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APPENDIXES



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Appendix A

Charge and Particle Measurement by E-SPART Analyzer of the Cyan Toner Mixed with the Carriers B and D

The charge and particle measurement by E-SPART analyzer give several useful information as follows: mass (ng), charge (fc), q/m ($\mu\text{C/g}$), maximum particle charge for both negative and positive (fc) and average diameters in terms of count and mass basis. The cyan toner q/m values evaluated by an E-SPART analyzer of the developers B and D with various toner concentrations, which are presented in Table A-1, imply that both measured by E-SPART and blow-off techniques are relatively close. The detailed information of charge and size distributions of the developers B and D is given in the following pages.

Table A-1 The cyan toner q/m values evaluated by the E-SPART analyzer and measured by the blow-off technique.

T/C (%)	Carrier B ($\mu\text{C/g}$)		Carrier D ($\mu\text{C/g}$)	
	E-SPART	Blow-off	E-SPART	Blow-off
1	-48.25	-59.57	-	-48.74
3	-34.32	-41.62	-35.55	-38.33
5	-24.56	-27.0	-30.61	-29.46
8	-15.38	-18.0	-20.96	-21.26
10	-	-14.17	-15.78	-16.14
15	-7.98	-8.4	-8.73	-12.55

Appendix A (continued)

Toner charge properties of 1% cyan toner in developer B

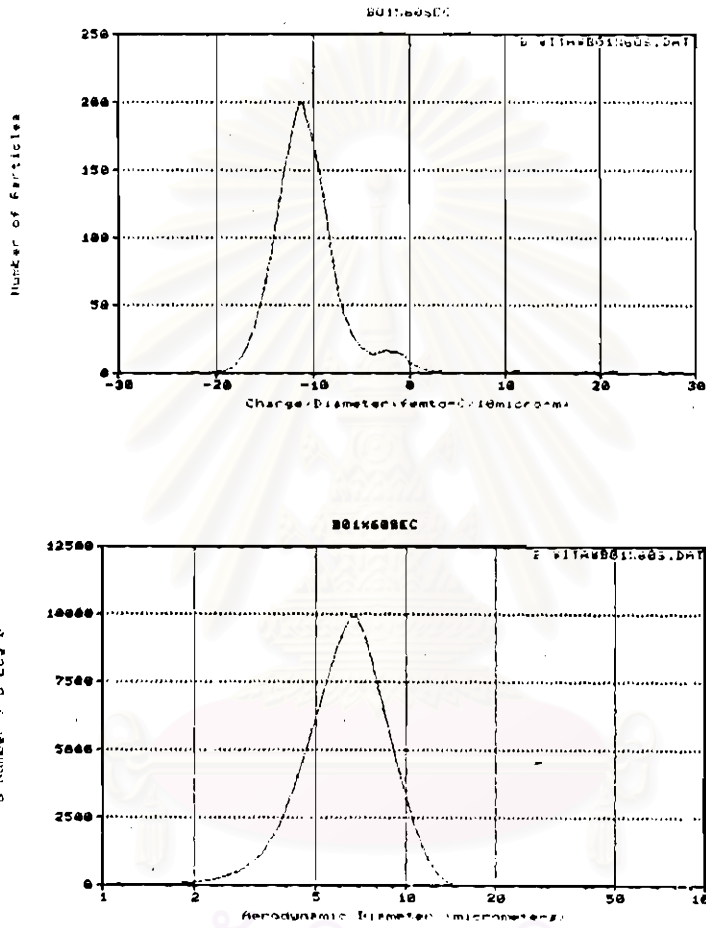


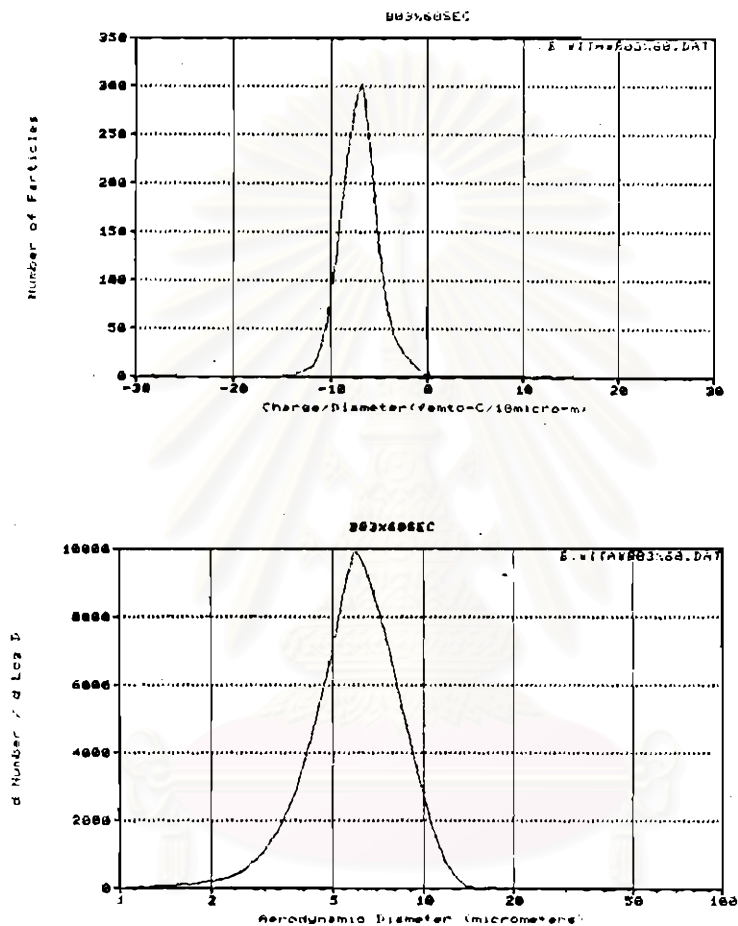
Figure A-1 Toner q/d and size distributions of 1% cyan toner in developer B

	Negative	Positive	Total
Count	2956	43	2999
Mass (nano-gram)	486.36	8.57	495.93
Charge (femto-C)	-24260.85	331.08	-23929.77
Charge/Mass (uC/g)	-48.88	34.58	-48.25

