



REFERENCES

1. L.H. Sperling. 1994. **Interpenetrating Polymer Networks**. Washington DC: American Chemical Society, 3-38.
2. J.A. Brydson. 1978. **Rubber Chemistry**. Essex England: Applied Science Publisher Ltd., 11-24.
3. R. St. David. 1985. **Encyclopedia of Polymer Science and Engineering**. Washington DC: John Wiley & Sons, 2nd ed., 14, 687-710.
4. N. Bemiller. 1976. **Encyclopedia of Polymer Science and Engineering**. Washington DC: John Wiley & Sons, 7, 551-555.
5. A.G. Bayer. 1993. **Ullmann's Encyclopedia of Industrial Chemistry**. VCH
6. Rubber Research Institute of Thailand. 1998. **Thailand Rubber Static**. V. 27, No.3,4.
7. H.H. Greve. **Ullmann's Encyclopedia of Industrial Chemistry**. VCH Publishers Inc., 233-235.
8. F. M. Robert 1994. **Latex and Foam Rubber**. John Wiley & Sons, 50-55.
9. L.H. Sperling. 1994. **Interpenetrating Polymer Networks**. Washington D.C. American Chemical Society, 6-39.
10. R. S. Lehrle. 1997. *Modification of Natural Rubber : A Study to Assess the Effect of Vinyl Acetate on the Efficiency of Grafting Methyl Methacrylate on Rubber in Latex Form*. **Polymer**. 38, 5937-5946.
11. L. J. Fetters, M. Morton. 1982. **Rubber Chemistry**. Applied Science Publishers Ltd., 36.
12. L.H. Sperling. 1993. **Introduction to Physical Polymer Science**. John Wiley & Sons, 2nd ed., 155.
13. S.L. Rosen. 1993. **Fundamental Principles of Polymeric Materials**. Missouri

- John Wiley & sons, 2nd ed., 372-373.
14. T. Sivadol. 1996. **Introduction to Probability and Statistics**. BKK. McGraw-Hill, 1st ed., 147-177.
 15. D.J. Hourston, and J. Romain. 1989. *Modification of natural rubber latex-I naturalrubber-polystyrene composite latices synthesized using an amine-activated hydroperoxide*. **Eur. Polym. J.** 25, 695-700.
 16. B. Das, S. Sinha, and T. Gangopaduyay. 1993. *NR-PS IPNs morphology and mechanical properties*. **Eur. Polym. J.** 29, 57-67.
 17. M. Schneider, T. Pith, and M. Lambla. 1996. *Preparation and morphological characterization of two- and three- component natural rubber-based latex particles*. **J. of Appl. Polym. Sci.** 62, 273-290.
 18. R. Asaletha, S. Thomas. 1995. *The technological compatibilization of natural rubber / PS blends by the addition of NR-graft-PS*. **J. Rub. Chem. Tech.** 68, 671-687.
 19. P. Pieroni. 1999. *Impact strength and morphology of PP/LLDPE/EPDM blends*. **J. of Elas. Plastics.** 31, 72-82.
 20. Dietmar, M.1999. *Influence of Comonomer Incorporation on Morphology and Thermal and Mechancal Properties of Blends Based upon Isotactic Metallocene-Polypropylene and Random Ethylene/1-Butene Copolymers*. **J.App. Polym. Sci.** 74, 898-848.
 21. C. Chotikunpisarn. 1998. **The Flexural Strength Improvement of PP/EPDM Blends**. Master's thesis, Chulalongkorn University
 22. K. Charmondusit. 1997. **Grafting of Methyl Methacrylate and Styrene onto Natural Rubber as Impact Modifier for PVC**. Master's thesis, Chulalongkorn University

23. S. Anuntathanawanich. 1999. **Natural Rubber-Polystyrene Interpenetrating Polymer Networks as Impact Modifier**. Master's thesis, Chulalongkorn University

APPENDICES

APPENDIX A

This section presents product specification of main raw materials, including PP (2500 TC), EPDM (EP35), antioxidant Irganox 1076, and Preyulcanize NR latex MR grade.

