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MECHANICAL PROPERTIES OF SYNDIOTACTIC POLYSTYRENE POLYMER BLEND

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for the Degree of Master of Engineering Program in Chemical Engineering

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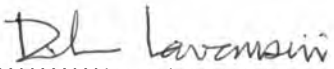
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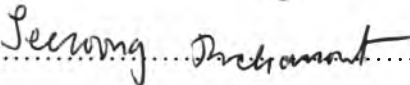
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สนธิ ขำสง่า: คุณสมบัติทางกลของพอลิเมอร์ผสมซินดิโอแทกติกพอลิสไตรีน (MECHANICAL PROPERTIES OF SYNDIOTACTIC POLYSTYRENE POLYMER BLEND) อ. ที่ปรึกษา: รศ. ดร. มล. ศุภกนก ทองใหญ่, 169 หน้า, ISBN 974-17-3941-9

งานวิจัยนี้ มุ่งเน้นที่จะศึกษาเกี่ยวกับการทดสอบคุณสมบัติทางกลของพอลิเมอร์ผสมระหว่างซินดิโอแทกติกพอลิสไตรีน (sPS) กับพอลิเมอร์ตัวอื่น เช่น พอลิแอลฟาเมทิลสไตรีน (PaMS), พอลิเอทิลเมทาคริเลต (PEMA), พอลิบิวทิลเมทาคริเลต (PBMA), พอลิไซโคลเฮกซิลเมทาคริเลต (PHMA) และพอลิไอโซพรีน (PIP) จากผลการทดลองพบว่า ค่าความยืดหยุ่นเชิงกล (storage modulus) ของพอลิเมอร์ผสมซินดิโอแทกติกพอลิสไตรีนมีค่าลดลงเมื่ออุณหภูมิเพิ่มขึ้นและที่ระยะเวลายาวนานขึ้นแต่มีค่าเพิ่มขึ้นเมื่อความถี่ที่ใช้มีค่าเพิ่มขึ้น นอกจากนี้ยังใช้หลักการซ้อนทับของเวลาและอุณหภูมิ (TTS) มาช่วยในการสร้างกราฟแม่บท (master curve) เพื่อทำนายค่าความยืดหยุ่นเชิงกลของพอลิเมอร์ผสมซินดิโอแทกติกพอลิสไตรีนที่ระยะเวลานานขึ้นและที่ความถี่ที่นอกเหนือจากช่วงที่ทดลองคือ 0.01-100 เฮิรตซ์ เมื่อนำกราฟแม่บทมาใช้เพื่อเปรียบเทียบผลของน้ำหนักโมเลกุลของซินดิโอแทกติกพอลิสไตรีน พบว่าระบบของการผสมทุกระบบให้ผลไปในทางเดียวกันคือ สารผสมจากซินดิโอแทกติกพอลิสไตรีนที่มีน้ำหนักโมเลกุลมากกว่า (sPS1) จะมีความแข็งมากกว่าซินดิโอแทกติกพอลิสไตรีนที่มีน้ำหนักโมเลกุลน้อยกว่า (sPS2) เนื่องจากความยาวของสายโซ่พอลิเมอร์ส่งผลโดยตรงต่อค่าความยืดหยุ่นเชิงกล ในการวิจัยนี้ยังมีการรายงานค่าคงที่ของวิลเลียม แลนเดลและเฟอรี (WLF constants) ที่ได้จากการสร้างกราฟแม่บท เมื่อนำระบบของพอลิเมอร์ผสมซินดิโอแทกติกพอลิสไตรีนที่มีน้ำหนักโมเลกุลของซินดิโอแทกติกพอลิสไตรีนเท่ากันทุกระบบมาเปรียบเทียบโดยใช้กราฟแม่บท พบว่า สามารถจัดกลุ่มพฤติกรรมของพอลิเมอร์ผสมที่เหมือนกันได้เป็น 3 ช่วง คือ ที่ความถี่มากกว่า 1×10^5 ที่ความถี่ระหว่าง $1 \times 10^3 - 1 \times 10^5$ และที่ความถี่น้อยกว่า 1×10^3 เฮิรตซ์