Max particle charge (neg) = -30.11 femto-C
 Max particle charge (pos) = 50.73 femto-C
 Count Average Diameter = 8.899 micrometers
 Mass Average Diameter = 7.971 micrometers

Appendix A (continued)

Toner charge properties of 3% cyan toner in developer B

Figure A-2 Toner q/d and size distributions of 3% cyan toner in developer B

	Negative	Positive	Total
Count	2976	24	3000
Mass (nano-gram)	437.18	4.34	441.50
Charge (femto-C)	-15277.58	125.22	-15152.36
Charge/Mass ($\mu\text{C/g}$)	-34.95	28.87	-34.32

Max particle charge (neg) = -21.74 femto-C
 Max particle charge (pos) = 28.84 femto-C
 Count Average Diameter = 6.352 micrometers
 Mass Average Diameter = 7.606 micrometers

Appendix A (continued)

Toner charge properties of 5% cyan toner in developer B

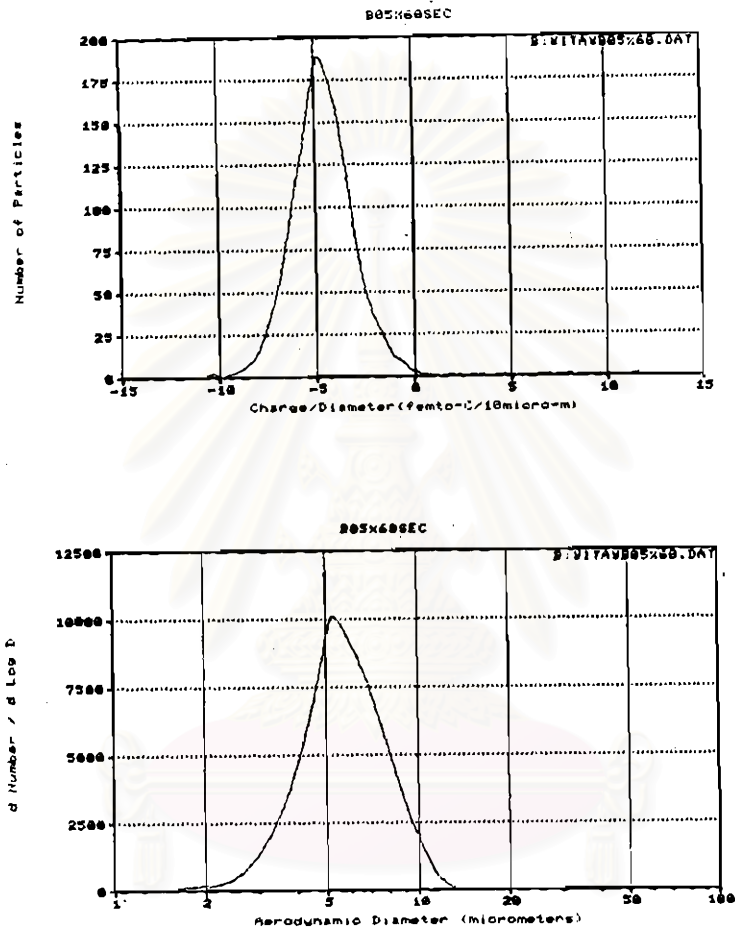


Figure A-3 Toner q/d and size distributions of 5% cyan toner in developer B

	Negative	Positive	Total
Count	2977	23	3000
Mass (nano-gram)	385.82	3.17	388.79
Charge (femto-C)	-9620.02	72.86	-9547.16
Charge/Mass (uC/g)	-24.95	22.89	-24.56

Max particle charge (neg) = -22.56 femto-C
 Max particle charge (pos) = 9.15 femto-C
 Count Average Diameter = 5.969 micrometers
 Mass Average Diameter = 7.482 micrometers

Appendix A (continued)

Toner charge properties of 8% cyan toner in developer B

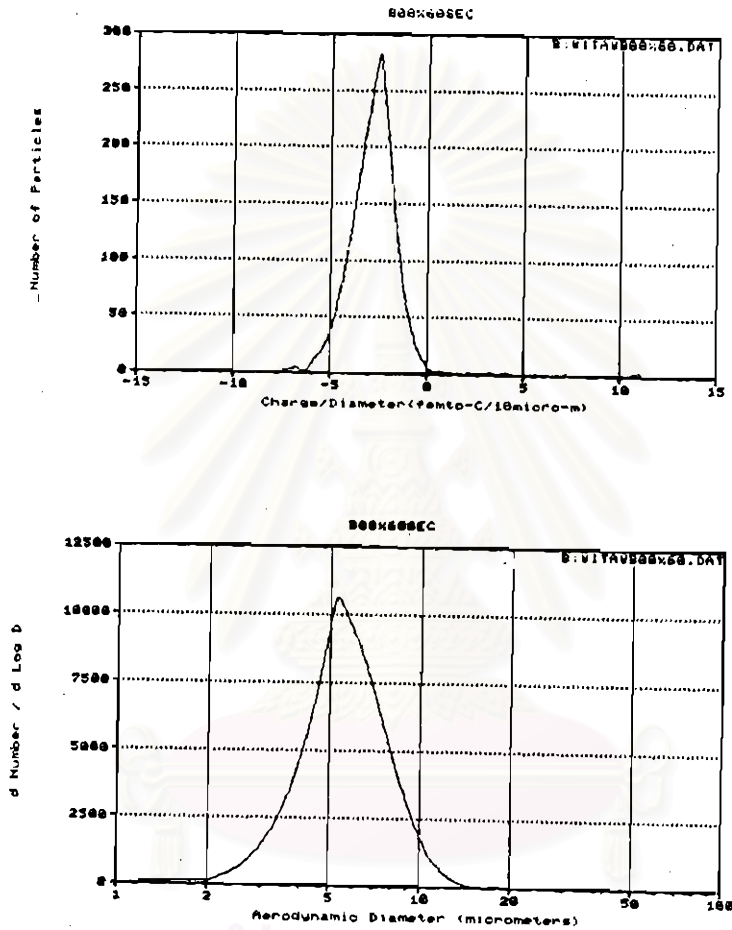


Figure A-4 Toner q/d and size distributions of 8% cyan toner in developer B

	Negative	Positive	Total
Count	2952	46	2998
Mass (nano-gram)	354.10	6.57	360.67
Charge (femto-C)	-5740.66	194.61	-5546.05
Charge/Mass (uC/g)	-16.21	29.82	-15.38