Table A1 Typical Data of Polypropylene Grade 2500 TC

Typical Data	Unit	Value	Test Method
Property			
MFI 2.16 kg/230°C	g/10 min	45	ASTM 1238
Tensile Strength at Yield	N/mm ²	21	ASTM D638
Charpy Impact Strength			
At -20°C	mJ/mm ²	5.5	DIN 53453
Shear Modulus	N/mm ²	430	DIN 53457
Ball Indentation Hardness	N/mm ²	53	DIN 53456
Heat Distortion Temp.			
At 0.45 N/mm ²	°C	90	ASTM
D648			

Table A2 Product Specification of EPDM grade EP 35

Item	Unit	Value	Test Method
Volatile Matter	%	0.75 max.	JIS K6383
Ash	%	0.20 max.	JSR AE102
Iodine Value	I ₂ /EPDM 100g	22-30	JSR AE104
Propylene Content	wt %	39-47	JSR AE103
Mooney Viscosity	ML ₁₊₄ (100°C)	75-91	JSR D6300
Tensile Strength	MPa	10.8 min	JIS K6301
Elongation	%	280 min	JIS K6301
200% Modulus	MPa	6.6-9.5	JIS K6301

Table A3 Typical Physical Properties of Antioxidant (Irganox 1076)

Properties	Unit	Powder	Pellets
Appearance		white to cremecolored powder	yellow-brown pellets
Melting Point On set (Capillary method)	°C	105 min.	105 min.
Volatile (10g/ 2h/ 100°C)	%	1.0 max.	1.0 max.
Ash Content (5g/300°C)	%	0.5 max.	0.5 max.
Sieve residue (>63 ^o)	%	4.0 max.	-

Table A4 Specification of Prevulcanized NR Latex (MR Grade)

Test Parameter	Unit	MR spec.
Total solids content	%	60.0-61.0
Ammonia content	% on latex wt.	0.60-0.70
pH Value	-	10-12
KOH No.	-	0.70 max.
VFA No.	-	0.50 max.
MST	sec (55% TSC)	750 min
Viscosity at 28°C		
Ford cup #3 (406)	sec	40 max.
LVT B/F (Eli) (SPI) 1/60 rpm, cps		150 max.
Coagulum, ppm/%		
80#	ppm	<100/<0.01
320#	ppm	<500/<0.05
Chloroform No.	-	3 – 3+
Toluene swelling	%	80-90
Petri dish cast film (1.0– 1.5 mm. Thick)		
Colour	-	yellow
Clarity	-	clear
Balloon speck	-	trace



APPENDIX B

In this research the DSC method was chosen for determination of glass transition temperature. The details are as follows:

