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APPENDIX A

Table A.1

Melt flow rate of commercial HIPS and HIPS blends
with flame retardant additive

Composition	Sample	MFI (g/10 min)
Commercial HIPS	1	3.52
	2	3.62
	3	3.58
	Mean	3.57
	S.D.	0.05
no.1	1	4.95
	2	4.75
	3	4.84
	Mean	4.85
	S.D.	0.10
no.2	1	4.72
	2	4.68
	3	4.70
	Mean	4.70
	S.D.	0.02
no.3	1	6.03
	2	6.05
	3	6.04
	Mean	6.04
	S.D.	0.01
no.4	1	6.04
	2	6.10
	3	6.04
	Mean	6.06
	S.D.	0.06
no.5	1	6.04
	2	6.16
	3	6.16
	Mean	6.12
	S.D.	0.12

Composition	Sample	MFI (g/10 min)
no.6	1	6.26
	2	6.15
	3	6.22
	Mean	6.21
	S.D.	0.11
no.7	1	6.06
	2	6.06
	3	6.06
	Mean	6.06
	S.D.	0.00
no.8	1	6.24
	2	6.33
	3	6.18
	Mean	6.25
	S.D.	0.15
no.9	1	6.51
	2	6.28
	3	6.32
	Mean	6.37
	S.D.	0.23
no.10	1	6.26
	2	6.20
	3	6.26
	Mean	6.24
	S.D.	0.06
no.11	1	6.40
	2	6.32
	3	6.36
	Mean	6.36
	S.D.	0.08

Table A.1 (Continued)

Composition	Sample	MFI (g/10 min)
no.12	1	6.78
	2	6.80
	3	6.64
	Mean	6.74
	S.D.	0.09
no.13	1	6.66
	2	6.43
	3	6.55
	Mean	6.55
	S.D.	0.12
no.14	1	8.26
	2	8.09
	3	8.08
	Mean	8.14
	S.D.	0.10
no.15	1	8.24
	2	8.16
	3	8.20
	Mean	8.20
	S.D.	0.04
no.16	1	9.01
	2	9.01
	3	9.00
	Mean	9.01
	S.D.	0.01
no.17	1	8.18
	2	8.19
	3	8.26
	Mean	8.21
	S.D.	0.08
no.18	1	8.80
	2	9.05
	3	9.08
	Mean	8.98
	S.D.	0.15

Table A.1 (Continued)

Composition	Sample	MFI (g/10 min)
no.19	1	9.01
	2	9.18
	3	9.09
	Mean	9.09
	S.D.	0.17
no.20	1	8.33
	2	8.42
	3	8.36
	Mean	8.37
	S.D.	0.05
no.21	1	9.06
	2	9.17
	3	8.95
	Mean	9.06
	S.D.	0.11
no.22	1	9.16
	2	9.25
	3	9.19
	Mean	9.20
	S.D.	0.05
no.23	1	8.80
	2	9.00
	3	9.02
	Mean	8.94
	S.D.	0.12
no.24	1	9.86
	2	9.88
	3	9.84
	Mean	9.86
	S.D.	0.02
no.25	1	10.05
	2	10.18
	3	9.82
	Mean	10.05
	S.D.	0.36

Composition	Sample	MFI (g/10 min)
no.26	1	10.02
	2	10.00
	3	10.10
	Mean	10.04
	S.D.	0.08
no.27	1	10.14
	2	10.26
	3	10.18
	Mean	10.20
	S.D.	0.12
no.28	1	12.18
	2	12.32
	3	12.10
	Mean	12.20
	S.D.	0.11
no.29	1	10.26
	2	10.25
	3	10.25
	Mean	10.25
	S.D.	0.01
no.30	1	10.28
	2	10.24
	3	10.38
	Mean	10.30
	S.D.	0.14
no.31	1	10.50
	2	10.10
	3	10.30
	Mean	10.30
	S.D.	0.20
no.32	1	13.60
	2	13.20
	3	13.60
	Mean	13.47
	S.D.	0.23

Composition	Sample	MFI (g/10 min)
no.33	1	10.50
	2	10.52
	3	10.49
	Mean	10.50
	S.D.	0.03
no.34	1	3.72
	2	3.69
	3	3.71
	Mean	3.71
	S.D.	0.02
no.35	1	3.68
	2	3.66
	3	3.66
	Mean	3.67
	S.D.	0.01
no.36	1	4.38
	2	4.32
	3	4.31
	Mean	4.34
	S.D.	0.03
no.37	1	4.21
	2	4.43
	3	4.44
	Mean	4.36
	S.D.	0.13
no.38	1	4.19
	2	4.20
	3	4.20
	Mean	4.20
	S.D.	0.01
no.39	1	4.39
	2	4.51
	3	4.46
	Mean	4.45
	S.D.	0.06

Composition	Sample	MFI (g/10 min)
no.40	1	4.59
	2	4.51
	3	4.55
	Mean	4.55
	S.D.	0.04
no.41	1	4.31
	2	4.39
	3	4.36
	Mean	4.35
	S.D.	0.08
no.42	1	4.50
	2	4.49
	3	4.51
	Mean	4.50
	S.D.	0.02
no.43	1	4.62
	2	4.52
	3	4.54
	Mean	4.56
	S.D.	0.08
no.44	1	4.60
	2	4.48
	3	4.57
	Mean	4.55
	S.D.	0.12

Table A.2 Izod impact strength of commercial HIPS and HIPS blends with flame retardant additive