Max particle charge (neg) = -9.20 femto-C
 Max particle charge (pos) = 11.72 femto-C
 Count Average Diameter = 5.909 micrometers
 Mass Average Diameter = 7.243 micrometers

Appendix A (continued)

Toner charge properties of 15% cyan toner in developer B

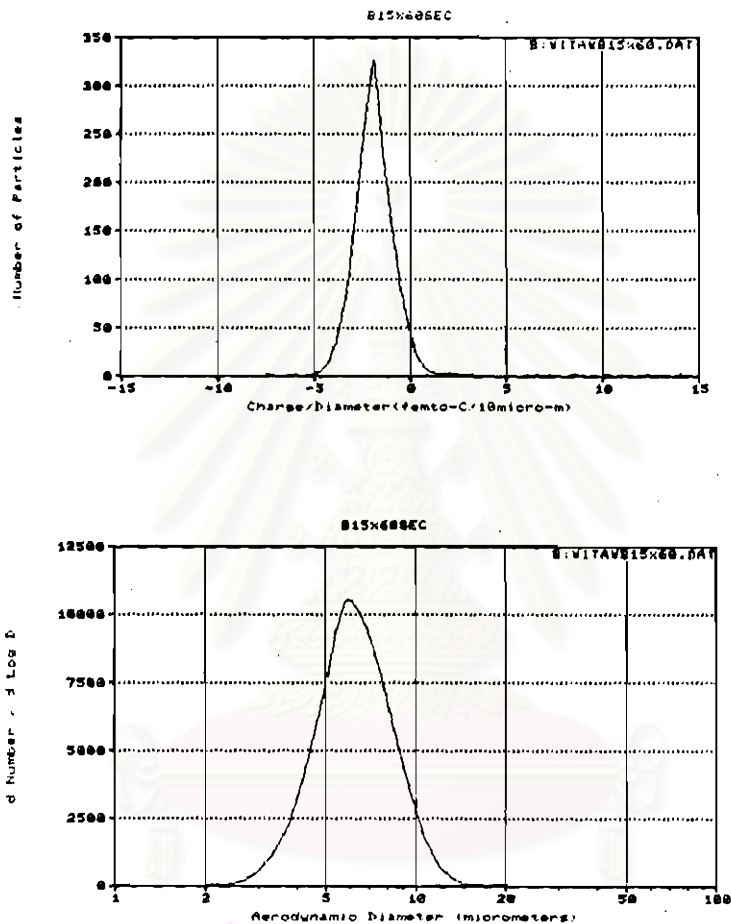


Figure A-5 Toner q/d and size distributions of 15% cyan toner in developer B

	Negative	Positive	Total
Count	2883	117	3000
Mass (nano-gram)	453.07	22.52	475.59
Charge (femto-C)	-4068.96	273.18	-3795.77
Charge/Mass (uC/g)	-8.98	12.13	-7.98

Max particle charge (neg) = -7.93 femto-C
 Max particle charge (pos) = 18.10 femto-C
 Count Average Diameter = 6.558 micrometers
 Mass Average Diameter = 7.776 micrometers

Appendix A (continued)

Toner charge properties of 3% cyan toner in developer D

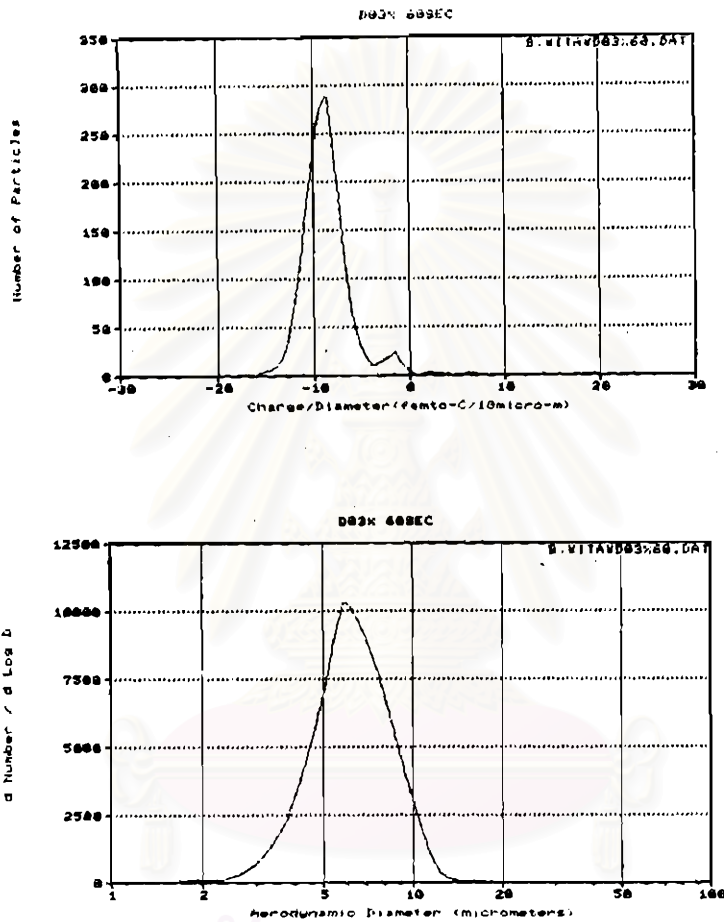


Figure A-6 Toner q/d and size distributions of 3% cyan toner in developer D

	Negative	Positive	Total
Count	2974	26	3000
Mass (nano-gram)	543.90	5.91	549.81
Charge (femto-C)	-19730.03	185.77	-19544.27
Charge/Mass (uC/g)	-36.28	31.44	-35.55

Max particle charge (neg) = -51.03 femto-C
 Max particle charge (pos) = 26.12 femto-C
 Count Average Diameter = 6.812 micrometers
 Mass Average Diameter = 8.243 micrometers

Appendix A (continued)

