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Appendix A

Organic Peroxides as Polymerization Initiators

Trade name Chemical denomination	Form	Peroxide content %	Active oxygen content %	Diluent	Half-life temperature (° C) in benzene (0,2 molar) for 10 h	1 h	1 min	Storage temperature (° C) rec.	max.	Applications Polymerisation of Acrylics	SAN/ABS	Ethylene	Styrene	Vinyl Acetate	Vinyl Chloride
Peroxyesters															
LUPEROX 10	Liquid	75	4,86	Hydro-carbon	46	65	105	<-10	0	■		■		■	■
LUPEROX 10-EN-30 t-Butyl perneodecanoate	Liquid	30	1,94	Water	46	65	105	<-10	0	■					■
LUPEROX 546 t-Amyl perneodecanoate	Liquid	75	4,60	Hydro-carbon	ca. 42 (46 in OMS)	–	–	<-12	-7			■			■
LUPEROX 188 α-Cumyl-perneodecanoate	Liquid	69-71	3,57-3,67	Hydro-carbon	38*	56*	–	<-18	-15			■			■
•D-610 4-Hydroxy-2-methyl-pentylperoxy-neo-decanoate	Liquid	50	2,77	Hydro-carbon	36*	–	–	<-20	-15			■			■
Peroxyketals															
LUPEROX 233-50	Liquid	50	5,47	Dibutyl Phthalate	113	130	167	<30	35				■		
LUPEROX 233M50 Ethyl 3,3-bis (t-butylperoxy)-butyrate	Liquid	50	5,47	Hydro-carbon	113	130	167	<30	35				■		
•D-533-M-65 Ethyl-3,3-bis(t-amyl-peroxy)-butyrate	Liquid	65	6,49	Hydro-carbon	ca.113	–	–	<30	35	■			■		
LUPEROX 220-50	Liquid	50	6,83	Dibutyl Phthalate	100	121	161	<30	38				■		
LUPEROX 220-M-50 2,2-Bis(t-butyl-peroxy)-butane	Liquid	50	6,83	Hydro-carbon	100	121	161	<30	38			■	■		
LUPEROX 331-50	Liquid	50	6,14	Dibutyl Phthalate	93	113	153	<30	35				■		
LUPEROX 331M50 1,1-Bis(t-butyl-peroxy)-cyclo-hexane	Liquid	50	6,14	Hydro-carbon	93	113	153	<30	35				■		
LUPEROX 231-50 1,1-Bis(t-butyl-peroxy)-3,3,5-trimethyl cyclohexane	Liquid	50	5,28	Dibutyl Phthalate	92	112	155	<30	35				■		
Dialkyl Peroxides															
LUPEROX 130 2,5-Dimethyl-2,5-bis(t-butylperoxy)-hexyne-(3)	Liquid	90	10,05	–	128	149	192	<30	38				■		
LUPEROX Di Di-t-butyl Peroxide	Liquid	98	10,60	–	126	149	199	<30	38				■		
LUPEROX 101 2,5-Dimethyl-2,5-bis(t-butylperoxy)-hexane	Liquid	90	9,92	–	119	138	177	<30	38				■		
LUPERCO 500-RC Dicumyl Peroxide	Crystals	99	5,86	–	115	135	177	<30	38				■		
LUPERCO 802 α α'-Bis(t-butyl-peroxy)-p-diiso-propylbenzoyl	Solid	96	9,08	–	120	142	185	<30	38				■		