Sample weight:	10-20 mg
Container:	aluminum pan
Temperature:	50 – 150°C

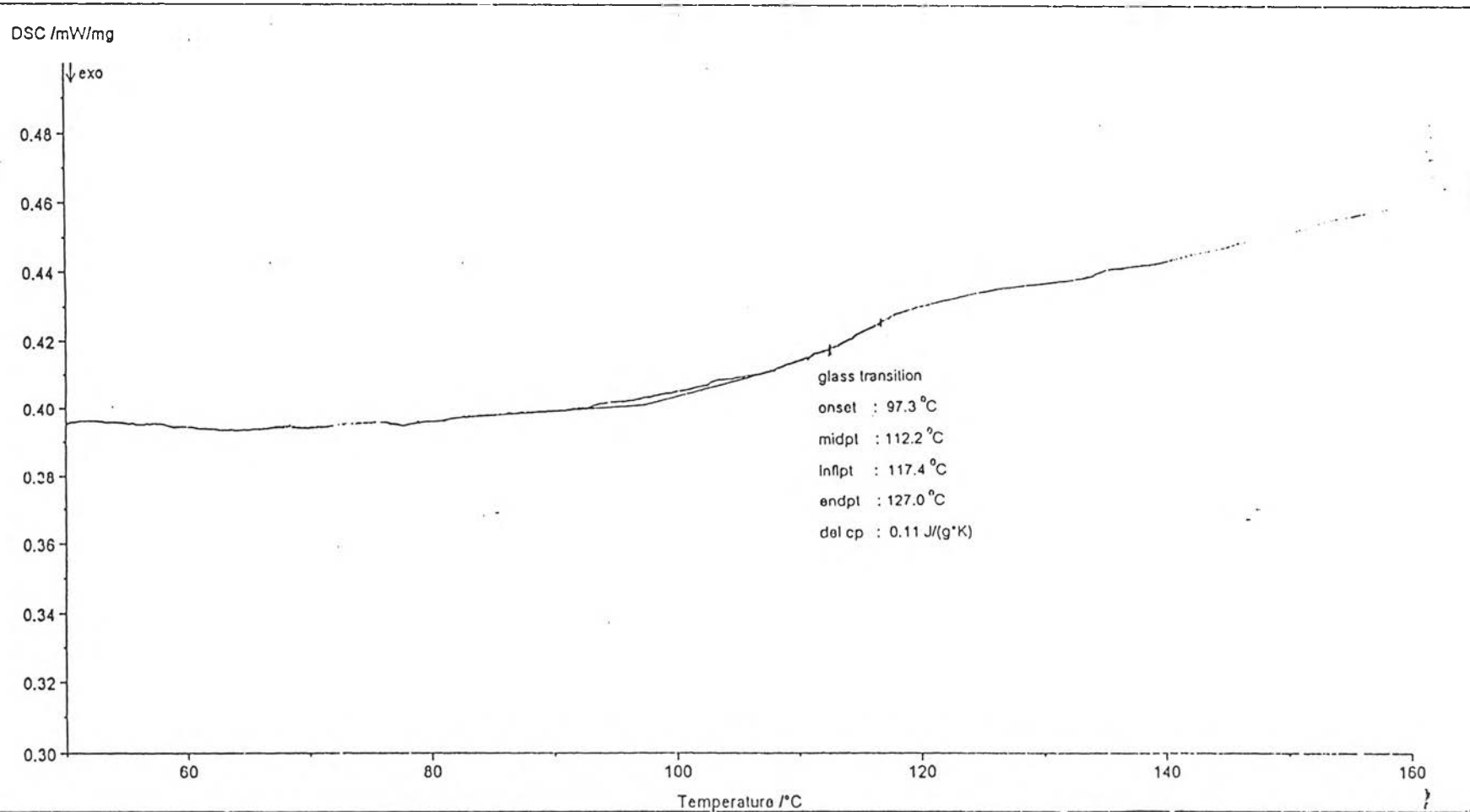


Figure B DSC thermograph of NR/PMMA IPNs 60/40

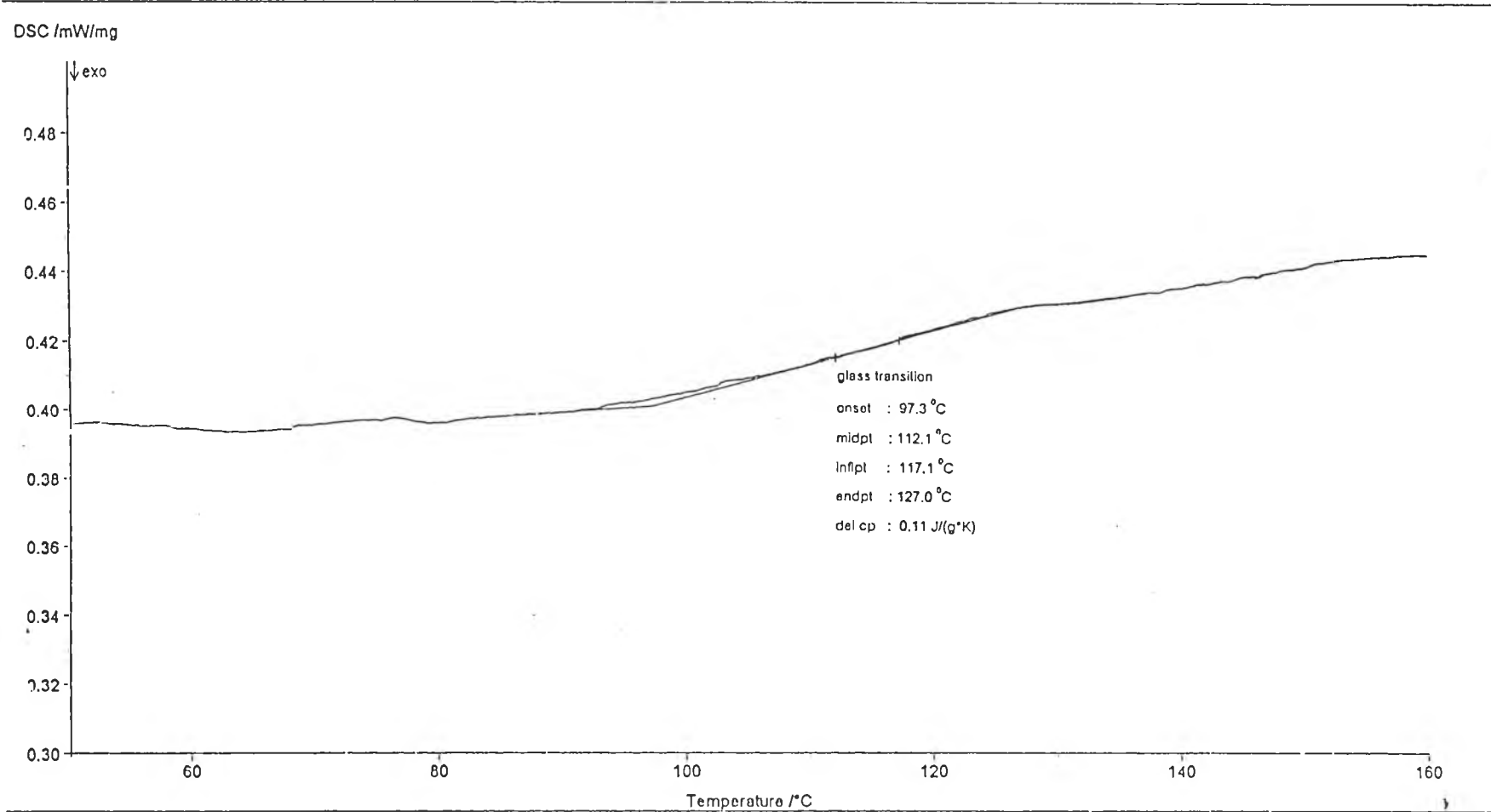