Toner charge properties of 5% cyan toner in developer D

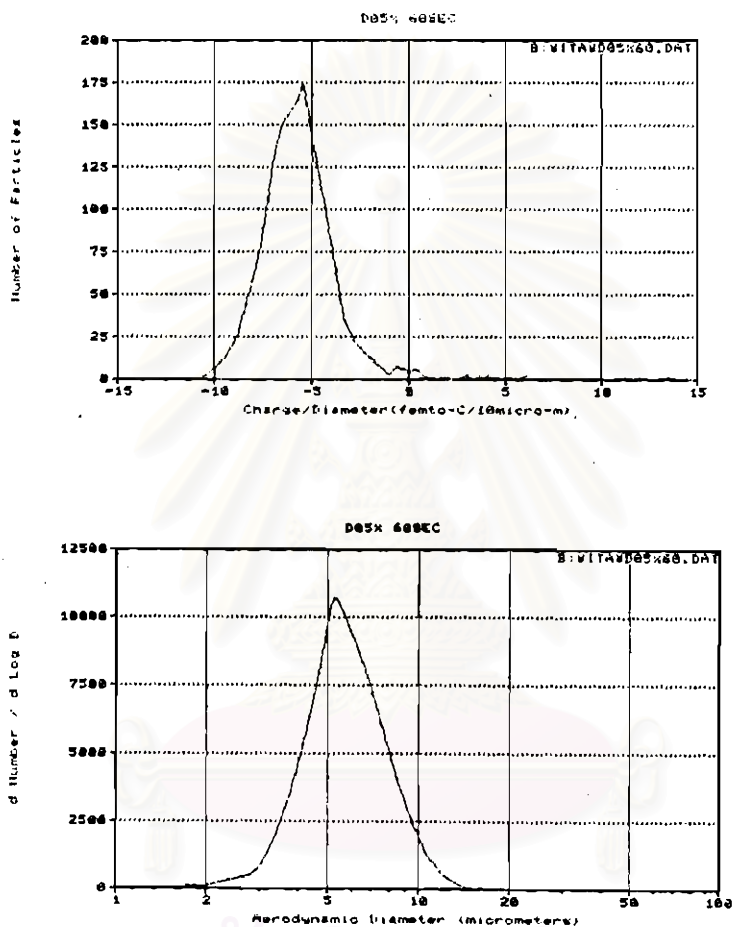


Figure A-7 Toner q/d and size distributions of 5% cyan toner in developer D

	Negative	Positive	Total
Count	2955	44	2999
Mass (nano-gram)	371.96	7.58	379.54
Charge (femto-C)	-11737.13	121.08	-11616.06
Charge/Mass (uC/g)	-31.55	15.97	-30.61

Max particle charge (neg) = -14.53 femto-C
 Max particle charge (pos) = 13.73 femto-C
 Count Average Diameter = 5.928 micrometers
 Mass Average Diameter = 7.362 micrometers

Appendix A (continued)

Toner charge properties of 8% cyan toner in developer D

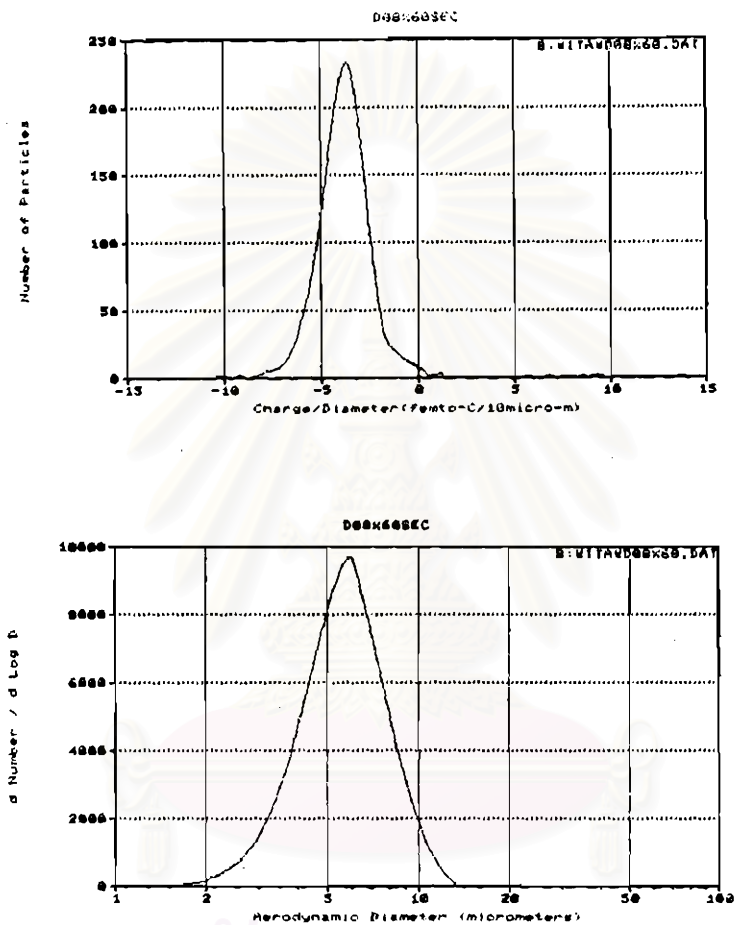


Figure A-8 Toner q/d and size distributions of 8% cyan toner in developer D

	Negative	Positive	Total
Count	2960	40	3000
Mass (nano-gram)	359.48	4.80	364.28
Charge (femto-C)	-7734.48	100.19	-7634.27
Charge/Mass (uC/g)	-21.52	20.88	-20.96

Max particle charge (neg) = -15.64 femto-C

Max particle charge (pos) = 10.79 femto-C

Count Average Diameter = 5.887 micrometers

Mass Average Diameter = 7.337 micrometers

Appendix A (continued)

