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APPENDICES

APPENDIX A

Specification of CB

Table A-1

Test Design	Properties	N220 (ISAF)	N330 (HAF)	N550 (FEF)	N660 (GPF)
D 1510	Iodine No. (mg/g)	121+/-8	82+/-7	43+/-7	35+/-5
D 1514	Sieve Residue #325 (%max)	0.035	0.100	0.050	0.100
D 1514	Sieve Residue #35 (%max)		0.001	0.001	0.001
D 1509	Heat Loss (%max)		2.5	2.5	1.0
D 2414	DBP Absorption (cc/100g)	114+/-7	102+/-7	121+/-7	91+/-5
D 3313	Pellet hardness Avg (g)		12-51	12-51	
D 1646	ML(1+4) at 125°C % compared with IRB#7		102+/-10	88+/-10	
D 1646	MST at 125°C % compared with IRB#7		94+/-10	105+/-10	

Specification of Natural rubber latex (lot no. 025)

Table A-2

Properties	HA	ISO specification
T.S.C. (Total solid content % by weight)	61.59	61.50 min
D.R.C. (Dry rubber content % by weight)	60.25	60.00 min
Non rubber solid (%)	1.34	2.00 max
Alkalinity (% on total weight)	0.69	0.60 min
M.S.T. (Mechanical stability time at 55% (T.S.C.) in second	1,076	650 second. min
V.F.A. (Volatile fatty acid number)	0.027	0.20 max
pH	10.48	
KOH Number	0.65	1.0 max
Magnesium content (ppm on latex)	27.34	50 max

Specification of Lab high speed intensive mixer model LMX 5

Table A-3

Mixer system	Closed system
Mixer bolw volume	5 Litre
Mixing capacity of powder with bulk density 1.0	Max : 1,250 gram
	Min : 250 gram
Motor power	1 KW
Impeller speed	High : 2,800 rpm
	Low : 1,400ppm