*in Trichlorethylene •D – Development product

Trade name Chemical denomination	Form	Peroxide content %	Active oxygen content %	Diluent	Half-life temperature (° C) in benzene (0,2 molar) for 10 h	1 h	1 min	Storage temperature (° C) rec.	max.	Applications Polymerisation of Acrylics	SAN/ABS	Ethylene	Styrene	Vinyl Acetate	Vinyl Chloride
Diacyl Peroxides															
LUPERCO WET	Fine Granules	98	6,47	25% Water	73	92	130	< 30	38						
LUPERCO WET-F-50 Benzoyl peroxide	Paste-like Suspens.	50	3,24	50% Water	73	92	130	< 30	38						
ALPEROX	Flakes	98	3,93	–	62	80	120	< 27	38						
ALPEROX S-40 Lauroyl peroxide	Suspension	40	1,60	Water	62 64*	80 81*	120 115*	< 27	38						
LUPERCO DEC Decanoyl peroxide	Flakes	97	4,53	–	61	80	120	< 15	20						
LUPERCO 887 o-Methylbenzoyl peroxide	Powder	50	2,96	25% Water + 25% PVC-Powder	60	78	116	< 20	30						
LUPEROX 219	Liquid	75	3,82	Hydrocarbon	59	77	115	– 5	0						
LUPEROX 219-EN-40 3,5,5-Trimethyl-hexanoyl peroxide	Liquid	40	2,04	Water	59	77	115	<–10	0						
Peroxyesters															
LUPEROX P t-Butyl perbenzoate	Liquid	98	8,07	–	105	125	167	<30	38						
LUPEROX 270 t-Butyl-per-3,5,5-trimethyl hexanoate	Liquid	98	6,80	–	102	123	165	<10** <30	35 38						
*D-570 t-Amyl-per-3,5,5-trimethyl hexanoate	Liquid	96	6,29	–	ca. 97	–	–	<30	–						
LUPEROX 118 2,5-Dimethyl-2,5-bis(benzoyl-peroxy)-hexane	Powder	92	7,66	–	100	118	155	<30	38						
LUPEROX TBIC-M-75 0,0-t-Butyl-0-iso-propyl-mono-peroxycarbonate	Liquid	75	6,81	Hydrocarbon	99	119	161	<30	38						
LUPEROX 80 t-Butyl-perisobutyrate	Liquid	75	7,49	Hydrocarbon	79	95	127	<10	15						
LUPEROX 26-R t-Butyl-per-2-ethylhexanoate	Liquid	98	7,25	–	73	92	132	<15	20						
LUPEROX 575 t-Amyl-per-2-ethylhexanoate	Liquid	96	6,67	–	ca. 69	–	–	<15	–						
LUPEROX 11 t-Butyl perpivalate	Liquid	75	6,89	Hydrocarbon	55	74	115	<–5	0						
LUPEROX 554 t-Amyl perpivalate	Liquid	75	6,37	Hydrocarbon	ca. 52 (54 in OMS)	–	–	<–10	–5						

* in Trichlorethylene ** for polyethylene production *D – Development product

Trade name Chemical denomination	Form	Pero-xide con-tent %	Active oxygen con-tent %	Diluent	Half-life temperature (° C) a) in benzene b) in trichlorethy-lene (0,2 molar) for			Storage temperature (° C)		Applications Polymerisation of					
					10 h	1 h	1 min	rec.	max.	Acrylics	SAN/ ABS	Ethylene	Styrene	Vinyl Acetate	Vinyl Chloride
Alkyl Hydroperoxides															
LUPEROX H 70X t-Butyl-Hydroperoxide	Liquid	70	12,43	Water	172	200	260	<30	38						
LUPEROX CU 80 Cumene Hydroperoxide	Liquid	80	8,40	Cumene	158	190	260	<30	38						
Peroxy Dicarbonates															
LUPEROX 223-E-40	Liquid	40	1,84	Water	a) 36 b) 49	– 67	– 102	<-15	-10						
LUPEROX 223-65 2-Ethylhexyl Percarbonate	Liquid	65	3,00	Hydro-carbon	a) 36 b) 49	– 67	– 102	<-10	-5						
*D-214 Myristyl Percarbonate	Fine Granules	90	2,80	Myristyl Alcohol	a) 36 b) 48	56 66	95 102	<20	25						
*D-216 Cetyl Percarbonate	Fine Granules	95	2,66	–	b) 48	66	102	<20	25						
*D-217 Bis(4-t-butylcyclo-hexyl)-peroxy-dicarbonate	Solid	95	3,81	–	a) 37 b) 49	56 67*	95 102	<20	25						
Azo-compounds															
LUAZO AP 2,2'-Azo-bis (2-acetoxypropane)	Powder	99	–	–	189	215	270	<30	35						
*LUAZO D-ABA 2,2'-Azo-bis (2-acetoxy-butane)	Liquid	96	–	–	191	217	272	<30	35						