Toner charge properties of 10% cyan toner in developer D

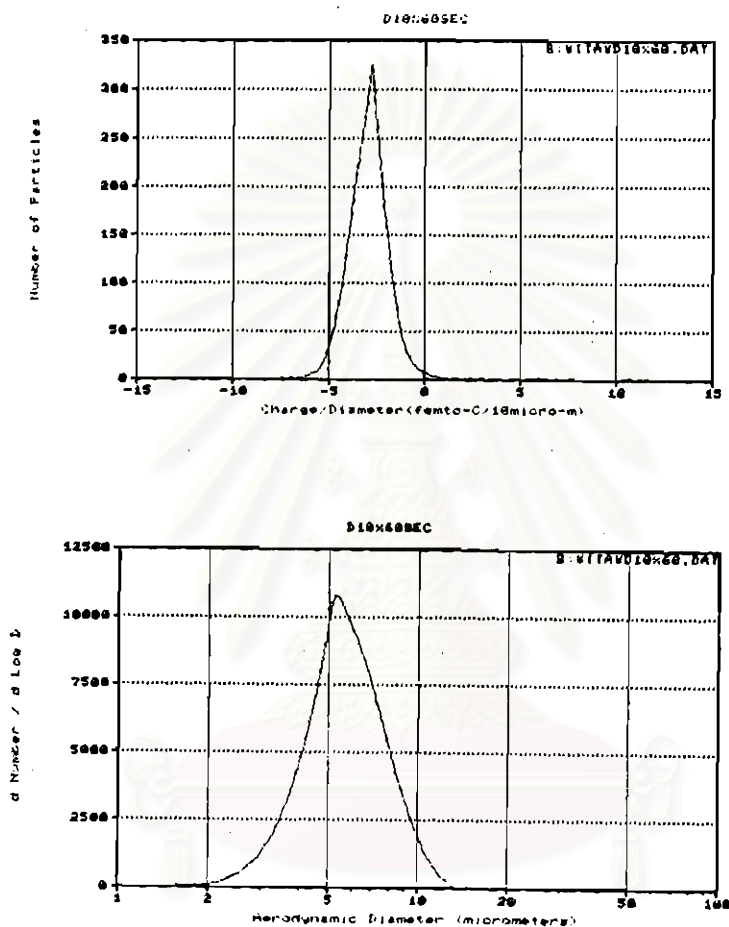


Figure A-9 Toner q/d and size distributions of 10% cyan toner in developer D

	Negative	Positive	Total
Count	2962	38	3000
Mass (nano-gram)	368.89	4.95	373.84
Charge (femto-C)	-6004.23	103.81	-5900.42
Charge/Mass ($\mu\text{C/g}$)	-16.28	20.97	-15.78

Max particle charge (neg) = -7.48 femto-C
 Max particle charge (pos) = 8.97 femto-C
 Count Average Diameter = 5.981 micrometers
 Mass Average Diameter = 7.291 micrometers

Appendix A (continued)

Toner charge properties of 15% cyan toner in developer D

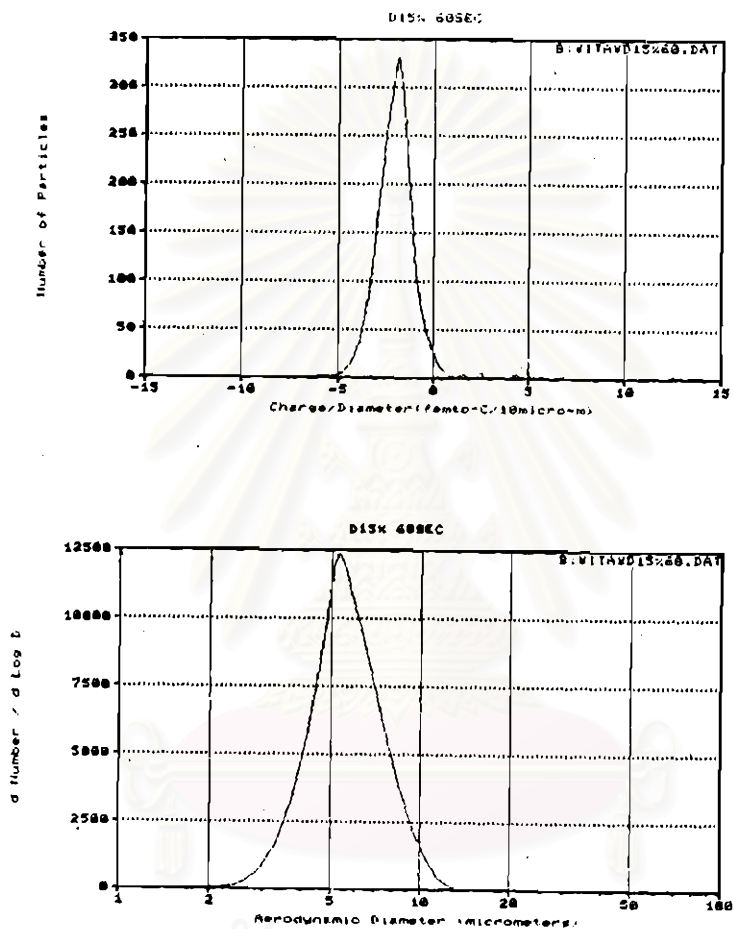


Figure A-10 Toner q/d and size distributions of 15% cyan toner in developer D

	Negative	Positive	Total
Count	2927	73	3000
Mass (nano-gram)	436.78	9.42	446.18
Charge (femto-C)	-4049.18	152.78	-3896.40
Charge/Mass (uC/g)	-9.27	16.21	-8.73

Max particle charge (neg) = -10.37 femto-C
 Max particle charge (pos) = 11.79 femto-C
 Count Average Diameter = 5.910 micrometers
 Mass Average Diameter = 7.822 micrometers

Appendix B

Triboelectric Series of Copolymers

Positive²²

Silicone elastomer with silica filler
 Borosilicate glass, fire polished
 Window glass
 Aniline-formol resin, acid catalyzed
 Polyformaldehyde
 Polymethylmethacrylate
 Ethylcellulose
 Polyamide
 Rocksalt (NaCl)
 Melamine formal
 Wool, knitted
 Silica, fire polished
 Silk, woven
 Poly (ethylene glycol succinate)
 Cellulose acetate
 Poly (ethylene glycol adipate)
 Poly (diallyl phthalate)
 Cellulose (regenerated) sponge
 Cotton, woven
 Polyurethane elastomer
 Styrene-acrylonitrile copolymer
 Styrene-butadiene copolymer
 Polystyrene
 Polyisobutylene
 Polyurethane flexible sponge
 Borosilicate glass, ground state
 Poly (ethylene glycol terephthalate)
 Poly (vinyl butyral)
 Formo-phenolique, hardened
 Epoxide resin
 Polychlorobutadiene
 Butadiene-acrylonitrile copolymer
 Natural rubber
 Polyacrylonitrile
 Polyethylene
 Poly (diphenylol propane carbonate)
 Chlorinated polyether
 Polyvinylchloride
 Polytrifluorechloroethylene
 Polytetrafluoroethylene

Negative

Appendix C

Irregular Carrier

The micrographs show the toner coverage on a rough irregular carrier, which morphology is similar to peaks and valleys, as shown in Figures C-1 and C-2.