Composition	Sample	NI (kg.cm/cm)
no.1	1	10.60
	2	10.64
	3	10.41
	Mean	10.55
	S.D.	0.12
no.2	1	10.02
	2	9.88
	3	9.65
	Mean	9.85
	S.D.	0.19
no.3	1	8.62
	2	8.46
	3	8.54
	Mean	8.54
	S.D.	0.08
no.4	1	8.54
	2	8.61
	3	8.32
	Mean	8.49
	S.D.	0.15
no.5	1	8.44
	2	8.28
	3	8.24
	Mean	8.32
	S.D.	0.11
no.6	1	8.56
	2	8.46
	3	8.45
	Mean	8.49
	S.D.	0.06

Table A.2 (Continued)

Composition	Sample	NI (kg.cm/cm)
no.7	1	8.23
	2	8.19
	3	8.06
	Mean	8.16
	S.D.	0.09
no.8	1	8.08
	2	8.15
	3	8.10
	Mean	8.11
	S.D.	0.04
no.9	1	7.82
	2	7.78
	3	8.22
	Mean	7.94
	S.D.	0.24
no.10	1	7.74
	2	7.86
	3	7.74
	Mean	7.78
	S.D.	0.07
no.11	1	7.59
	2	7.68
	3	7.59
	Mean	7.62
	S.D.	0.05
no.12	1	10.20
	2	10.16
	3	10.15
	Mean	10.17
	S.D.	0.03

Table A.2 (Continued)

Composition	Sample	NI (kg.cm/cm)
no.13	1	9.98
	2	9.86
	3	9.86
	Mean	9.90
	S.D.	0.07
no.14	1	9.38
	2	9.46
	3	9.57
	Mean	9.47
	S.D.	0.10
no.15	1	9.08
	2	9.04
	3	8.64
	Mean	8.92
	S.D.	0.24
no.16	1	8.18
	2	8.26
	3	8.19
	Mean	8.21
	S.D.	0.04
no.17	1	8.78
	2	8.95
	3	8.70
	Mean	8.81
	S.D.	0.13
no.18	1	8.82
	2	8.78
	3	8.68
	Mean	8.76
	S.D.	0.07

Table A.2 (Continued)

Composition	Sample	NI (kg.cm/cm)
no.19	1	8.66
	2	8.48
	3	8.81
	Mean	8.65
	S.D.	0.17
no.20	1	8.26
	2	8.32
	3	8.38
	Mean	8.32
	S.D.	0.06
no.21	1	8.44
	2	8.31
	3	7.94
	Mean	8.23
	S.D.	0.26
no.22	1	8.18
	2	8.22
	3	8.08
	Mean	8.16
	S.D.	0.07
no.23	1	10.68
	2	10.25
	3	10.30
	Mean	10.41
	S.D.	0.24
no.24	1	9.50
	2	9.64
	3	9.42
	Mean	9.52
	S.D.	0.11

Table A.2 (Continued)

Composition	Sample	NI (kg.cm/cm)
no.25	1	8.90
	2	8.72
	3	8.42
	Mean	8.68
	S.D.	0.24
no.26	1	8.42
	2	8.36
	3	8.24
	Mean	8.34
	S.D.	0.09
no.27	1	7.68
	2	7.74
	3	7.44
	Mean	7.62
	S.D.	0.16
no.28	1	7.38
	2	7.46
	3	7.36
	Mean	7.40
	S.D.	0.05
no.29	1	7.36
	2	7.22
	3	7.17
	Mean	7.25
	S.D.	0.10
no.30	1	7.08
	2	7.12
	3	6.92
	Mean	7.04
	S.D.	0.11

Table A.2 (Continued)

Composition	Sample	NI (kg.cm/cm)
no.31	1	7.32
	2	7.26
	3	7.50
	Mean	7.36
	S.D.	0.12
no.32	1	7.02
	2	7.14
	3	7.08
	Mean	7.08
	S.D.	0.06
no.33	1	6.12
	2	6.05
	3	6.01
	Mean	6.06
	S.D.	0.06
no.34	1	7.36
	2	7.32
	3	7.52
	Mean	7.40
	S.D.	0.11
no.35	1	7.02
	2	6.85
	3	7.01
	Mean	6.96
	S.D.	0.10
no.36	1	6.66
	2	6.72
	3	6.36
	Mean	6.58
	S.D.	0.19

Table A.2 (Continued)

Composition	Sample	NI (kg.cm/cm)
no.37	1	6.24
	2	6.45
	3	6.24
	Mean	6.31
	S.D.	0.12
no.38	1	6.31
	2	6.19
	3	6.28
	Mean	6.26
	S.D.	0.06
no.39	1	6.12
	2	5.96
	3	6.04
	Mean	6.04
	S.D.	0.08
no.40	1	5.29
	2	5.32
	3	5.56
	Mean	5.39
	S.D.	0.15
no.41	1	5.38
	2	5.45
	3	5.34
	Mean	5.39
	S.D.	0.06
no.42	1	5.08
	2	5.12
	3	5.31
	Mean	5.17
	S.D.	0.12

Table A.2 (Continued)

Composition	Sample	NI (kg.cm/cm)
no.43	1	5.10
	2	5.18
	3	5.05
	Mean	5.11
	S.D.	0.07
no.44	1	4.58
	2	4.62
	3	4.84
	Mean	4.68
	S.D.	0.14

APPENDIX B

Table B.1 Shows typical properties of flame retardants used in this study.

Properties	DE 83-R	DE 79	BA 59	PDBS-80
Appearance	White powder	White powder	white powder	amber pellets
Bromine content	83.3%	79.8%	58.8%	59.0%
Molecular weight	959.2	801.4	543.7	80,000
Melting range (°C)	300-315	70-150	179-181	210-230
Specific gravity	3.3	2.8	2.2	1.9
TGA (%wt loss / °C)	5/357	5/304	5/284	5/381

VITAE

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