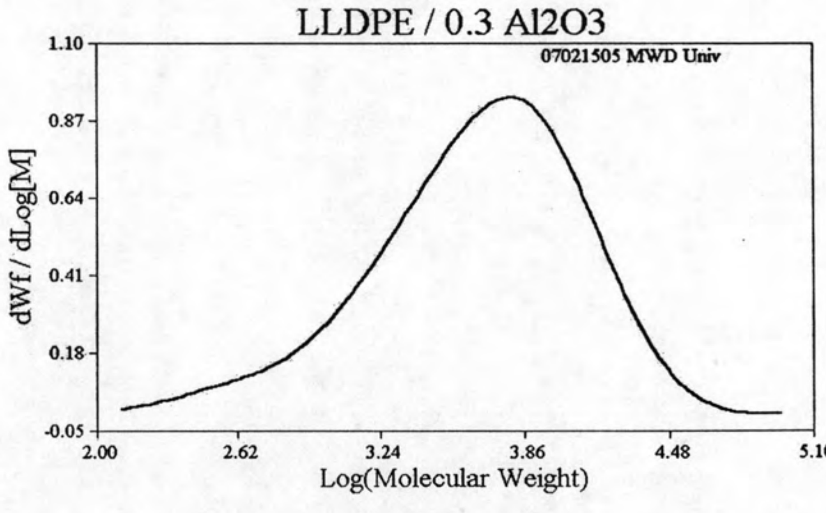

Figure C-6 : GPC curve of LLDPE/nano-alumina composite at $[Al]_{d\text{-}MMAO}/[Zr]_{cat}$=1135, catalyst precursor= 0.3 g

APPENDIX D

Calculation of polymer properties

Calculation of polymer microstructure

Polymer microstructure and also triad distribution of monomer can be calculated according to the Prof. James C. Randall as literature 73 in the list of reference. The detail of calculation was be interpreted as follow

Ethylene/1-hexene copolymer

The integral area of 13C-NMR spectrum in the specify rage are listed.

T_A	=	39.5-42	ppm
T_B	=	38.1	ppm
T_C	=	33-36	ppm
T_D	=	26.5-27.5	ppm
T_F	=	24-25	ppm
T_G	=	23.4	ppm
T_H	=	14.1	ppm

Triad distribution was calculated as the followed formular

k[HHH]	=	$2T_A - T_C + T_G + 2T_F + T_E$
k[EHH]	=	$2T_C - 2T_G - 4T_F - 2T_E - 2T_A$
k[EHE]	=	T_B
k[EEE]	=	$0.5T_E - 0.5T_G - 0.25T_E$
k[HEE]	=	T_E
k[HEH]	=	T_F

Calculation of crystallinity for ethylene/1-olefin copolymer

The crystallinities of copolymers were determined by differential scanning calorimeter. % crystallynity of copolymers is calculated from equation.

$$\%Crystallinity = \frac{\Delta H_m}{\Delta H_m^o} \times 100$$

Where ΔHm = the heat of fusion of sample (J/g)

ΔHm = the heat of fusion of perfectly crystalline polyethylene

= 286 J/g

APPENDIX E

The specification of commercial nano-materials

Aluminum oxide nanopowder

Aldrich	
Synonym	Alumina
Molecular Formula	Al_2O_3
Molecular Weight	101.96
CAS Number	1344-28-1
EG/EC Number	2156916
MDL number	MFCD00003424

Properties

description	gamma phase
form	nanopowder
particle size	40-47 nm
surface area	35-43 m^2/g
mp	2040 °C(lit.)

References

Merck	*Merck* **13**,35
Fieser	*Fieser* **1**,19 / *Fieser* **2**,17 / *Fieser* **3**,6 / *Fieser* **4**,8 / *Fieser* **6**,16 / *Fieser* 7,5 / *Fieser* **8**,9 / *Fieser* **9**,8 / *Fieser* **10**,8 / *Fieser* **11**,22 / *Fieser* **13**,14 / *Fieser* **14**,20 / *Fieser* **16**,9
reference	*Corp MSDS* **1** (1), 115:A / *RegBook* **1** (3), 3273:J / *RegBook* **1** (3), 3533:A / *Sax* **6**, 178

Safety

WGK Germany	-
RTECS	BD1200000
F	3

Nano-SiO_2 15 nm, 99.5%

Aldrich	Silica
Molecular Formula	SiO_2
Molecular Weight	60.08

Properties

surface area BET surf. area	140-180 m2/g
bp	>100 °C(lit.)
	2230 °C(lit.)
Mp	>1600 °C(lit.)
density	2.2-2.6 g/mL at 25 °C
bulk density	.011 g/mL

References

Merck	Merck 13,8567
Reference	Corp MSDS 1 (2), 3090:A / RegBook 1 (3), 3535:B / Sax 6, 2395

Safety

Safety Statements 22-24/25

WGK	Germany 2
RTECS	VV7310000

Zinc oxide nanopowder

Aldrich	
Molecular Formula	ZnO
Molecular Weight	81.39
CAS Number	1314-13-2
EG/EC Number	2152225
MDL number	MFCD00011300

Properties

Form	nanopowder
Surface area	15-25 m^2/g
Particles size	50-70 nm

References

Cited References	1. Healey, A.M. et al. *Inorg. Chem.* **38**, 455, (1999)
Merck	*Merck* **13**,10200
Fieser	*Fieser* **1**,1294 / *Fieser* **5**,622
reference	*Corp MSDS* **1** (2), 3631:C / *RegBook* **1** (3), 3281:C / *Sax* **6**, 2755

Safety

Hazard Codes	N
Risk Statements	50/53
Safety Statements	60-61
RIDADR	UN 3077 9/PG 3
WGK Germany	2
RTECS	ZH4810000

Titanium(IV) oxide nanopowder, doped with 1% Mn, 97+ %

Aldrich

Synonym	Titania
	Titanium dioxide
Molecular Formula	TiO_2
Molecular Weight	79.87
CAS Number	13463-67-7
EG/EC Number	2366755
MDL number	MFCD00011269

Properties

assay	97+ %
particle size	<100 nm
surface area	>14.0 m^2/g
mp	>350 °C(lit.)
density	4.26 g/mL at 25 °C(lit.)
bulk density	.011 g/mL

References

G. Wakefield, S. Lipscomb, E. Holland, J. Knowland, The Effects of Manganese Doping on UVA Absorption and Free Radical Generation of Micronised Titanium Dioxide and Its Consequences for the Photostability of UVA Absorbing Organic Sunscreen Components *Photochem. Photobiol.* **3**, 648-652, (2004)

G. Wakefield, M. Green, S. Lipscomb, B. Flutter, Modified Titania Nanomaterials for Sunscreen Application - Reducing Free Radical Generation and DNA Damage *Mater. Sci. Technol.* **20**, 985-988, (2004)

Stone, V.F.; Davis, R.J. *Chem. Mater.* **10**, 1468, (1998)

Merck *Merck* **13**,9549

Safety

Hazard Codes Xn

VITA

Mr. Chanathip Desharun was born in August 7^{th}, 1983 in Phangnga, Thailand. He finished high school from Princess Chulabhorn's college, Trang and received bachelor's degree in Engineering from the department of Chemical Engineering, Faculty of Engineering, Prince of Songkla University, Songkhla, Thailand in 2005.