Figure C-1 The micrograph of the red toners 5% covering on a carrier H



Figure C-2 The micrograph of the cyan toners 5% covering on a carrier H

Appendix D

Thermal Properties of the Red and Cyan Toners

The thermal properties of the red and cyan toners are analysed by DSC. The detailed curves and information evaluated by the Thermal Analysis System are presented in the following pages.



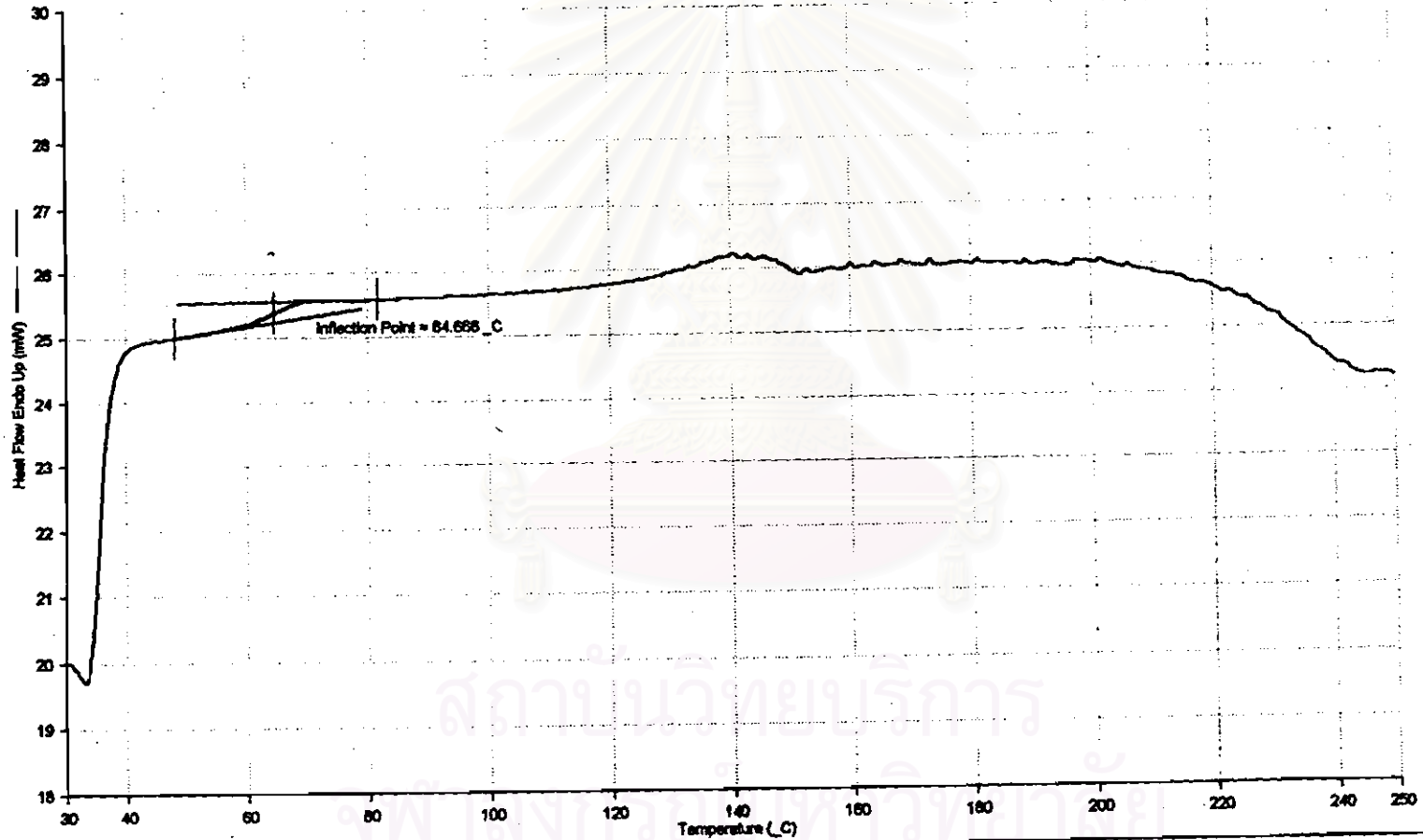
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Thermal Properties of the Red Toner

Filename: s:\pe\pyria\data\redtoner3.dsd - Apr 16, 2000 01:33:07 PM
Operator ID: Piyawan
Sample ID: red toner
Sample Weight: 5.630 mg
Comment:

