UNITED INITIATORS

CUROX®

Thermoset Applications

Product Code	Chemical Structure	Active Oxygen Content	Peroxide Continent	Safety Information: Recommended Storage Temperature	Safety Information: SADT	Application Temperature: Hand Lay-up/Spray-up	Casting/Winding	Polymer Concrete & Marble, Buttons	Gelcoats	Body Fillers	Chemical Anchors & Mine bolts	RTM, Vacuum Infusion	Coatings	Resin Transfer Molding (RTM)	Cured In Place Pipes (CIPP)	Engineered Stone	Continuous Laminating	Pultrusion	SMC, BMC, GMC, TMC	Special Resins: Vinylesters	Acrylic Resins
Ketone Peroxides		%	%	°C	°C	Ambient								Elevated		High					
Methyl ethyl ketone peroxide (CAS No. 1338-23-4)																					
CUROX®M-303 *	General purpose MEKP with medium reactivity	9.1		max. 30	60	●	●	●	●	●		●		●		●					
CUROX®M-403 *	Faster gel & cure than CUROX®M-303	9.7		max. 30	60	●	●	●	●	●		●		●		●					
CUROX®M-503 *	Faster gel than CUROX®M-403	9.5		max. 30	60	●	●	●						◉		◉					
CUROX®M-370	Mixture with similar gel time but faster cure than CUROX®M-312	7.7		max. 30	60	●	●	●				●		●		●					
Methyl ethyl ketone peroxide (phthalatefree) (CAS No. 1338-23-4)																					
CUROX®M-312 *	General purpose MEKP with medium reactivity, approved gelcoat type	8.9		max. 30	60	●	●	●	●	●		●		●		●					
CUROX®M-102 *	MEKP designed for UP, VE resins, less foaming	8.6		max. 30	60	●	●		●				◉	●		●				●	
CUROX®M-202	General purpose MEKP	9.1		max. 30	60	●	●	●	●	●		●	●	●		●					
CUROX®M-402	Faster gel than CUROX®M-403	9.8		max. 30	60	●	●	●						◉		◉					
Acetylacetone peroxide (CAS No. 13704-51-5)																					
CUROX®A-300	Standard AAP	4.1		10-25	60	●	●	●				●		●		●					
CUROX®A-390	AAP with improved cure performance	4.5		0-25	60	●	●					●		●		●					
CUROX®A-390W	AAP for potable water application, improved cure performance	3.9		5-25	60	●	●					●		●		●					
Methyl isobutyl ketone peroxide (CAS No. 37206-20-5)																					
CUROX®I-300	High reactive MIBKP in aliphatic hydrocarbons	10.5		max. 25	50		◉	◉					◉			●	●			◉	
Hydroperoxides																					
Cumyl hydroperoxide (CAS No. 80-15-9)																					
CUROX®CUHP	Low exotherm temp, for thicker laminates	8.5	80-85	max. 30	60	◉	◉					◉				◉				●	
CUROX®CP-50 **	Promoted CUROX®CUHP for fast curing of some VE resins	4.5		max. 30	60	●	●					●		●		◉				●	
CUROX®CM-70 *	Lower exotherm temp, longer gel & cure than CUROX®CM-75, for thicker laminates	9.3		max. 30	60	●	●					●		●						●	
CUROX®CM-75 *	Lower exotherm temp, long gel time, good final cure, for thicker laminates	8.9		max. 60	60	●	●					●		●						◉	
Diacyl Peroxides																					
Dibenzoyl peroxide (CAS No. 94-36-0)																					
BENOX®L-40LV-EU	40 %, sprayable BPO dispersion	2.6	40	0-25	50	●		●		●	◉	◉	●							◉	●
BENOX®C-50	50 % BPO powder with phtalate	3.3	50	max. 30	60	●		●	◉	●		●	◉							◉	●
BENOX®C-50S	50 % BPO powder with phtalate, free flowing (chalk)	3.3	50	max. 30	60	●		●	◉	●		●	◉							◉	●
BENOX®C-50PF	50 % BPO powder phtalate-free, free flowing (chalk)	3.3	50	max. 30	60	●		●	◉	●		●	◉							◉	●
BENOX®A-75	75 % BPO granules in water	5.0	75	0-25	70	◉		●													●

* Available as red coloured system for improved homogenization during mixing. The colour disappears in the curing process.