APPENDIX B

Cure curve

Table B-1

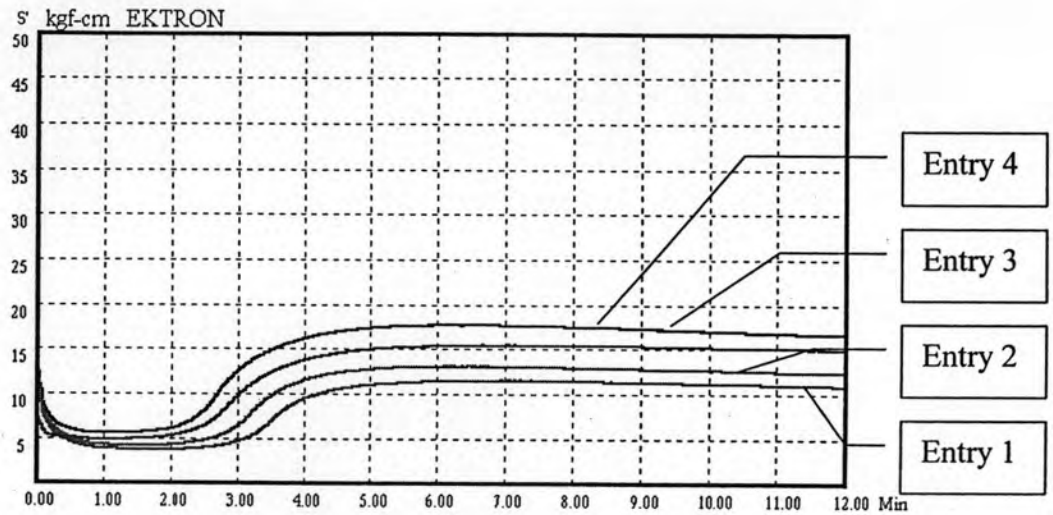


Table B-2

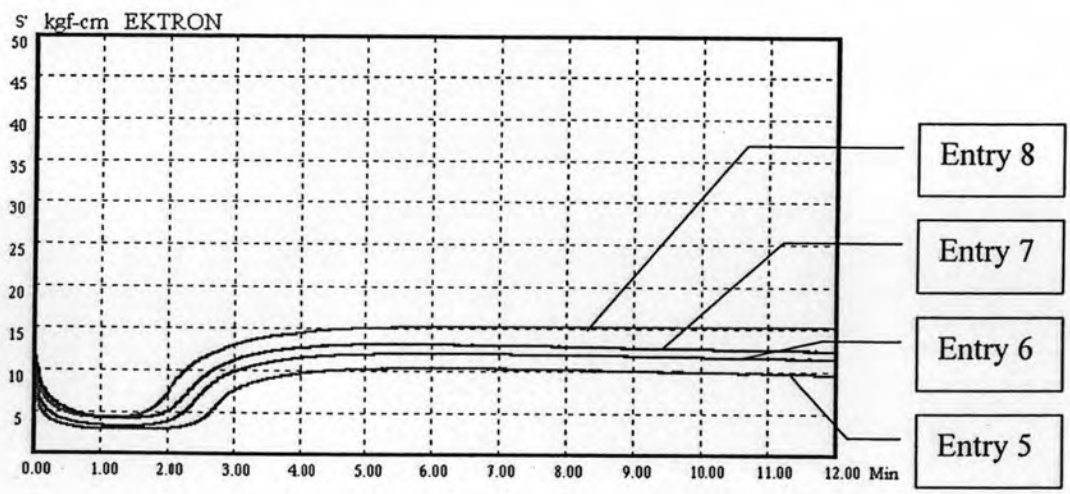


Table B-3

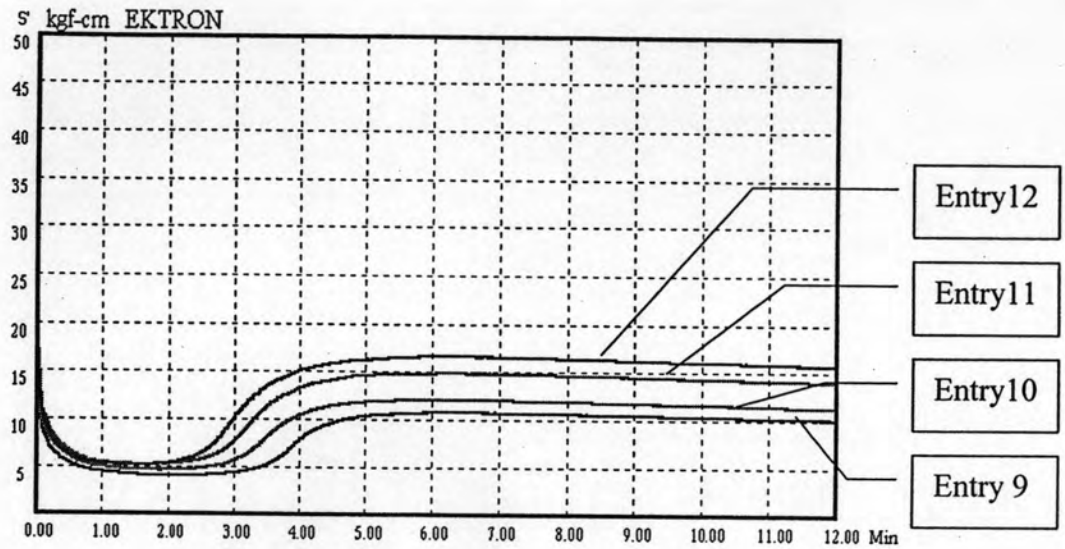
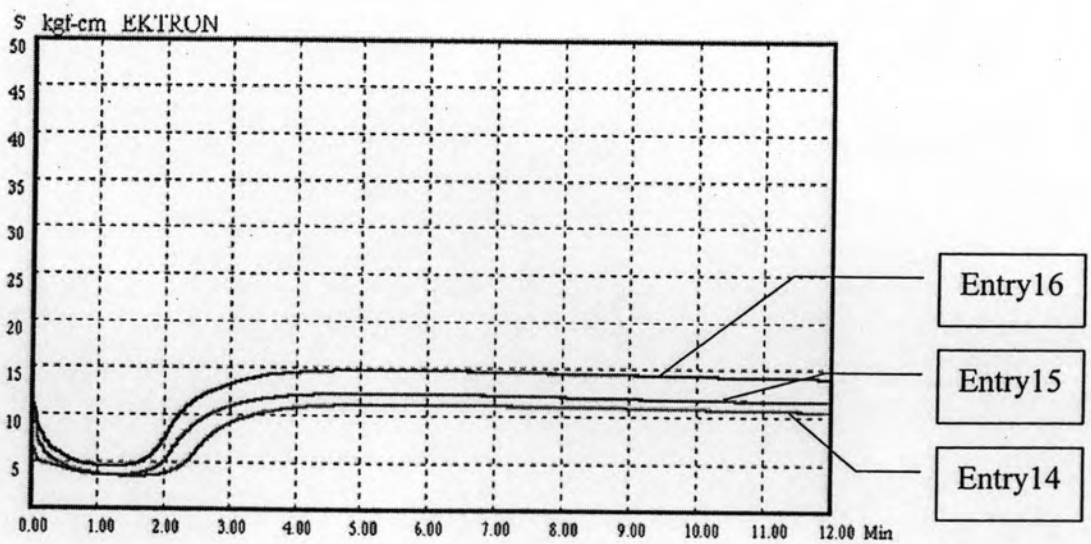