red toner: redtoner3
Unsubtracted Heat Flow Ends Up (mW) : Step: 1

Perkin-Elmer Thermal Analysis



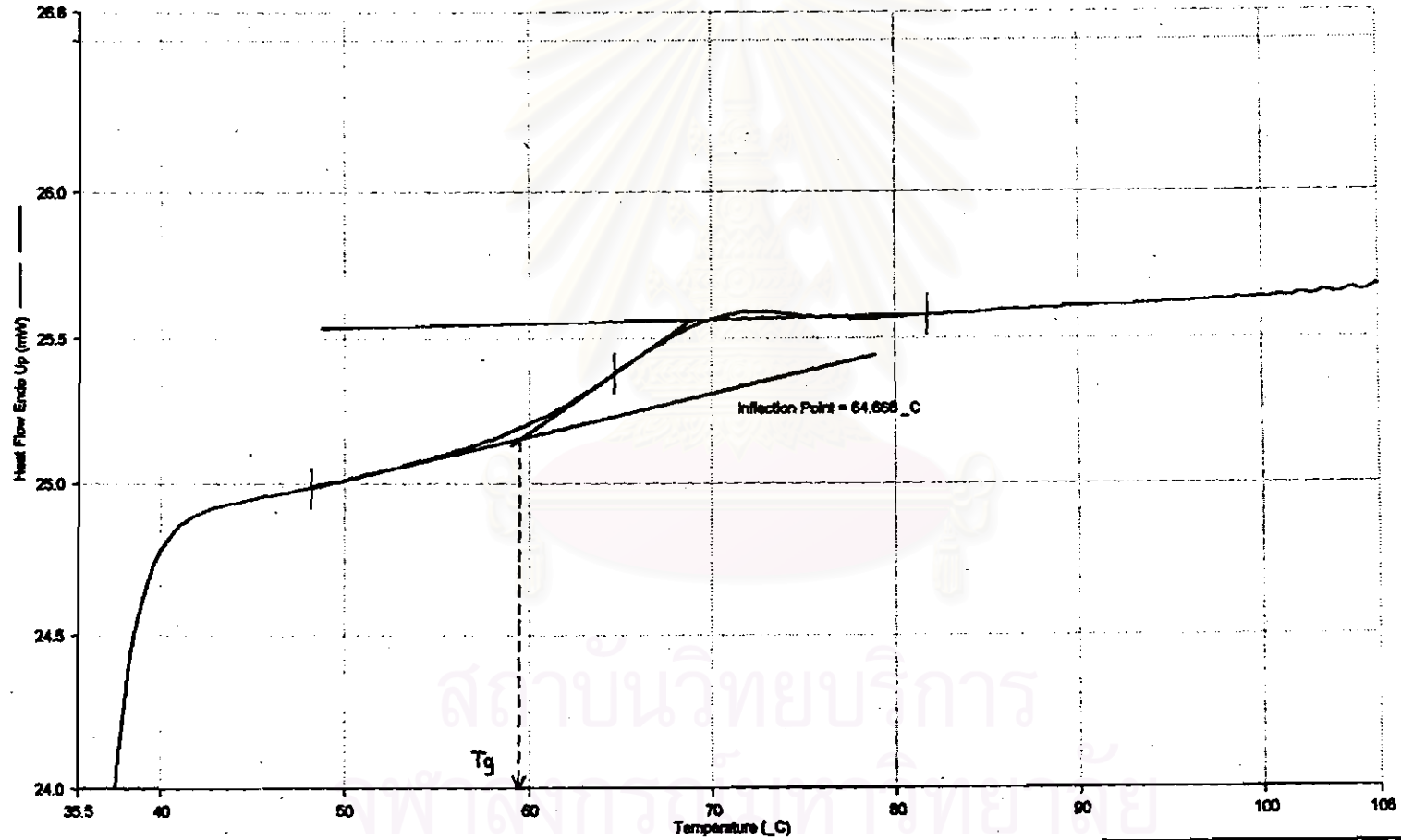
1) Heat from 30.00_C to 250.00_C at 20.00_C/min

04/16/00 - 14:17:09

Glass Transition Temperature of the Red Toner

Filename: c:\pe\pyris\data\redtoner3.dad - Apr 18, 2000 01:33:07 PM
Operator ID: Piyawan
Sample ID: red toner
Sample Weight: 5.630 mg
Comment: red toner, redtoner3
Unsubtracted Heat Flow Ends Up (mW) : Step: 1

Perkin-Elmer Thermal Analysis



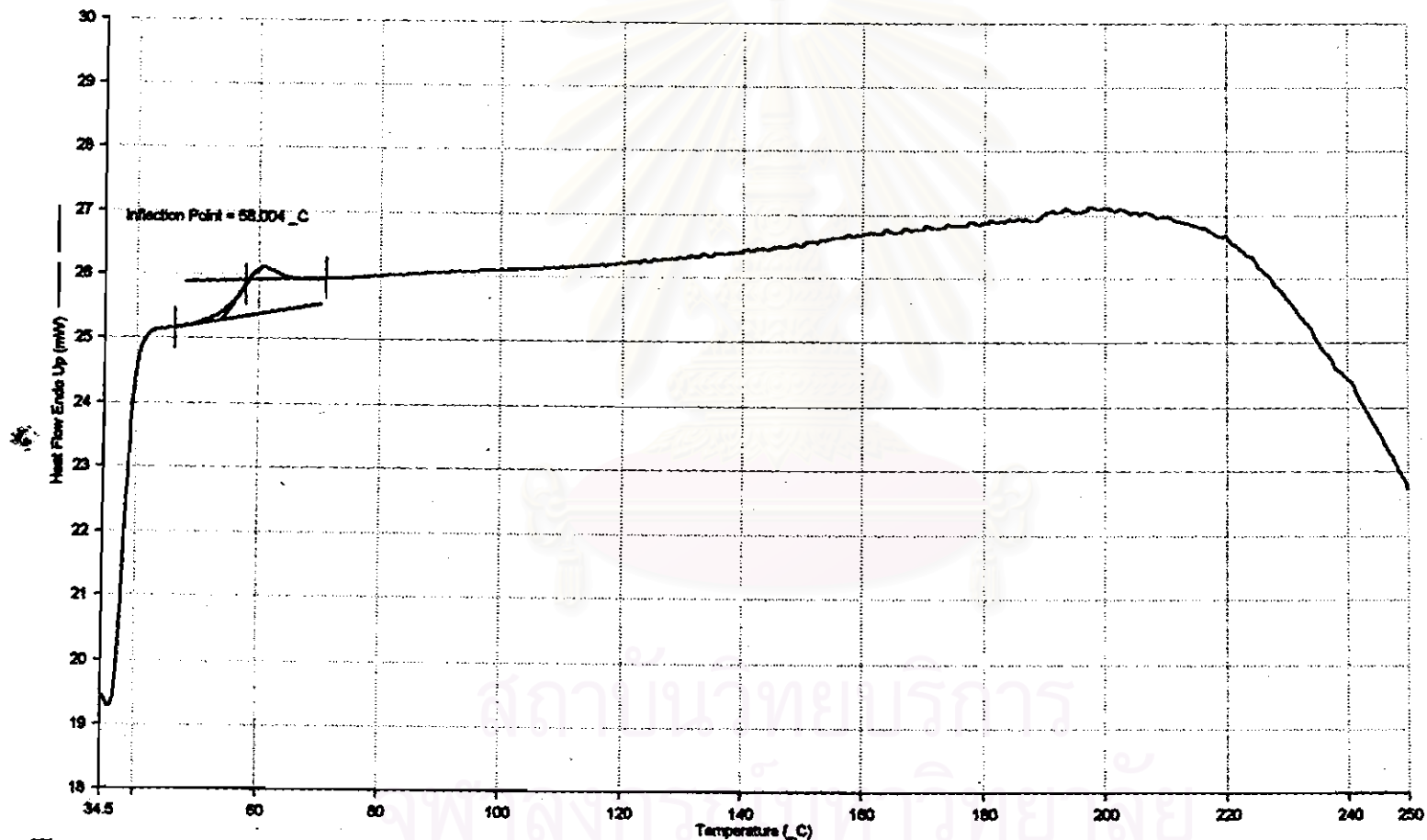
1) Heat from 30.00_C to 250.00_C at 20.00_C/min 04/18/00 - 14:16:19