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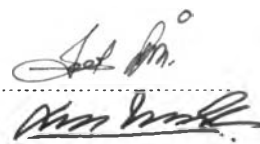
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This research is concerned with studying the mechanical properties of syndiotactic polystyrene (sPS) blend with several polymers such as poly(α -methyl styrene) (PaMS), poly(ethyl methacrylate) (PEMA), poly(*n*-butyl methacrylate) (PBMA), poly(cyclohexyl methacrylate) (PHMA) and poly(*cis*-isoprene) (PIP). From the experimental results, it was found that storage modulus (E') of all sPS blend system decreased with increasing time and temperature but increased with increasing frequency. Moreover, storage modulus master curve was created for all blend system by using Time-Temperature Superposition (TTS) principle. Storage modulus of sPS blend can be predicted for a longer time and for more than the experiments frequency range of 0.01-100 Hz. Then the effects of sPS molecular weight on mechanical properties were determined by using master curve comparison. Both of the two molecular weights of sPS have same trend in master curve. Storage modulus of higher molecular weight sPS were higher than that of less molecular weight of sPS because higher polymer chain lengths were resulted in higher storage modulus. Futhermore, William Landel and Ferry constants were reported by using shift factor calculated from creating master curves. All blend systems that have the same molecular weight of sPS were compared by way of master curves. The same sPS blend behaviors can be divided into three sections as a function of frequency as the range over 1×10^5 , the range between 1×10^{-3} - 1×10^5 and the range under 1×10^{-3} Hz.

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CONTENTS

	Page
ABSTRACT (IN THAI).....	iv
ABSTRACT (IN ENGLISH).....	v
ACKNOWLEDGEMENTS.....	vi
CONTENTS.....	vii
LIST OF FIGURES.....	x
LIST OF TABLES.....	xiv
CHAPTERS	
I INTRODUCTION.....	1
1.1 The Objective of This Thesis.....	3
1.2 The Scope of This Thesis.....	3
II LITERATURE REVIEWS.....	4
2.1 Syndiotactic Polystyrene.....	4
2.2 Polymer Blend.....	5
2.3 Mechanical Properties.....	9
III THEORY.....	10
3.1 Syndiotactic Polystyrene.....	10
3.2 Polymer Tacticity of Polystyrene.....	11
3.3 Polymer Morphology.....	12
3.3.1 The Amorphous State.....	12
3.3.2 Glass Transition Temperature.....	13
3.3.3 The Crystalline Polymer.....	14
3.4 Melting Phenomena.....	15
3.5 Thermal Properties.....	15
3.6 Polymer blends.....	15
3.6.1 Melt Mixing.....	16
3.6.2 Solvent Casing.....	16
3.6.3 Freeze Drying.....	17

	Page
3.6.4 Emulsions.....	17
3.6.5 Reactive Blend.....	18
3.7 Ultimate Mechanical Properties.....	18
3.7.1 Stress-Strain Diagram.....	19
3.7.2 Type of Stress-Strain Curve.....	21
3.7.3 Tensile Test.....	22
3.8 Dynamic Mechanical Analysis.....	24
3.8.1 Introduction to dynamic mechanical analysis.....	24
3.8.2 Basic Principle.....	24
3.8.3 Applying a dynamic stress to a sample.....	27
3.8.4 Testing Geometries.....	31
3.8.5 Time-Temperature Scans.....	39
3.8.6 Time-Temperature Superposition.....	44
3.8.7 Master Curve.....	47
3.8.8 The WLF Equation.....	48
IV EXPERIMENT.....	55
4.1 Materials and Chemicals.....	55
4.1.1 Chemicals.....	55
4.1.2 Materials.....	56
4.2 Equipments.....	56
4.2.1 Digital Hot Plate Stirrer.....	56
4.2.2 Automatic Hydraulic Hot Press.....	56
4.3 Analysis Instruments.....	56
4.3.1 Differential Scanning Calorimetry (DSC).....	56
4.3.2 Thermal Gravity Analyzer (TGA).....	57
4.3.3 Dynamic Mechanical Analysis (DMA).....	58
4.4 Procedure.....	58
4.4.1 Preparation.....	58

