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APPENDICES

PART I. PA 6/LDPE/Ionomer Ternary blends

Appendix A Differential Scanning Calorimetry

Table A1 Delta H (ΔH) of LDPE in PA 6/LDPE/ionomer ternary blends as determined by DSC

Surlyn® ionomer (%)	ΔH ($J.g^{-1}$) of LDPE for PA 6/LDPE blends			
	80/20	60/40	40/60	20/80
0.0	28.92	57.61	87.33	104.19
0.1	29.10	41.85	60.57	79.19
0.5	26.40	44.33	59.68	87.04
1.0	28.00	57.50	80.72	96.25
2.5	37.22	56.78	66.24	107.41
5.0	15.13	36.99	59.34	86.84
10.0	17.66	50.84	63.65	73.18
15.0	22.184	49.11	66.30	76.87
35.0	25.55	68.62	99.32	103.49

- Pure PA 6: $\Delta H = 67.43\ J.g^{-1}$
- Pure LDPE: $\Delta H = 101.84\ J.g^{-1}$
- Pure Surlyn® 9020: $\Delta H = 41.61\ J.g^{-1}$

Table A2 Delta H (ΔH) of PA 6 in PA 6/LDPE/ionomer ternary blends as determined by DSC

Surlyn® ionomer (%)	ΔH ($J.g^{-1}$) of PA 6 for PA 6/LDPE blends			
	80/20	60/40	40/60	20/80
0.0	49.96	28.27	21.59	12.03
0.1	60.75	43.58	23.56	10.49
0.5	58.67	36.18	19.79	11.00
1.0	58.44	41.58	26.13	10.77
2.5	53.17	35.75	28.5	9.87
5.0	49.73	38.48	25.71	12.22
10.0	45.75	38.92	28.50	14.11
15.0	45.31	35.18	22.43	11.53
35.0	36.13	27.38	16.22	7.84

- Pure PA 6: $\Delta H = 67.43\ J.g^{-1}$
- Pure LDPE: $\Delta H = 101.84\ J.g^{-1}$
- Pure Surlyn® 9020: $\Delta H = 41.61\ J.g^{-1}$

Appendix B Mechanical Properties

Table B1 Tensile strength of PA 6/LDPE/ionomer ternary blends

Surlyn® ionomer (%)	Tensile strength (MPa) of PA 6/LDPE blends			
	80/20	60/40	40/60	20/80
0.0	32.6 ± 1.1	10.7 ± 0.8	11.2 ± 0.3	11.4 ± 0.4
0.1	33.3 ± 1.6	14.2 ± 1.0	13.0 ± 0.8	11.9 ± 0.7
0.5	32.9 ± 0.8	12.9 ± 0.4	12.4 ± 0.1	11.9 ± 0.7
1.0	37.0 ± 1.1	15.9 ± 1.0	13.3 ± 0.4	12.1 ± 0.4
2.5	38.1 ± 0.8	18.3 ± 0.8	13.0 ± 0.3	12.2 ± 0.4
5.0	40.0 ± 1.6	15.4 ± 0.4	14.5 ± 0.4	12.6 ± 0.4
10.0	36.2 ± 0.8	15.6 ± 1.0	14.0 ± 0.3	12.6 ± 0.8
15.0	36.7 ± 3.1	15.5 ± 0.9	14.0 ± 0.8	11.7 ± 0.1
35.0	25.4 ± 1.4	14.6 ± 0.3	13.3 ± 0.7	11.3 ± 0.7