** Available as red colored system for improved homogenization during the hole process. The colour remains in the final product.

● = Recommended application ◉ = Other possible application

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Peresters		%	%	°C	°C	Ambient								Elevated			High				
tert-Butylperbenzoate (CAS No. 614-45-9)																					
TBPB	High efficient perester, lowest residual styrene	8.1	>98	10-30	60									●	○	●	○	○	●		
TBPB-HA-M1	Promoted TBPB for elevated/high temperature processes	7.4	90	10-30	60							●		○	●	○	●	●	○		
TBPB-HA-M3	Higher promoted TBPB for elevated/high temperature processes	6.6	80	10-30	60							●		○	●	○	●	●	●		
tert-Butylperoxy-2-ethylhexylcarbonate (CAS No. 34443-12-4)																					
TBPEHC	High efficient, low TOC-emission	6.4	97	max. 30	70												●	○	●		
tert-Amylperoxy-2-ethylhexylcarbonate (CAS No. 34443-12-4)																					
TAPEHC	High efficient, low TOC-emission	5.8	95	max.20	55												●	○	●		
tert-Butylperoxy-2-ethylhexanoate (CAS No. 3006-82-4)																					
TBPEH	Fast perester, reduced cycle times	7.3	99	max. 10	40									●			○	○			
TBPEH-LA-M3	Longer prepreg shelflife	6.7	90	max. 15	40									●			○	○			
tert-Amylperoxy-2-ethylhexanoate (CAS No. 686-31-7)																					
TAPEH	Fast perester, reduced cycle times	6.9	99	max. 10	40									●			○	○			
tert-Butylperoxy-3,5,5-trimethylhexanoate (CAS No. 13122-18-4)																					
TBPIN	High efficient perester, drinking water application	6.9	99	max. 30	60									●	●		○	○	●		
TBPIN-HA-M1	Promoted TBPIN for elevated temperature processes	6.3	90	max. 30	55						●		○	●	●		○	○	●		
Peroxidicarbonates																					
Di(4-*tert*-butylcyclohexyl)peroxydicarbonate (CAS No. 15520-11-3)																					
BCHPC	Fast kick off peroxide for two step curing	3.8	>96	max. 20	45							●		○			○	○		●	
Perketals																					
1,1-Di(*tert*-amylperoxy)cyclohexane (CAS No. 15667-10-4)																					
ACH-80-AL3	Improved SMC surface properties	8.8	80	max. 30	60												○	○			
1,1-Di(*tert*-butylperoxy)cyclohexane (CAS No. 3006-86-8)																					
CH-80-AL (AL3)	Higher concentrated version, moderate exothermal reaction	9.7	80	max. 30	60												○	○			
1,1-Di(*tert*-butylperoxy)-3,3,5-trimethylcyclohexane (CAS No. 6731-36-8)																					
TMCH-90-AL	Most efficient perketale	9.5	90	max. 30	60												○	○			
TMCH-HA-M1	Accelerated curing performance	5.8	mix	max. 20	50												○	○			

● = Recommended application ● = Other possible application

Safety **Information**

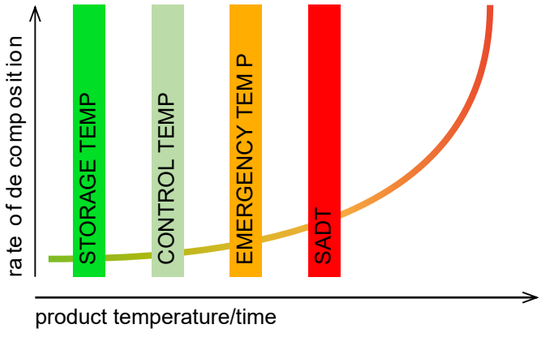
Half-life

Peroxide decomposition rates are commonly reported in terms of half-life time or when 50% of the peroxide has decomposed at a certain temperature. Recommended organic peroxide heat temperatures commonly reflect the half-life time at 10 hours, 1 hour and 1 minute. The higher the half-life temperature, the more stable the peroxide. Half-life temperatures can vary based on formulations and solvents.