	Page
4.4.2 Polymer Characterization	59
4.4.3 Applying Data	59
V RESULTS AND DISCUSSION	64
5.1 Selecting Polymer to Blending	64
5.1.1 From Differential Scanning Calorimetry (DSC)	64
5.1.2 From Thermal Gravity Analyzer (TGA)	66
5.2 Mechanical Properties	68
5.2.1 Effect of time and temperature	68
5.2.2 Effect of frequency	74
5.2.3 Creating master curve by using Time-Temperature Superposition (TTS)	79
5.2.4 Effect of main component (sPS)	89
5.2.5 William Landel Ferry (WLF) constants	92
5.2.6 Effect of blended polymer type	99
VI CONCLUSIONS AND SUGGESTIONS	103
6.1 Conclusions	103
6.2 Suggestions	105
REFERENCE	106
APPENDICES	108
APPENDIX A	109
APPENDIX B	113
APPENDIX C	115
VITA	169

LIST OF FIGURES

Figure	Page
3.2.1 Types of olefin polymer tacticity	16
3.7.1 A typical stress-strain curve	17
3.7.2 The component of stress	18
3.7.3 Illustration of (a) extensional strain (b) simple shear strain	20
3.7.4 Extension types (a) bond bending (b) uncoiling (c) slippage	20
3.7.5 Types of stress-strain curve	26
3.7.6 Diagram illustrating stress-strain curve form which modulus and elongation values are derived	28
3.8.1 How a DMA works	29
3.8.2 Stress-strain curves relate force to deformation	29
3.8.3 DMA relationships	30
3.8.4 Oscillating a sample	31
3.8.5 Material response (a) In-phase response (b) Out-phase response (c) Viscoelastic material fall in between these two lines (d) Relationship between the phase angle, E' , E'' and E^*	36
3.8.6 Storage and loss	36
3.8.7 Flexure test I (a) three point bending (b) four-point bending and (c) compressive and tensile strains in three-point bending specimen	36
3.8.8 Flexure test fixtures II (a) Strain in a dual cantilever (b) Dual cantilever and (c) Single cantilever	37
3.8.9 Parallel plate fixture for axial analyzers (a) Standard parallel plates (b) Sintered plates (c) Tray and plates and (d) Cup and plate	38
3.8.10 Extension and sliding shear fixtures (a) Extension fixture (b) Sliding plate shear fixture	38
3.8.11 Plate geometries for torsion (a) Parallel plates (b) Cone and plates	40
3.8.12 Couette and torsion bar (a) Couette fixture (b) Torsion bar	40
3.8.13 Time-temperature studies in the DMA (a) Vary temperature (b) Hold temperature constant	40

Figure	Page
3.8.14 Free volume in polymer (a) The relationship of free volume to transition (b) A schematic example of free volume and crankshaft model	42
3.8.15 Ideallized temperature scan of a polymer	42
3.8.16 Operating range by DMA (a) Polycarbonate (b) Epoxy and (c) Polypropylene	43
3.8.17 Preparation of a Stress Relaxation Master Curve from Experimentally Measured Modulus-Time Curves at Various Temperatures	46
3.8.18 The WLF Equation for Polystyrene	47
3.8.19 Plot of a Stress Relaxation Master Curve at Various Temperatures	49
3.8.20 Plot of Modulus Versus Temperature Curves for Various Values of the Constant Time	50
4.3.1 Differential Scanning Calorimetry (DSC) Equipment	51
4.3.2 Thermal Gravity Analyzer (TGA) Equipment	23
4.3.3 Dynamic Mechanical Analysis (DMA) Equipment	52
4.4.1 Example for preparation of a Stress Relaxation Master Curve from Measured Modulus-Time Curves at Various Temperatures	57
5.1.1 Sample temperature at 5 % and 10 % losing weight	67
5.2.1 E' curve as time function for sPS1	69
5.2.2 E' curve as time function for sPS2	69
5.2.3 E' curve as time function for sPS1/PIP blend	70
5.2.4 E' curve as time function for sPS2/PIP blend	70
5.2.5 E' curve as time function for sPS1/PBMA blend	71
5.2.6 E' curve as time function for sPS2/PBMA blend	71
5.2.7 E' curve as time function for sPS1/PEMA blend	72
5.2.8 E' curve as time function for sPS2/PEMA blend	72
5.2.9 E' curve as time function for sPS1/PHMA blend	73
5.2.10 E' curve as time function for sPS2/PHMA blend	73
5.2.11 E' curve as time function for sPS1/PaMS blend	74
5.2.12 E' curve as time function for sPS2/PaMS blend	74
5.2.13 E' curve as frequency function for sPS1	75
5.2.14 E' curve as frequency function for sPS2	75