Table B2 Elongation at break of PA 6/LDPE/ionomer ternary blends

Surlyn® ionomer (%)	Elongation at break (%) of PA 6/LDPE blends			
	80/20	60/40	40/60	20/80
0.0	82.4 ± 3.4	6.0 ± 0.6	8.1 ± 1.2	20.8 ± 3.0
0.1	65.8 ± 1.3	10.8 ± 0.7	10.0 ± 0.6	17.9 ± 1.7
0.5	54.8 ± 1.0	7.5 ± 1.5	6.7 ± 0.9	19.9 ± 2.3
1.0	96.3 ± 8.9	7.2 ± 1.2	9.5 ± 0.5	27.3 ± 1.9
2.5	118.1 ± 7.9	10.5 ± 2.4	11.7 ± 1.0	32.0 ± 2.1
5.0	145.6 ± 3.0	10.5 ± 1.3	14.7 ± 2.0	33.1 ± 2.4
10.0	155.7 ± 2.0	11.8 ± 0.8	21.2 ± 2.5	35.6 ± 1.7
15.0	130.4 ± 2.4	19.2 ± 1.5	28.2 ± 4.5	39.4 ± 2.4
35.0	98.2 ± 1.5	38.2 ± 4.1	40.9 ± 6.7	52.4 ± 5.5

PART II. PA 6/Ionomer Binary Blends

Appendix C Fourier Transform Infrared Spectrometry

Table C Peaks present in FTIR spectra of PA 6/ionomer blends

Blend composition (PA 6/ionomer)	Peak	Wave number (cm^{-1})
100/0	1	3301
	2	3074
	3	2937
	4	2868
	5	1639
	6	1544
	7	1463
80/20	1	3301
	2	3074
	3	2921
	4	2851
	5	1639
	6	1543
	7	1463
60/40	1	3301
	2	3084
	3	2919
	4	2851
	5	1699
	6	1641
	7	1547
	8	1464

Blend composition (PA 6/ionomer)	Peak	Wave number (cm^{-1})
50/50	1	3301
	2	3085
	3	2923
	4	2851
	5	1699
	6	1642
	7	1548
	8	1464
40/60	1	3302
	2	3084
	3	2919
	4	2851
	5	1699
	6	1641
	7	1547
	8	1465
20/80	1	3302
	2	2921
	3	2851
	4	1699
	5	1642
	6	1585
	7	1549
	8	1465
0/100	1	2918
	2	2850
	3	1699
	4	1585
	5	1466

Appendix D Dynamic Mechanical Analysis

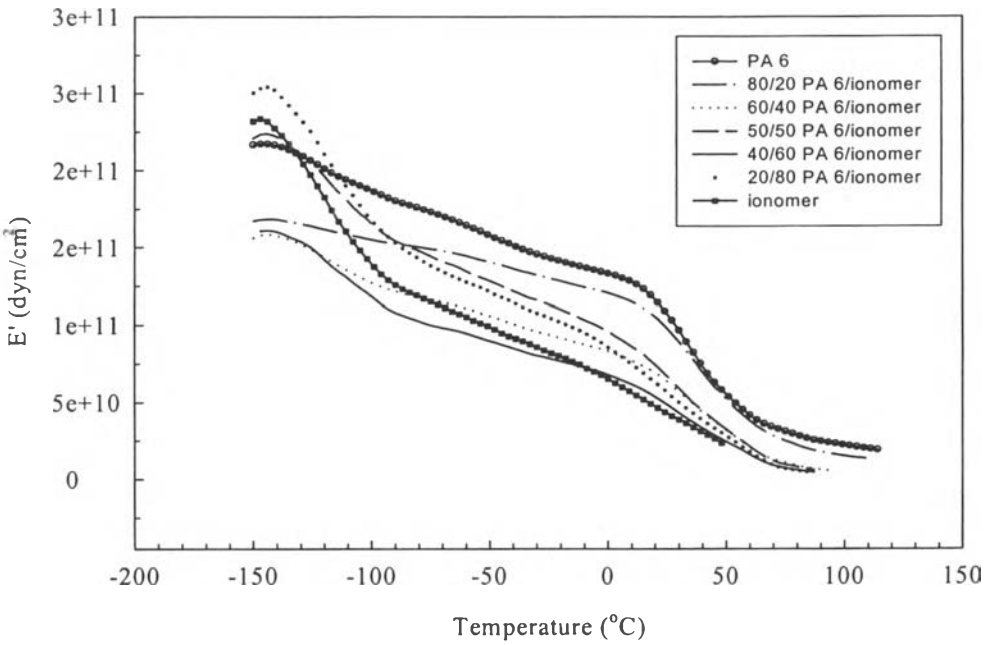

Figure D Temperature dependence of storage modulus E' of pure PA 6, pure ionomer and PA 6/ionomer blends.