Figure B DSC thermograph of NR/PMMA IPNs 70/30

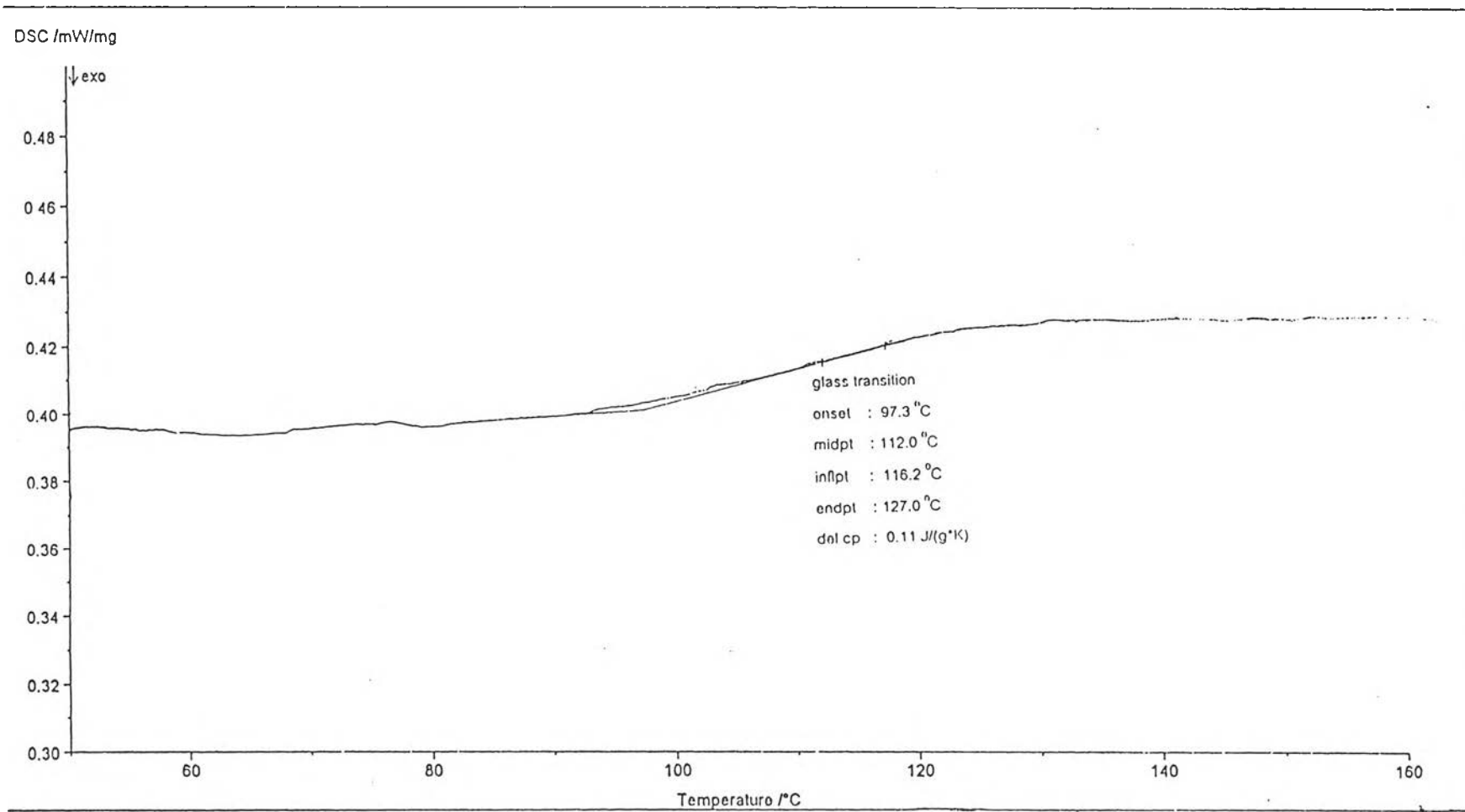


Figure B DSC thermograph of NR/PMMA IPNs 80/20



APPENDIX C

This experiment was analyzed thermal for degradation properties from thermogravimetric Analysis (TGA). The test conditions are as follows:

Sample Weight:	10 mg
Container:	Platinum pan
Temperature:	50-800°C
Heating-Cooling rate:	20°C/min
Purged-gas:	original air 30/15