Figure	Page
5.2.15 E' curve as frequency function for sPS1/PIP blend.....	75
5.2.16 E' curve as frequency function for sPS2/PIP blend.....	76
5.2.17 E' curve as frequency function for sPS1/PBMA blend.....	76
5.2.18 E' curve as frequency function for sPS2/PBMA blend.....	76
5.2.19 E' curve as frequency function for sPS1/PEMA blend.....	77
5.2.20 E' curve as frequency function for sPS2/PEMA blend.....	77
5.2.21 E' curve as frequency function for sPS1/PHMA blend.....	77
5.2.22 E' curve as frequency function for sPS2/PHMA blend.....	78
5.2.23 E' curve as frequency function for sPS1/PaMS blend.....	78
5.2.24 E' curve as frequency function for sPS2/PaMS blend.....	78
5.2.25 Master curve for sPS1 as time function with T_r 100.25 °C.....	79
5.2.26 Master curve for sPS2 as time function with T_r 100.25 °C.....	79
5.2.27 Master curve for sPS1/PIP blend as time function with T_r 70.71 °C.....	80
5.2.28 Master curve for sPS2/PIP blend as time function with T_r 70.71 °C.....	80
5.2.29 Master curve for sPS1/PBMA blend as time function with T_r 84.22 °C....	80
5.2.30 Master curve for sPS2/PBMA blend as time function with T_r 84.22 °C....	81
5.2.31 Master curve for sPS1/PEMA blend as time function with T_r 81.95 °C....	81
5.2.32 Master curve for sPS2/PEMA blend as time function with T_r 81.95 °C....	81
5.2.33 Master curve for sPS1/PHMA blend as time function with T_r 79.22 °C....	82
5.2.34 Master curve for sPS2/PHMA blend as time function with T_r 79.22 °C....	82
5.2.35 Master curve for sPS1/PaMS blend as time function with T_r 90.24 °C.....	82
5.2.36 Master curve for sPS2/PaMS blend as time function with T_r 90.24 °C.....	83
5.2.37 Master curve for sPS1 as frequency function with T_r 100.25 °C.....	84
5.2.38 Master curve for sPS2 as frequency function with T_r 100.25 °C.....	84
5.2.39 Master curve for sPS1/PIP blend as frequency function with T_r 70.71 °C	85
5.2.40 Master curve for sPS2/PIP blend as frequency function with T_r 70.71 °C	85
5.2.41 Master curve for sPS1/PBMA blend as frequency function with T_r 84.22 °C.....	86
5.2.42 Master curve for sPS2/PBMA blend as frequency function with T_r 84.22 °C.....	86