Appendix E Rheological Studies

Table E1 Rheological properties of pure PA 6

Frequency (rad/s)	G' (Pa.s)	G" (Pa.s)	Complex viscosity (Pa.s)
0.0500	5.0981	11.1843	245.8300
0.0792	8.0973	17.4707	242.9930
0.1256	13.2146	27.6234	243.8130
0.1991	22.8151	41.5266	238.0330
0.3155	29.8384	58.3155	207.6400
0.5000	36.5844	84.7884	184.6890
0.7925	43.4726	125.4760	167.5740
1.2559	50.2652	190.2930	156.7110
1.9905	59.1375	292.7430	150.0380
3.1548	71.6086	453.5340	145.5420
5.0000	90.0765	707.7610	142.6940
7.9245	120.9220	1109.5400	140.8430
12.5594	178.1700	1750.9300	140.1310
19.9054	296.3830	2782.2800	140.5660
31.5479	540.6300	4425.4100	141.3190
50.0000	995.4860	6953.4900	140.4880
79.2447	1839.4700	10767.8000	137.8490

Table E2 Rheological properties of 80/20 PA 6/ionomer blend

Frequency (rad/s)	G' (Pa.s)	G" (Pa.s)	Complex viscosity (Pa.s)
0.0500	22.3533	40.1104	918.3710
0.0792	58.4178	75.8041	1207.6800
0.1256	90.3648	110.0300	1133.6600
0.1991	121.0030	148.3510	961.7560
0.3155	147.8470	209.3530	812.4030
0.5000	175.9480	298.3490	692.7330
0.7925	213.4650	436.8860	613.6030
1.2559	266.0860	651.4600	560.3010
1.9905	354.7750	972.0640	519.8510
3.1548	504.9070	1440.8400	483.9450
5.0000	759.7660	2109.4400	448.4180
7.9245	1177.5800	3049.1000	412.4680
12.5594	1844.4700	4355.6100	376.6140
19.9054	2858.8700	6161.2800	341.2270
31.5479	4301.8300	8602.4800	304.8740
50.0000	6286.0000	11886.7000	268.9300
79.2447	9037.0900	16390.3000	236.1870

Table E3 Rheological properties of 60/40 PA 6/ionomer blend

Frequency (rad/s)	G' (Pa.s)	G" (Pa.s)	Complex viscosity (Pa.s)
0.0500	287.7750	209.1880	7115.4400
0.0792	456.6330	293.9590	6853.0900
0.1256	626.7800	390.4850	5879.7700
0.1991	789.3510	509.0960	4718.7500
0.3155	967.7850	660.9900	3714.9000
0.5000	1171.8100	851.0980	2896.5600
0.7925	1427.3800	1081.3100	2259.7300
1.2559	1738.6100	1361.4000	1758.2000
1.9905	2128.1700	1689.9300	1365.2300
3.1548	2603.5800	2077.5100	1055.8100
5.0000	3174.9400	2558.7000	815.5300
7.9245	3850.6900	3156.9100	628.3510
12.5594	4655.6800	3954.5900	486.3700
19.9054	5647.7800	5060.4600	380.9650
31.5479	6904.9800	6605.7000	302.8990
50.0000	8555.8300	8802.2200	245.5050
79.2447	10807.7000	11908.6000	202.9370