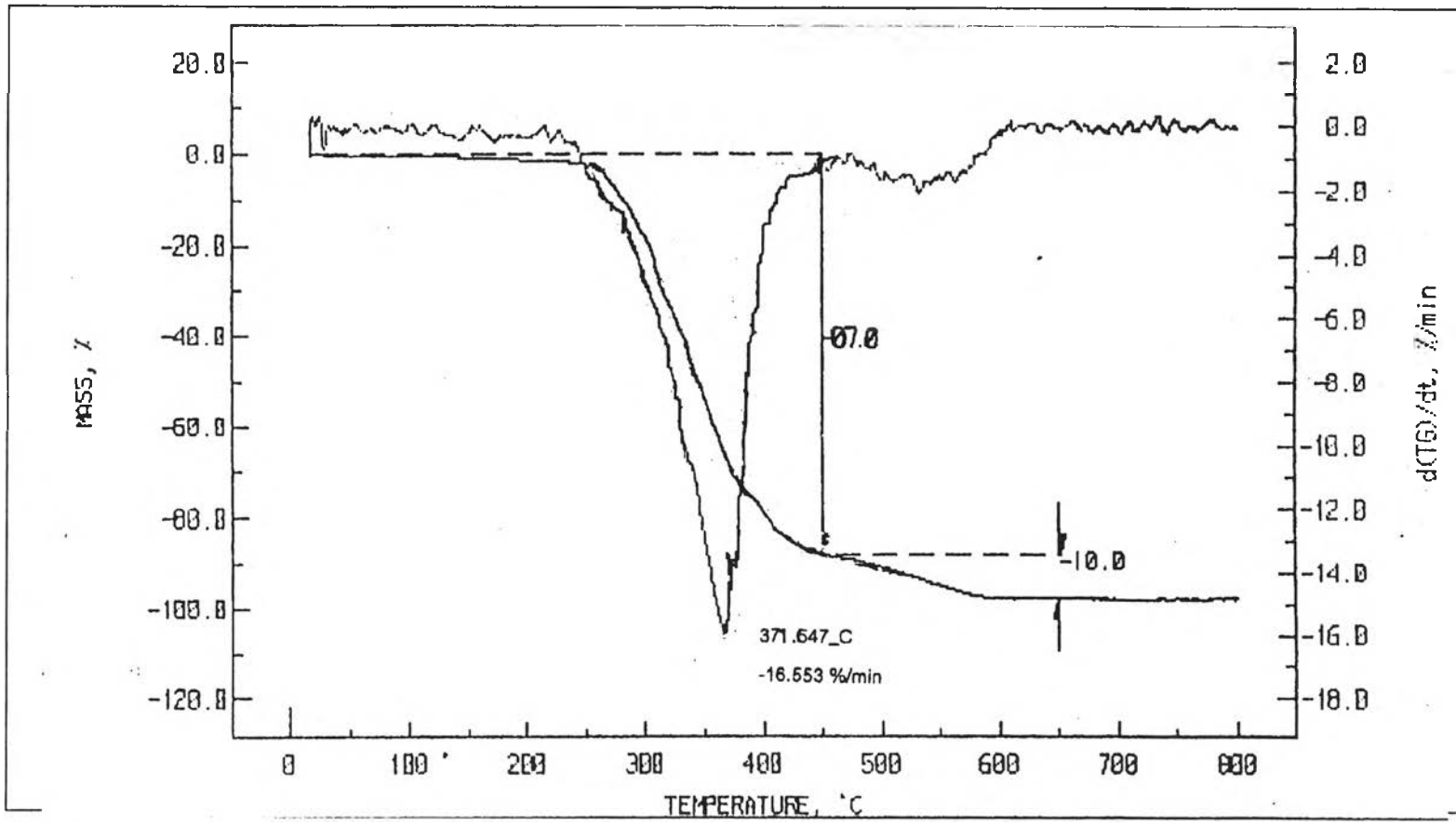


Figure C TGA decomposition curve of pure NR latex

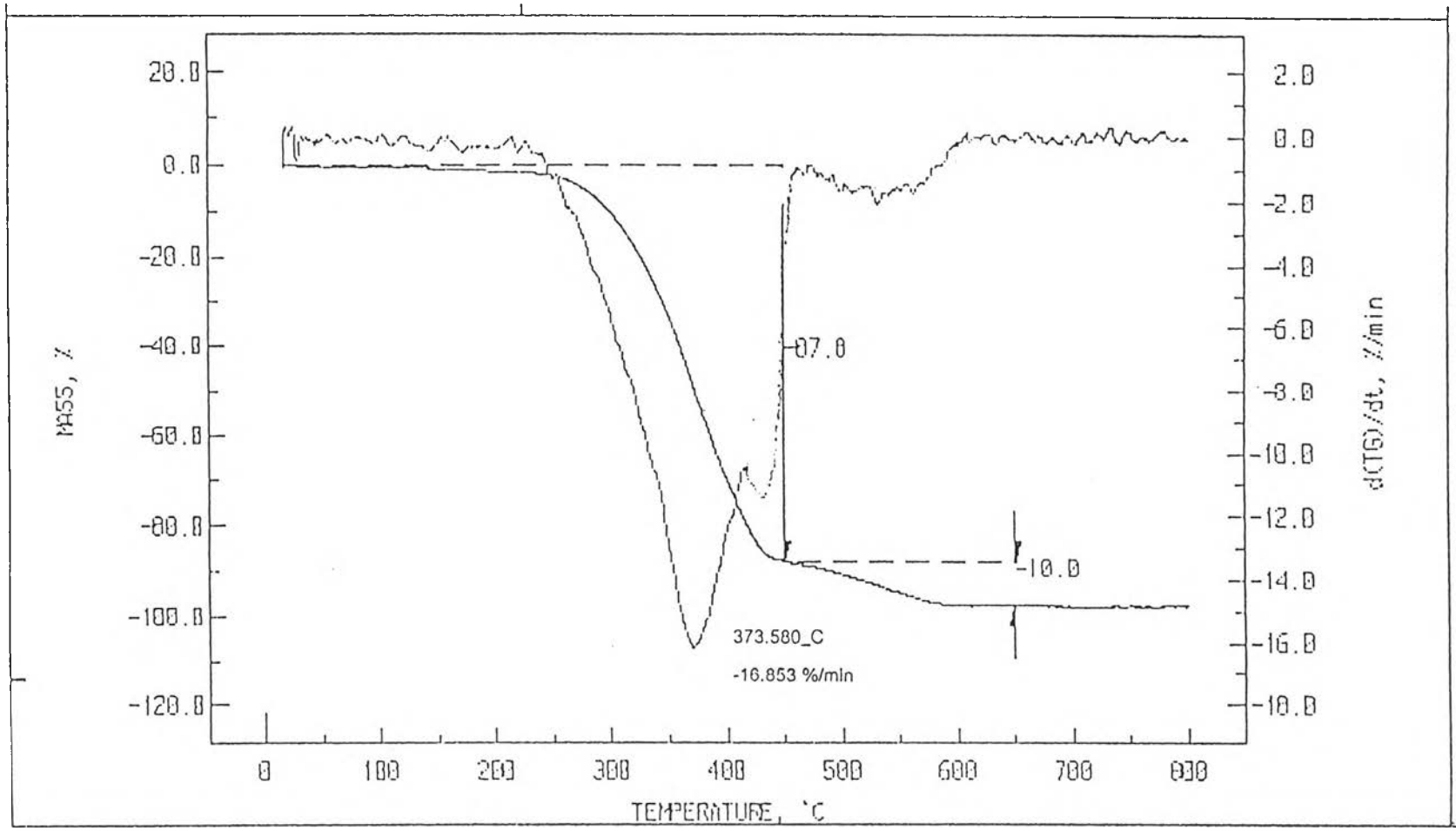


Figure C TGA decomposition curve of IPNs 60/40

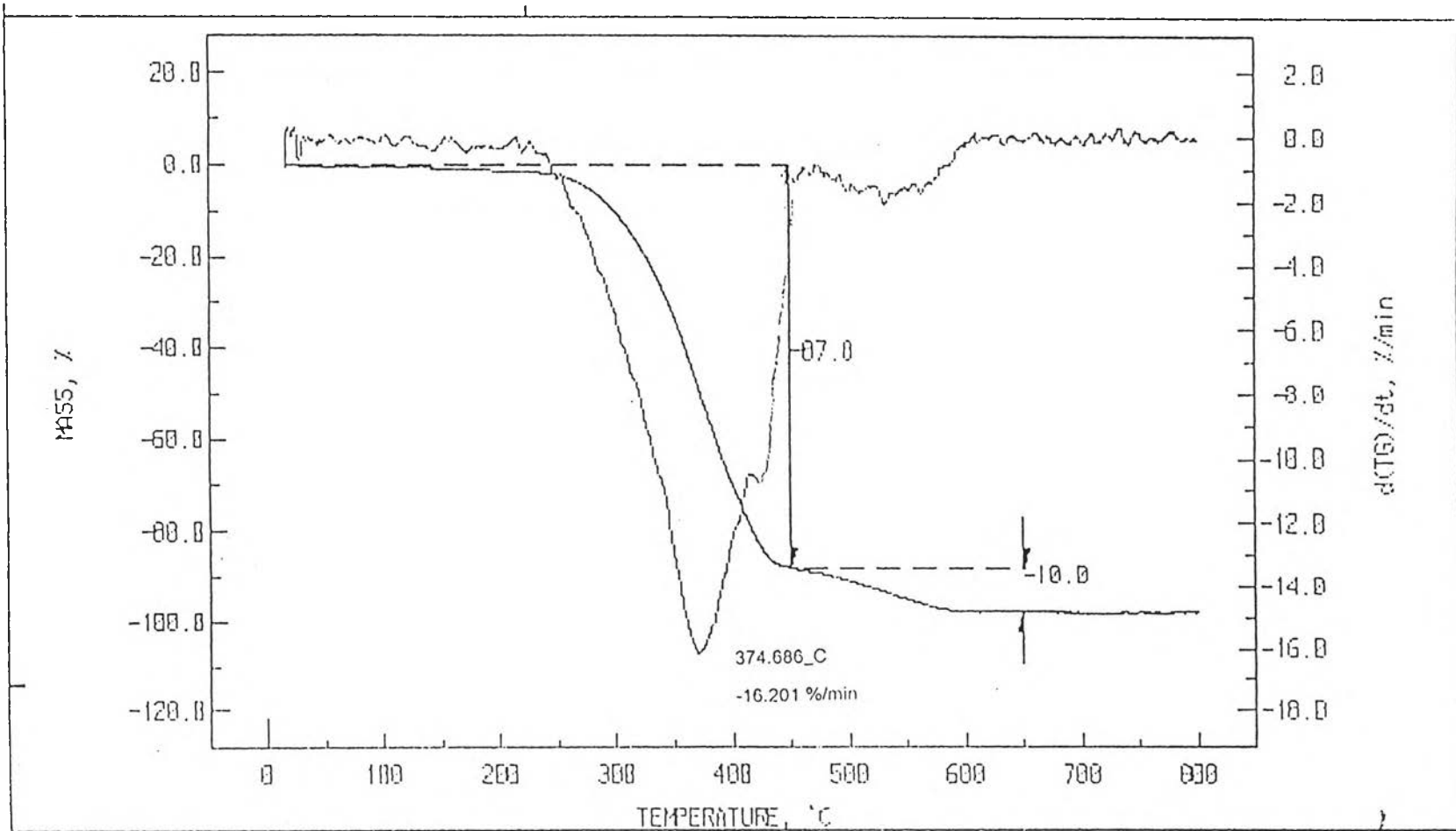