Figure	Page
5.2.43 Master curve for sPS1/PEMA blend as frequency function with T_r 81.95 °C	87
5.2.44 Master curve for sPS2/PEMA blend as time function with T_r 81.95 °C	87
5.2.45 Master curve for sPS1/PHMA blend as time function with T_r 79.22 °C	88
5.2.46 Master curve for sPS2/PHMA blend as time function with T_r 79.22 °C	88
5.2.47 Master curve for sPS1/PaMS blend as time function with T_r 90.24 °C	89
5.2.48 Master curve for sPS2/PaMS blend as time function with T_r 90.24 °C	89
5.2.49 Master curve for sPS1 and sPS2	90
5.2.50 Master curve for sPS1 and sPS2 blended with PIP	90
5.2.51 Master curve for sPS1 and sPS2 blended with PBMA	91
5.2.52 Master curve for sPS1 and sPS2 blended with PEMA	91
5.2.53 Master curve for sPS1 and sPS2 blended with PHMA	91
5.2.54 Master curve for sPS1 and sPS2 blended with PaMS	92
5.2.55 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS1	93
5.2.56 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS1	93
5.2.57 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS1/PIP	94
5.2.58 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS2/PIP	94
5.2.58 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS1/PBMA	95
5.2.60 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS2/PBMA	95
5.2.61 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS1/PEMA	96
5.2.62 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS2/PEMA	96
5.2.63 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS1/PHMA	97
5.2.64 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS2/PHMA	97
5.2.65 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS1/PaMS	98
5.2.66 Relationship between $-1/\log a_T$ versus $1/(T-T_g)$ for sPS2/PaMS	98

Figure	Page
5.2.67 E' master curve for all sPS1 blend systems	100
5.2.68 E' master curve for all sPS2 blend systems	100
A.1 DSC curve of sPS1	109
A.2 DSC curve of sPS1 blended with PIP	109
A.3 DSC curve of sPS1 blended with PBMA	109
A.4 DSC curve of sPS1 blended with PEMA	110
A.5 DSC curve of sPS1 blended with PHMA	110
A.6 DSC curve of sPS1 blended with PaMS	110
A.7 DSC curve of sPS	111
A.8 DSC curve of sPS blended with PIP	111
A.9 DSC curve of sPS blended with PBMA	111
A.10 DSC curve of sPS blended with PEMA	112
A.11 DSC curve of sPS blended with PHMA	112
A.12 DSC curve of sPS blended with PaMS	112
A.13 TGA curve of sPS	113
A.14 TGA curve of sPS blended with PIP	113
A.15 TGA curve of sPS blended with PBMA	113
A.16 TGA curve of sPS blended with PEMA	114
A.17 TGA curve of sPS blended with PHMA	114
A.18 TGA curve of sPS blended with PaMS	114

LIST OF TABLES

Table	Page
3.7.1 Characteristic features of stress-strain curve as they relate to the polymer properties.....	22
3.8.1 Geometric factors for fixtures.....	32
3.8.2 WLF parameters.....	49
4.1 Temperature range for DSC measurement.....	60
4.2 Conditions and parameter for running DMA.....	61
5.1.1 Glass transition temperature (T_g), melting temperature (T_m) and crystallization temperature (T_c) of blend system.....	65
5.1.2 Glass transition temperature (T_g), melting temperature (T_m) and crystallization temperature (T_c) of blend system.....	65
5.1.3 Glass transition temperature (T_g) of sPS polymer blend.....	66
5.1.3 Sample temperature at 5 % and 10 % losing weight.....	67
5.2.1 C_1 and C_2 for pure sPS and all blend systems.....	99
5.2.2 Average storage modulus different of all blend systems for two sections.....	101
5.2.2(Cont.).....	102
A.1 DMA data of sPS1 for temperature 60 °C.....	115
A.2 DMA data of sPS1 for temperature 80 °C.....	115
A.3 DMA data of sPS1 for temperature 90 °C.....	116
A.4 DMA data of sPS1 for temperature 100.25 °C.....	116
A.5 DMA data of sPS1 for temperature 110 °C.....	117
A.6 DMA data of sPS1 for temperature 120 °C.....	117
A.7 DMA data of sPS1 for temperature 140 °C.....	118
A.8 DMA data of sPS1 for temperature 160 °C.....	118
A.9 DMA data of sPS1 for temperature 180 °C.....	119
A.10 DMA data of sPS1 blended with PIP for temperature 60 °C.....	119
A.11 DMA data of sPS1 blended with PIP for temperature 65 °C.....	120
A.12 DMA data of sPS1 blended with PIP for temperature 70.71 °C.....	120