Thermal Properties of the Cyan Toner

Filename: c:\pe\pyrif\data\cyan_toner2.dad - Apr 18, 2000 11:10:33 AM
Operator ID: Plyawan
Sample ID: cyan toner
Sample Weight: 5.500 mg
Comment:

cyan toner: cyan_toner2
Unsubtracted Heat Flow Ends Up (mW) : Step: 1

Parkin-Elmer Thermal Analysis



1) Heat from 30.00_C to 250.00_C at 20.00_C/min

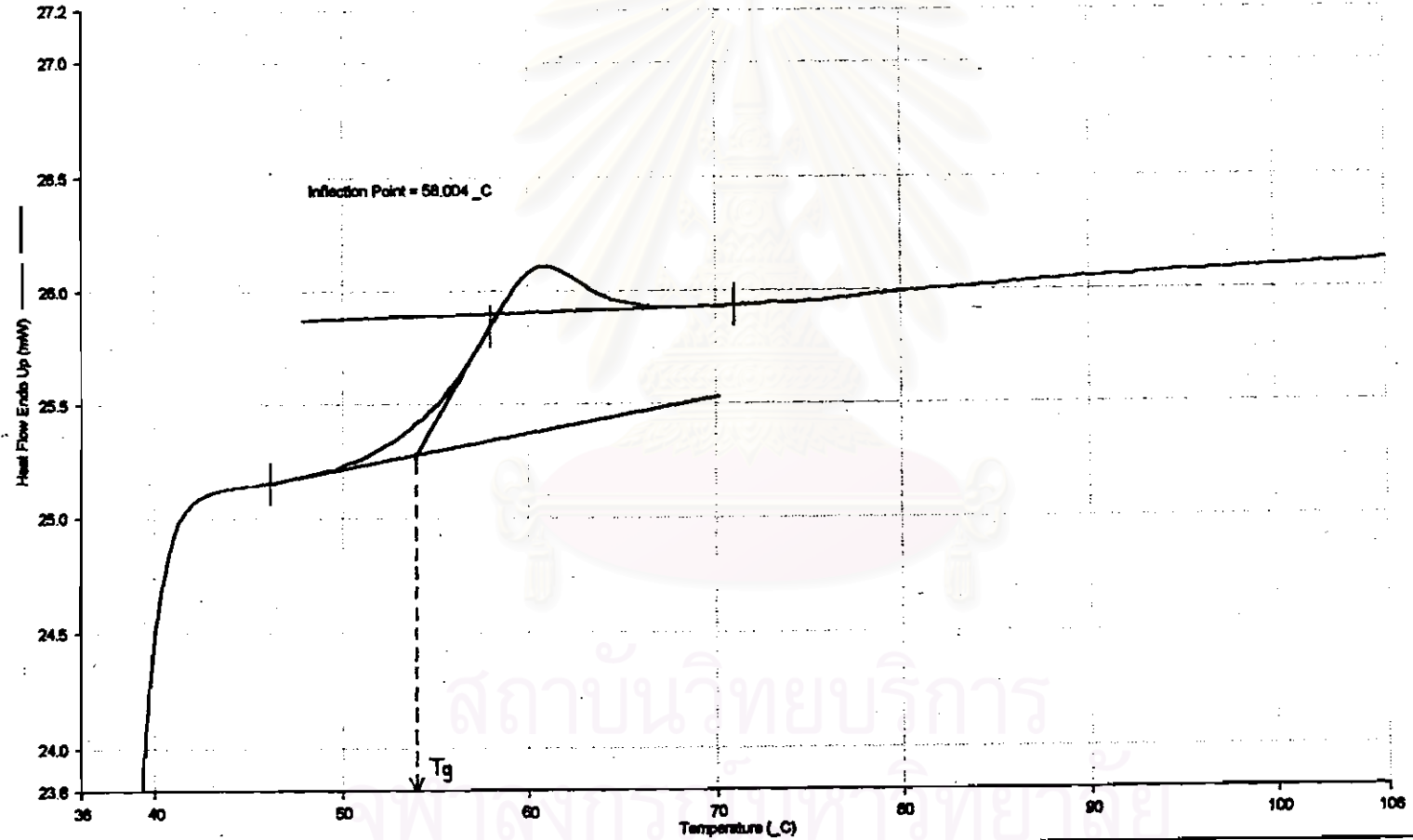
04/18/00 - 13:56:31

Glass Transition Temperature of the Cyan Toner

Filename: c:\pe\pyria\data\cyan_toner2.dad - Apr 18, 2000 11:10:33 AM
Operator ID: Piyawan
Sample ID: cyan toner
Sample Weight: 5.500 mg
Comment:

cyan toner: cyan_toner2
Unsubtracted Heat Flow Endo Up (mW) : Step: 1

Perkin-Elmer Thermal Analysis



1) Heat from 30.00_C to 250.00_C at 20.00_C/min

04/18/00 - 13:57:07

VITA

Mrs. Suchapa Netpradit was born in Bangkok on January, 9, 1965. She earns a Bachelor of Science in Photographic Science and Printing Technology, from the Faculty of Science, Chulalongkorn University in 1988. After having worked as a chief printer for seven years in two private printing houses, she becomes a lecturer at the Department of Printing Technology, King Mongkut's University of Technology, Thonburi. Presently, she is a graduate student in Imaging Technology Program, Faculty of Science, Chulalongkorn University.



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