*D – Development product

APPENDIX B

1. Effect of the TBPB Catalyst on Mechanical Properties of the SMC.

Type of catalyst	Concentrations of catalyst (phr)	Storage time (days)	1 min cure time, Flexural strength: $\bar{X}_{FS}$ (MPa)	1 min cure time, Flexural strength: Std.dev.	2 min cure time, Flexural strength: $\bar{X}_{FS}$ (MPa)	2 min cure time, Flexural strength: Std.dev.	3 min cure time, Flexural strength: $\bar{X}_{FS}$ (MPa)	3 min cure time, Flexural strength: Std.dev.
TBPB	2	3	186.34	8.41	208.79	11.78	-	-
TBPB	2	17	202.16	19.60	233.05	5.73	227.10	5.58
TBPB	2	30	215.32	10.00	250.47	3.23	237.23	14.43
TBPB	2	45	196.37	16.28	210.60	9.11	220.32	12.41
BPO	0.5	3	175.88	7.71	183.47	8.54	180.35	23.59

Note: $\bar{X}_{FS}$ stands for an average value of flexural strength for 4 measurements.

(P.T.O.)

(continued).

Type of catalyst	Concentrations of catalyst (phr)	Storage time (days)	1 min cure time		2 min cure time		3 min cure time	
			Flexural modulus		Flexural modulus		Flexural modulus	
			$\bar{X}_{FM}$ (MPa)	Std.dev.	X_{FM} (MPa)	Std.dev.	$\bar{X}_{FM}$ (MPa)	Std.dev.
TBPB	2	3	7107.24	464.97	7774.46	472.85	-	-
TBPB	2	17	8927.23	573.78	9416.91	748.50	8687.27	309.39
TBPB	2	30	8956.74	499.21	8919.91	52.74	9558.06	607.97
TBPB	2	45	7569.88	27.33	8813.33	650.57	9542.06	490.35
BPO	0.5	3	6364.39	1.16	7267.47	64.87	6217.32	926.96

Note: $\bar{X}_{FM}$ stands for an average value of flexural modulus for 4 measurements.

(P.T.O.)

(continued).

Concentrations of TBPB (phr)	Storage time (days)	1 min cure time Flexural strength		2 min cure time Flexural strength	
		$\bar{X}_{FS}$ (MPa)	Std.dev.	$\bar{X}_{FS}$ (MPa)	Std.dev.
0.5	3	175.45	16.11	207.10	13.27
0.5	17	182.71	19.14	216.96	6.62
0.5	30	152.57	10.52	196.02	7.38
1.0	3	193.87	13.52	222.30	20.69
1.0	17	208.17	20.27	224.14	3.25
1.0	30	168.71	17.50	202.14	7.41
2.0	3	186.34	8.41	208.79	11.78
2.0	17	202.16	19.60	233.05	5.73
2.0	30	215.32	10.00	250.47	3.23
3.0	3	184.37	8.11	215.28	16.82
3.0	17	207.83	10.54	233.49	10.11
3.0	30	229.68	7.60	241.26	21.15

Note: $\bar{X}_{FS}$ stands for an average value of flexural strength for 4 measurements.

(P.T.O.)

(continued).

Concentrations of TBPB (phr)	Storage time (days)	1 min cure time Flexural modulus		2 min cure time Flexural modulus	
		$\bar{X}_{FM}$ (MPa)	Std.dev.	$\bar{X}_{FM}$ (MPa)	Std.dev.
0.5	3	6869.28	1158.40	8039.86	665.65
0.5	17	6860.29	284.81	9073.87	967.43
0.5	30	6299.23	302.30	7339.69	892.76
1.0	3	7947.07	541.53	8585.53	967.71
1.0	17	7515.51	569.23	8774.51	385.77
1.0	30	7036.20	386.20	7693.14	1226.57
2.0	3	7107.24	464.97	7774.46	472.85
2.0	17	8927.23	573.78	9416.91	748.50
2.0	30	8956.74	499.21	9819.91	52.74
3.0	3	8005.52	1088.95	8160.71	496.48
3.0	17	8815.63	253.43	8920.39	551.82
3.0	30	8643.96	337.92	9603.98	408.00

Note: $\bar{X}_{FM}$ stands for an average value of flexural modulus for 4 measurements.