Table	Page
A.13 DMA data of sPS1 blended with PIP for temperature 85°C.....	121
A.14 DMA data of sPS1 blended with PIP for temperature 100 °C.....	121
A.15 DMA data of sPS1 blended with PIP for temperature 120 °C.....	122
A.16 DMA data of sPS1 blended with PIP for temperature 140 °C.....	122
A.17 DMA data of sPS1 blended with PIP for temperature 160 °C.....	123
A.18 DMA data of sPS1 blended with PIP for temperature 180 °C.....	123
A.19 DMA data of sPS1 blended with PBMA for temperature 60 °C.....	124
A.20 DMA data of sPS1 blended with PBMA for temperature 80 °C.....	124
A.21 DMA data of sPS1 blended with PBMA for temperature 84.22 °C.....	125
A.22 DMA data of sPS1 blended with PBMA for temperature 90 °C.....	125
A.23 DMA data of sPS1 blended with PBMA for temperature 100 °C.....	126
A.24 DMA data of sPS1 blended with PBMA for temperature 120 °C.....	126
A.25 DMA data of sPS1 blended with PBMA for temperature 140 °C.....	127
A.26 DMA data of sPS1 blended with PBMA for temperature 160 °C.....	127
A.27 DMA data of sPS1 blended with PBMA for temperature 180 °C.....	128
A.28 DMA data of sPS1 blended with PEMA for temperature 60 °C.....	128
A.29 DMA data of sPS1 blended with PEMA for temperature 70 °C.....	129
A.30 DMA data of sPS1 blended with PEMA for temperature 81.95 °C.....	129
A.31 DMA data of sPS1 blended with PEMA for temperature 90°C.....	130
A.32 DMA data of sPS1 blended with PEMA for temperature 100 °C.....	130
A.33 DMA data of sPS1 blended with PEMA for temperature 120 °C.....	131
A.34 DMA data of sPS1 blended with PEMA for temperature 140 °C.....	131
A.35 DMA data of sPS1 blended with PEMA for temperature 160 °C.....	132
A.36 DMA data of sPS1 blended with PEMA for temperature 180 °C.....	132
A.37 DMA data of sPS1 blended with PHMA for temperature 60 °C.....	133
A.38 DMA data of sPS1 blended with PHMA for temperature 70 °C.....	133
A.39 DMA data of sPS1 blended with PHMA for temperature 79.22 °C.....	134
A.40 DMA data of sPS1 blended with PHMA for temperature 90 °C.....	134
A.41 DMA data of sPS1 blended with PHMA for temperature 100 °C.....	135

Table	Page
A.42 DMA data of sPS1 blended with PHMA for temperature 120 °C	135
A.43 DMA data of sPS1 blended with PHMA for temperature 140 °C	136
A.44 DMA data of sPS1 blended with PHMA for temperature 160 °C	136
A.45 DMA data of sPS1 blended with PHMA for temperature 180 °C	137
A.46 DMA data of sPS1 blended with PaMS for temperature 60 °C	137
A.47 DMA data of sPS1 blended with PaMS for temperature 70 °C	138
A.48 DMA data of sPS1 blended with PaMS for temperature 80 °C	138
A.49 DMA data of sPS1 blended with PaMS for temperature 90.24°C	139
A.50 DMA data of sPS1 blended with PaMS for temperature 100 °C	139
A.51 DMA data of sPS1 blended with PaMS for temperature 120 °C	140
A.52 DMA data of sPS1 blended with PaMS for temperature 140 °C	140
A.53 DMA data of sPS1 blended with PaMS for temperature 160 °C	141
A.54 DMA data of sPS1 blended with PaMS for temperature 180 °C	141
A.55 DMA data of sPS1 for temperature 60 °C	142
A.56 DMA data of sPS1 for temperature 80 °C	142
A.57 DMA data of sPS1 for temperature 90 °C	143
A.58 DMA data of sPS1 for temperature 100.25 °C	143
A.59 DMA data of sPS1 for temperature 110 °C	144
A.60 DMA data of sPS1 for temperature 120 °C	144
A.61 DMA data of sPS1 for temperature 140 °C	145
A.62 DMA data of sPS1 for temperature 160 °C	145
A.63 DMA data of sPS1 for temperature 180 °C	146
A.64 DMA data of sPS2 blended with PIP for temperature 60 °C	146
A.65 DMA data of sPS2 blended with PIP for temperature 65 °C	147
A.66 DMA data of sPS2 blended with PIP for temperature 70.71 °C	147
A.67 DMA data of sPS2 blended with PIP for temperature 85°C	148
A.68 DMA data of sPS2 blended with PIP for temperature 100 °C	148
A.69 DMA data of sPS2 blended with PIP for temperature 120 °C	149
A.70 DMA data of sPS2 blended with PIP for temperature 140 °C	149