Table E4 Rheological properties of 50/50 PA 6/ionomer blend

Frequency (rad/s)	G' (Pa.s)	G" (Pa.s)	Complex viscosity (Pa.s)
0.0500	571.3520	222.7870	12265.0000
0.0792	844.0660	267.9490	11175.2000
0.1256	1052.2600	336.7030	8796.6900
0.1991	1221.9200	438.2300	6521.5000
0.3155	1401.1000	588.5870	4817.1600
0.5000	1582.9200	798.0660	3545.4500
0.7925	1807.3100	1073.3300	2652.5500
1.2559	2111.8300	1423.2100	2027.6700
1.9905	2526.6200	1839.7100	1570.1500
3.1548	3075.5900	2321.1600	1221.3800
5.0000	3766.3600	2872.7800	947.3830
7.9245	4600.9000	3510.5300	730.3000
12.5594	5590.9900	4293.7700	561.2920
19.9054	6736.6500	5311.1700	430.9650
31.5479	8140.2200	6730.2200	334.7970
50.0000	9917.0800	8743.9500	264.4280
79.2447	12270.9000	11622.1000	213.2780

Table E5 Rheological properties of 40/60 PA 6/ionomer blend

Frequency (rad/s)	G' (Pa.s)	G" (Pa.s)	Complex viscosity (Pa.s)
0.0500	866.2550	204.5620	17801.6000
0.0792	1508.3900	241.8290	19277.7000
0.1256	1861.3200	249.5240	14952.7000
0.1991	2118.0500	289.1390	10739.3000
0.3155	2291.9500	371.8940	7359.9900
0.5000	2439.2400	507.1920	4982.8200
0.7925	2597.4600	704.2840	3396.1300
1.2559	2782.0400	995.9400	2352.7600
1.9905	3043.8300	1384.9800	1680.0100
3.1548	3431.9700	1894.8600	1242.6600
5.0000	3980.4300	2515.3200	941.7140
7.9245	4713.9800	3266.1000	723.6940
12.5594	5650.0100	4176.7900	559.4400
19.9054	6804.1100	5313.0000	433.6880
31.5479	8207.9100	6816.7900	338.2010
50.0000	9941.0200	8877.4200	266.5580
79.2447	12222.5000	11761.2000	214.0480

Table E6 Rheological properties of 20/80 PA 6/ionomer blend

Frequency (rad/s)	G' (Pa.s)	G" (Pa.s)	Complex viscosity (Pa.s)
0.0500	1139.8700	245.6080	23320.6000
0.0792	1775.3200	252.3610	22628.2000
0.1256	2269.0500	234.3740	18162.6000
0.1991	2553.0700	224.0780	12875.3000
0.3155	2771.6700	246.7800	8820.3500
0.5000	2916.2300	310.8480	5865.5000
0.7925	3036.3800	423.2570	3868.7000
1.2559	3143.0600	591.1100	2546.4200
1.9905	3290.1300	853.0480	1707.5400
3.1548	3492.8600	1226.6500	1173.4500
5.0000	3798.3600	1728.6100	834.6410
7.9245	4247.9000	2398.0300	615.5660
12.5594	4885.5000	3267.2600	467.9620
19.9054	5769.0900	4387.0700	364.1070
31.5479	6957.9100	5832.8700	287.7960
50.0000	8555.0700	7745.4000	230.8080
79.2447	10707.5000	10320.0000	187.6620

Table E7 Rheological properties of pure Surlyn® ionomer

Frequency (rad/s)	G' (Pa.s)	G" (Pa.s)	Complex viscosity (Pa.s)
0.0500	2099.1600	347.4500	42554.4000
0.0792	2650.6800	295.6820	33656.8000
0.1256	3041.9600	291.7030	24331.6000
0.1991	3303.4600	301.9160	16665.0000
0.3155	3448.4900	345.8570	10985.8000
0.5000	3545.0000	415.9350	7138.6300
0.7925	3630.5000	524.7660	4628.9900
1.2559	3709.4300	688.1480	3003.8900
1.9905	3798.5700	928.1160	1964.4500
3.1548	3922.1100	1263.5400	1306.1500
5.0000	4142.4600	1742.3600	898.7940
7.9245	4467.9100	2404.2800	640.2620
12.5594	4952.7900	3306.4900	474.1520
19.9054	5658.6400	4509.3100	363.5010
31.5479	6646.5700	6088.8700	285.7230
50.0000	7978.0200	8123.2900	227.7160
79.2447	9836.9200	10736.9000	183.7570