(P.T.O.)

2. Effect of the DTBC Catalyst on Mechanical Properties of the SMC.

Concentrations of DTBC (phr)	Storage time (days)	1 min cure time Flexural strength		2 min cure time Flexural strength	
		$\bar{X}_{FS}$ (MPa)	Std.dev.	$\bar{X}_{FS}$ (MPa)	Std.dev.
0.5	3	178.69	19.42	179.55	19.18
0.5	17	175.63	13.56	200.71	10.56
0.5	30	182.62	8.04	205.85	16.10
1.0	3	206.91	24.79	212.78	12.12
1.0	17	189.03	20.12	214.78	12.12
1.0	30	178.24	14.97	192.04	3.80
2.0	3	183.07	13.59	205.33	9.36
2.0	17	181.27	7.34	204.23	16.43
2.0	30	179.47	4.89	200.53	22.29
3.0	3	175.36	7.71	204.13	23.44
3.0	17	197.94	5.76	225.88	6.50
3.0	30	185.93	7.79	218.50	17.49

Note: $\bar{X}_{FS}$ stands for an average value of flexural strength for 4 measurements.

(P.T.O.)

(continued).

Concentrations of DTBC (phr)	Storage time (days)	1 min cure time Flexural modulus		2 min cure time Flexural modulus	
		$\bar{X}_{FM}$ (MPa)	Std.dev.	$\bar{X}_{FM}$ (MPa)	Std.dev.
0.5	3	6925.25	510.36	6900.00	791.53
0.5	17	7061.07	896.19	7238.64	593.34
0.5	30	7031.91	470.87	8220.85	399.07
1.0	3	7922.13	1002.73	7456.57	300.81
1.0	17	7382.65	637.19	7991.94	492.38
1.0	30	7097.19	451.47	7443.79	80.03
2.0	3	6614.72	1880.51	7002.47	879.91
2.0	17	7404.39	410.36	8137.66	733.19
2.0	30	7316.42	442.20	7799.64	238.17
3.0	3	6071.87	165.31	7197.88	1451.28
3.0	17	7503.02	592.48	9021.37	570.18
3.0	30	7318.79	639.03	7814.07	414.44

Note: $\bar{X}_{FM}$ stands for an average value of flexural modulus for 4 measurements.

(P.T.O.)

3. Effect of the BPO Catalyst on Mechanical Properties of the SMC.

Concentrations of BPO (phr)	Storage time (days)	1 min cure time		2 min cure time	
		Flexural strength		Flexural strength	
		$\bar{X}_{FS}$ (MPa)	Std.dev.	$\bar{X}_{FS}$ (MPa)	Std.dev.
0.1	3	127.69	3.36	168.92	6.70
0.5	3	175.88	7.71	183.47	8.54
0.75	3	184.60	18.22	195.71	8.51
1.0	3	198.74	15.26	206.79	12.61

Concentrations of BPO (phr)	Storage time (days)	1 min cure time		2 min cure time	
		Flexural modulus		Flexural modulus	
		$\bar{X}_{FM}$ (MPa)	Std.dev.	$\bar{X}_{FM}$ (MPa)	Std.dev.
0.1	3	4283.03	520.30	6128.17	206.83
0.5	3	6364.39	1.16	7267.47	64.87
0.75	3	6375.02	371.75	7389.00	561.81
1.0	3	7435.27	939.51	7664.37	638.98

Note: $\bar{X}_{FS}$ and $\bar{X}_{FM}$ stand for an average value of flexural strength and modulus for 4 measurements, respectively.

VITA

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