Table	Page
A.71 DMA data of sPS2 blended with PIP for temperature 160 °C	150
A.72 DMA data of sPS2 blended with PIP for temperature 180 °C	150
A.73 DMA data of sPS2 blended with PBMA for temperature 60 °C	151
A.74 DMA data of sPS2 blended with PBMA for temperature 80 °C	151
A.75 DMA data of sPS2 blended with PBMA for temperature 84.22 °C	152
A.76 DMA data of sPS2 blended with PBMA for temperature 90 °C	152
A.77 DMA data of sPS2 blended with PBMA for temperature 100 °C	153
A.78 DMA data of sPS2 blended with PBMA for temperature 120 °C	153
A.79 DMA data of sPS2 blended with PBMA for temperature 140 °C	154
A.80 DMA data of sPS2 blended with PBMA for temperature 160 °C	154
A.81 DMA data of sPS2 blended with PBMA for temperature 180 °C	155
A.82 DMA data of sPS2 blended with PEMA for temperature 60 °C	155
A.83 DMA data of sPS2 blended with PEMA for temperature 70 °C	156
A.84 DMA data of sPS2 blended with PEMA for temperature 81.95 °C	156
A.85 DMA data of sPS2 blended with PEMA for temperature 90°C	157
A.86 DMA data of sPS2 blended with PEMA for temperature 100 °C	157
A.87 DMA data of sPS2 blended with PEMA for temperature 120 °C	158
A.88 DMA data of sPS2 blended with PEMA for temperature 140 °C	158
A.89 DMA data of sPS2 blended with PEMA for temperature 160 °C	159
A.90 DMA data of sPS2 blended with PEMA for temperature 180 °C	159
A.91 DMA data of sPS2 blended with PHMA for temperature 60 °C	160
A.92 DMA data of sPS2 blended with PHMA for temperature 70 °C	160
A.93 DMA data of sPS2 blended with PHMA for temperature 79.22 °C	161
A.94 DMA data of sPS2 blended with PHMA for temperature 90 °C	161
A.95 DMA data of sPS2 blended with PHMA for temperature 100 °C	162
A.96 DMA data of sPS2 blended with PHMA for temperature 120 °C	162
A.97 DMA data of sPS2 blended with PHMA for temperature 140 °C	163
A.98 DMA data of sPS2 blended with PHMA for temperature 160 °C	163

Table	Page
A.99 DMA data of sPS2 blended with PHMA for temperature 180 °C	164
A.100 DMA data of sPS2 blended with PaMS for temperature 60 °C	164
A.101 DMA data of sPS2 blended with PaMS for temperature 70 °C	165
A.102 DMA data of sPS2 blended with PaMS for temperature 80 °C	165
A.103 DMA data of sPS2 blended with PaMS for temperature 90.24°C	166
A.104 DMA data of sPS2 blended with PaMS for temperature 100 °C	166
A.105 DMA data of sPS2 blended with PaMS for temperature 120 °C	167
A.106 DMA data of sPS2 blended with PaMS for temperature 140 °C	167
A.107 DMA data of sPS2 blended with PaMS for temperature 160 °C	168
A.108 DMA data of sPS2 blended with PaMS for temperature 180 °C	168