Table B-4



APPENDIX C

Specific gravity calculation of rubber compound

Table C-1

Materials	Weight; W (g)	Density; d (g/cm^3)	Volume (=W/d)
Natural rubber	100.00	0.92	108.70
Zinc oxide	3.00	5.57	0.54
Stearic acid	1.00	0.85	1.18
Carbon black	20.00	1.80	11.11
TBBS	1.20	1.28	0.94
Sulphur	1.75	2.07	0.85
Total	126.95		123.32

Density = Total weight / Total volume
= 126.95/123.32
= 1.03 (g/cm^3)

Specific gravity = 1.03

APPENDIX D

Table D-1 The hardness of NR/CB vulcanizates

Sample	phr	1	2	3	4	5	Average
N330-solid NR	0	34	34	34	33	34	33.8 ± 0.4
	20	46	45	45	45	45	45.2 ± 0.4
	30	52	52	52	53	53	52.4 ± 0.5
	40	58	58	58	59	58	58.2 ± 0.4
	50	65	65	64	64	63	64.2 ± 0.8
N550-solid NR	0	34	34	34	33	34	33.8 ± 0.4
	20	43	44	43	43	44	43.4 ± 0.5
	30	50	51	51	51	51	50.8 ± 0.4
	40	56	56	56	57	57	56.4 ± 0.5
	50	61	61	62	62	64	62.0 ± 1.2
N330-latex NR	0	-	-	-	-	-	-
	20	38	38	38	39	39.0	38.4 ± 0.5
	30	45	46	46	46	46	45.8 ± 0.4
	40	50	52	51	51	51	51.0 ± 0.7
	50	60	60	60	60	60	60.0 ± 0.0
N550-latex NR	0	-	-	-	-	-	-
	20	-	-	-	-	-	-
	30	47	47	47	47	47	47.0 ± 0.0
	40	52	52	52	52	53	52.2 ± 0.4
	50	55	56	56	56	55	55.6 ± 0.5

Table D-2 The tensile strength of NR/CB vulcanizates

Sample	phr	1	2	3	4	5	Average
N330-solid NR	0	221.9	237.2	225.4	231.2	229.8	235.8 ± 5.8
	20	344.8	334.5	318.0	323.8	322.5	328.7 ± 10.8
	30	338.7	342	340.4	346.1	350.1	343.5 ± 4.6
	40	309.4	306.4	328.1	319.9	310.7	314.9 ± 8.9
	50	287.1	283.1	285.3	298.2	288.8	288.5 ± 5.8
N550-solid NR	0	221.9	237.2	225.4	231.2	229.8	235.8 ± 5.8
	20	326.6	321.5	314.4	311.3	302.3	315.2 ± 9.4
	30	312.5	319.4	317.1	313.0	325.2	317.4 ± 5.2
	40	313.0	303.0	296.2	301.3	301.4	303.0 ± 6.2
	50	280.6	276.9	273.9	280.1	276.9	277.7 ± 2.7
N330-latex NR	20	260.2	266.2	268.0	267.1	272.8	266.9 ± 4.5
	30	310.1	314.9	320.3	317.5	317.1	316.0 ± 3.8
	40	300.1	310.7	301.4	307.4	318.9	307.7 ± 7.6
	50	303.9	304.3	291.9	297.6	292.4	298.0 ± 6.0
N550-latex NR	20	-	-	-	-	-	-
	30	311.1	306.5	312.4	313.2	313	311.2 ± 2.8
	40	293.6	300.8	296.2	298.2	302.1	298.2 ± 3.4
	50	278.2	271.1	273.6	276.2	272.3	274.3 ± 2.9