Appendix F Differential Scanning Calorimetry

Table F Delta H (ΔH) of PA 6 and ionomer in PA 6/ionomer blends as determined by DSC

Blend composition (PA 6/ionomer)	ΔH ($J.g^{-1}$) of PA 6	ΔH ($J.g^{-1}$) of Surlyn® ionomer
100/0	66.81	-
80/20	60.05	12.63
60/40	39.40	23.25
50/50	34.05	34.80
40/60	27.03	37.73
20/80	13.81	50.74
0/100	-	58.51

Appendix G X-ray Diffraction

Table G WAXS data of PA 6/ionomer binary blends

Blend composition (PA 6/ionomer)	Peak	2 θ	D-value	Intensity	I/I_0
100/0	1	20.200	4.3924	2658	100
	2	21.366	4.1564	2435	92
	3	23.800	3.7355	2451	94
80/20	1	21.440	4.1411	4089	100
	2	23.820	3.7324	3119	78
60/40	1	21.280	4.1719	4293	100
	2	23.660	3.7573	2379	56
50/50	1	21.420	4.1449	4098	100
	2	23.840	3.7293	2175	54
40/60	1	21.200	4.1874	3129	100
	2	23.560	3.7730	1738	56
20/80	1	21.440	4.1411	5003	100
	2	23.820	3.7324	2472	50
0/100	1	21.280	4.1719	4383	100
	2	23.680	3.7542	2235	52

Appendix H Tensile Properties, Izod Impact Strength, Hardness and Gloss

Table H1 Tensile strength of pure PA 6, pure ionomer and PA 6/ionomer blends

Time	Tensile strength (MPa) of PA 6/ionomer blends						
	100/0	80/20	60/40	50/50	40/60	20/80	0/100
1	70.3	45.4	22.7	20.8	19.2	17.2	17.0
2	59.7	44.7	25.0	20.3	19.7	16.4	18.0
3	68.7	45.0	22.2	20.7	20.2	17.7	18.7
4	68.3	45.5	23.3	21.2	19.7	18.9	16.7
5	71.8	45.0	23.3	19.9	19.2	18.9	19.0
Ave	67.8	45.1	23.3	20.66	19.6	17.8	17.9
STD	4.7	0.3	1.0	0.5	0.4	1.1	1.0

Table H2 Elongation at break of pure PA 6, pure ionomer and PA 6/ionomer blends

Time	Elongation at break (%) of PA 6/ionomer blends						
	100/0	80/20	60/40	50/50	40/60	20/80	0/100
1	270.1	32.7	10.8	31.7	74.7	123.5	308.1
2	301.5	26.7	11.5	26.0	44.9	169.1	360.4
3	278.3	20.4	6.5	29.9	91.1	256.0	325.8
4	279.6	23.2	9.6	27.9	89.2	238.7	338.8
5	315.2	21.4	8.2	22.2	39.0	150.7	305.6
Ave	288.9	24.9	9.3	27.5	67.8	187.6	327.7
STD	18.7	5.0	2.0	3.7	24.5	57.2	22.8

Table H3 Tensile modulus of pure PA 6, pure ionomer and PA 6/ionomer blends

Time	Tensile modulus (MPa) of PA 6/ionomer blends						
	100/0	80/20	60/40	50/50	40/60	20/80	0/100
1	2315.6	1776.5	1569.0	1387.3	1387.5	1219.9	561.9
2	3145.7	2091.3	1216.2	795.4	1508.4	546.6	541.0
3	2421.9	1965.0	1234.4	824.5	1248.4	644.9	443.1
4	2013.2	1992.5	1203.9	1556.6	844.7	836.3	521.66
5	2500.8	2242.8	1122.5	842.2	763.6	918.5	572.4
Ave	2479.4	2013.6	1269.21	1081.2	1150.5	833.3	528.0
STD	415.9	171.5	173.0	362.1	330.5	261.9	51.3