Figure C TGA decomposition curve of IPNs 70/30

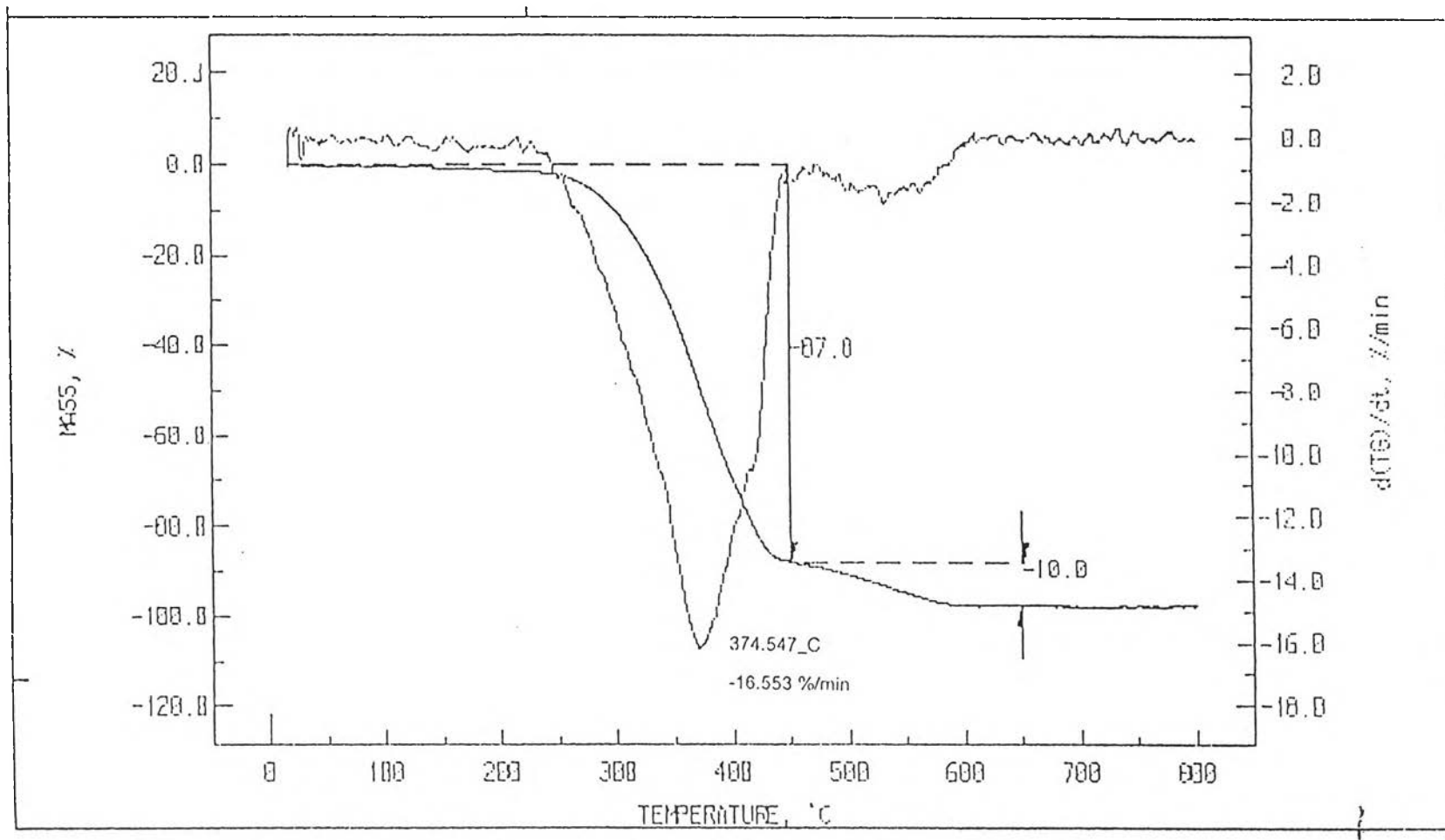


Figure C TGA decomposition curve of IPNs 80/20



VITA

Valee Likitbannakorn was born on May 25, 1977, in Bangkok Thailand. She received the Bachelor's Degree in Chemistry from Faculty of Science, Chulalongkorn University in 1998. She has been a graduate student in the Program of Petrochemistry and Polymer Science, Faculty of Science, Chulalongkorn University since 2002.