Table D-3 The M300 of NR/CB vulcanizates

Sample	phr	1	2	3	4	5	Average
N330-solid NR	0	19.1	20.4	20.1	19.8	20.0	19.9 ± 0.5
	20	66.7	63.7	66.3	67.1	65.6	65.9 ± 1.4
	30	111.8	106.1	108.9	107.2	107.3	108.3 ± 2.2
	40	134.4	143.7	132.4	142.7	141.8	139.0 ± 5.2
	50	184.1	184.1	191.0	192.0	193.3	188.9 ± 4.5
N550-solid NR	0	19.1	20.4	20.1	19.8	20.0	19.9 ± 0.5
	20	73.2	72.4	71.8	70.8	71.2	71.9 ± 0.9
	30	110.8	111.6	112.6	109.4	115.4	112.0 ± 2.3
	40	149.9	148.4	150.1	155.0	159.3	152.5 ± 4.5
	50	195.1	191.2	190.3	192.0	191.5	192.0 ± 1.8
N330-latex NR	20	44.5	43.0	44.3	40.1	43.9	43.1 ± 1.8
	30	74.4	74.0	77.6	74.0	76.9	75.4 ± 1.7
	40	107.9	105.6	108.0	107.2	113.2	108.4 ± 2.9
	50	165.9	167.6	170.5	168.0	159.5	166.3 ± 4.1
N550-latex NR	20	-	-	-	-	-	-
	30	83.6	90.1	92.4	92.4	89.1	89.5 ± 3.6
	40	124.4	121.9	127.5	124.6	120.0	123.7 ± 2.8
	50	150.1	152.0	156.2	151.8	155.5	153.1 ± 2.6

Table D-4 The tear strength of NR/CB vulcanizates

Sample	phr	1	2	3	4	5	Average
N330-solid NR	0	36.6	30.5	35.4	35.0	34.4	34.4 ± 2.3
	20	60.6	67.9	63.0	65.0	66.0	64.5 ± 2.8
	30	87.9	76.7	81.5	83.0	75.0	80.8 ± 5.2
	40	83.5	109.2	79.3	103.0	87.0	92.4 ± 13.0
	50	71.2	76.8	74.0	78.0	72.3	74.5 ± 2.9
N550-solid NR	0	36.6	30.5	35.4	35.0	34.4	34.4 ± 2.3
	20	61.3	66.4	64.4	63.8	60.6	63.3 ± 2.4
	30	74.0	74.9	73.0	72.9	70.2	73.0 ± 1.8
	40	76.5	88.5	87.4	80.5	87.0	84.0 ± 5.2
	50	83.2	80.5	81.0	81.1	83.7	81.9 ± 1.4
N330-latex NR	20	53.3	46.0	50.1	49.6	48.4	49.5 ± 2.6
	30	62.2	62.2	60.0	61.0	60.5	61.2 ± 1.0
	40	72.7	77.6	75.0	79.0	75.4	75.9 ± 2.4
	50	80.0	75.2	75.8	79.0	78.5	77.7 ± 2.1
N550-latex NR	20	-	-	-	-	-	-
	30	67.5	67.6	66.9	67.0	67.4	67.3 ± 0.3
	40	79.0	83.2	81.5	86.7	83.2	82.7 ± 2.8
	50	79.3	78.8	81.0	78.8	80.0	79.6 ± 0.9

Table D-5 The elongation at break of NR/CB vulcanizates

Sample	phr	1	2	3	4	5	Average
N330-solid NR	0	760.0	793.0	770.0	780.0	784.0	777.4 ± 12.8
	20	624.2	630.7	640.8	632.2	631.9	631.9 ± 5.9
	30	588.2	577.7	570.2	578.3	584.5	579.8 ± 6.9
	40	511.7	501.6	519.5	504.4	506.9	508.8 ± 7.0
	50	444.4	433.5	435.5	428.1	420.5	432.4 ± 8.9
N550-solid NR	0	760.0	793.0	770.0	780.0	784.0	777.4 ± 12.8
	20	597.2	594.6	592.7	598.6	594.8	595.6 ± 2.3
	30	547.1	542.9	543.2	544.4	549.0	545.3 ± 2.7
	40	470.6	484.9	490.0	484.4	496.2	485.2 ± 9.5
	50	423.3	423.1	411.5	424.7	408.7	418.3 ± 7.5
N330-latex NR	20	631.6	632.6	637.6	637.3	645.0	636.8 ± 5.3
	30	615.5	613.8	610.1	615.7	616.6	614.3 ± 2.6
	40	526.3	550.8	554.7	543.2	537.3	542.4 ± 11.3
	50	470.9	468.9	474.8	470.3	473.4	471.7 ± 2.4
N550-latex NR	20	-	-	-	-	-	-
	30	607.3	578.6	544.3	586.2	579.1	579.1 ± 22.7
	40	548.2	550.8	525.4	541.5	510.5	535.3 ± 17.0
	50	487.2	450.6	474.5	461.0	475.9	469.9 ± 14.2

VITAE

Arisara Chanama, born to Wiphaphat and Veera Chanama, was raised in Bangkok, Thailand. In 2001, she graduated from Ramkhamhaeng University, Faculty of Science, Department of Chemistry. In 2004, she was admitted as a Master degree student at Chulalongkorn University, Faculty of Science in Petrochemistry and Polymer Science Program, and completed the program in May 2007.