Table H4 Impact strength of pure PA 6 and PA 6/ionomer blends

Time	Impact strength (kJ/m^2) of PA 6/ionomer blends		
	100/0	80/20	60/40
1	9.1	20.9	14.0
2	6.9	13.5	15.6
3	8.5	18.3	11.2
4	11.7	14.1	16.9
5	5.7	19.4	12.4
6	12.4	16.3	11.8
7	9.8	15.4	12.4
8	13.2	23.6	14.7
9	7.5	16.0	14.0
10	6.8	18.1	13.3
Ave	9.2	17.6	13.6
STD	2.6	3.1	1.8

Table H5 Hardness of pure PA 6, pure ionomer and PA 6/ionomer blends

Time	Hardness of PA 6/ionomer blends (Shore D)						
	100/0	80/20	60/40	50/50	40/60	20/80	0/100
1	81.5	79.0	72.5	69.0	65.0	65.0	60.0
2	82.0	79.5	74.0	71.5	67.0	65.0	61.0
3	82.0	79.5	72.5	70.0	66.0	64.0	61.0
4	82.0	80.0	73.0	70.0	66.5	65.0	59.0
5	81.5	80.0	74.0	69.5	67.0	65.5	60.0
6	82.5	79.0	73.0	70.0	67.0	65.0	61.0
7	81.0	80.0	73.5	69.0	66.0	63.5	60.0
8	81.0	80.0	74.0	71.0	66.5	65.5	60.0
9	81.0	79.0	72.5	69.0	66.0	65.0	59.0
10	81.5	79.5	72.0	71.0	66.5	64.0	61.0
Ave	81.6	79.6	73.1	70.0	66.4	64.8	60.2
STD	0.5	0.4	0.7	0.9	0.6	0.7	0.8

Table H6 Gloss measured at 60 ° reflectance angle of pure PA 6, pure ionomer and PA 6/ionomer blends

Time	Gloss of PA 6/ionomer blends (60 ° reflectance)						
	100/0	80/20	60/40	50/50	40/60	20/80	0/100
1	51.5	56.4	15.3	7.6	7.3	7.9	34.2
2	51.2	55.9	11.7	7.1	6.0	7.8	35.3
3	48.1	52.3	12.3	10.7	5.1	7.4	35.1
4	50.9	57.7	13.2	7.7	6.3	7.5	33.1
5	46.9	54.8	13.7	7.5	6.5	7.2	37.9
6	50.0	58.2	12.5	8.3	5.8	7.0	37.0
7	49.6	51.3	11.5	8.0	7.1	9.3	35.0
8	48.3	53.5	13.0	7.5	5.8	8.5	34.3
9	49.5	57.1	16.0	9.1	5.6	7.1	36.1
10	48.8	55.9	14.1	7.2	6.0	7.3	34.1
Ave	49.5	55.3	13.3	8.1	6.2	7.7	35.2
STD	1.5	2.3	1.5	1.1	0.7	0.7	1.5

Table H7 Gloss measured at 85 ° reflectance angle of pure PA 6, pure ionomer and PA 6/ionomer blends

Time	Gloss of PA 6/ionomer blends (85 ° reflectance)						
	100/0	80/20	60/40	50/50	40/60	20/80	0/100
1	87.4	90.9	50.1	38.4	28.0	48.7	77.8
2	86.6	87.9	51.8	35.4	22.8	50.5	77.8
3	86.3	86.6	51.7	42.9	22.2	51.5	76.1
4	87.5	89.4	50.3	36.3	21.4	49.6	77.3
5	86.0	89.3	54.4	32.3	24.6	46.6	77.6
6	85.5	90.4	51.2	40.1	24.4	44.9	76.0
7	88.4	87.5	54.7	37.4	27.8	52.4	76.9
8	86.3	88.0	53.1	37.0	22.0	49.9	78.5
9	87.1	89.7	53.0	38.0	23.9	45.2	78.4
10	87.2	88.7	50.1	36.0	25.0	54.6	77.0
Ave	86.8	88.8	52.0	37.4	24.2	49.4	77.3
STD	0.9	1.3	1.7	2.8	2.3	3.1	0.9

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