Using the Arrhenius equation, acronyms related to halflife time include:

$k_d = A \cdot e^{-EA/RT}$ and $t_{1/2} = \ln 2/k_d$

k_d: Rate constant of the peroxide dissociation
A: Arrhenius frequency factor
E_A: Activation energy for the dissociation
R: Ideal gas constant
T: Temperature
$t_{1/2}$: Half-life time



Controlling the temperature is the most important constant. If the temperature is maintained well below its self-accelerating decomposition temperature (SADT), most hazards are avoided when shipping, handling or storing. For storage over a longer period of time, follow the manufacturer's temperature recommendations.

Self-Accelerating Decomposition Temperature (SADT)

The SADT is the lowest constant temperature for self-accelerating decomposition when transporting packaged peroxides. At the SADT, when elevated heat temperatures from decomposition exceed the heat loss, over time, the peroxide's temperature increases and it decomposes faster or self-accelerates. The final decomposition may be uncontrollable.

Minimum/Maximum Recommended Storage Temperature

The maximum recommended storage temperature is lower than the control temperature for quality assurance purposes not safety. Keep in mind, some liquid or paste organic peroxides must not be stored below a certain minimum temperature as turbidity, phase separation, crystal deposits or solidification can occur.

Control Temperature (T_C)

The Tc is the maximum transportation temperature recommended for the product's estimated time of arrival. Tc is not required if the SADT exceeds 50°C (122°F). Generally, the Tc mirrors SADT canister guidelines.

T_C = SADT minus 20°C if SADT < 20°C
T_C = SADT minus 15°C if SADT < 35°C
T_C = SADT minus 10°C if SADT < 50°C

SADT transportation temperatures are based on recommendations by the UN Committee of Experts on the Transportation of Dangerous Goods.

Emergency Temperature (T_E)

The control temperature Tc is supplemented by an emergency temperature, Te, which is higher than the Tc but still well below the SADT. The Tc may be exceeded if maintenance is necessary or until alternative cooling such as dry or wet ice is available. However, if the Te is reached, emergency procedures must be implemented immediately – for instance, cooling down the organic peroxides.

Product Code	Chemical Name	Storage Temperature	EA [kJ/mol]	Half Life [°C]		
				10 h	1 h	1 min
IBP	Diisobutyryl peroxide	●	110	23	39	73
CUPND	Cumyl peroxyneodecanoate	●	115	38	55	90
TOPND	1,1,3,3-Tetramethylbutyl peroxyneodecanoate	●	117	40	57	92
TAPND	*tert*-Amyl peroxyneodecanoate	●	113	44	62	100
CEPC	Dicetyl peroxydicarbonate	●	124	41	57	90
MYPC	Dimyristyl peroxydicarbonate	●	124	41	57	90
SBPC	Di-sec-butyl peroxydicarbonate	●	120	41	57	90
EHPC	Di-2-ethylhexyl peroxydicarbonate	●	121	47	64	83
TBPND	*tert*-Butyl peroxyneodecanoate	●	121	47	64	100
BCHPC	Di-4-*tert*-butylcyclohexyl peroxydicarbonate	●	129	48	64	82
NBPC	Di-*n*-butyl peroxydicarbonate	●	130	49	65	99
TBPNH	*tert*-Butyl peroxyneoheptanoate	●	116	51	69	107
TAPPI	*tert*-Amyl peroxypivalate	●	121	53	71	110
DCLBP	Di-2,4-dichlorobenzoyl peroxide	●	121	54	72	110
TBPPI	*tert*-Butyl peroxypivalate	●	121	56	74	110
INP	Di-3,5,5-trimethylhexanoyl peroxide	●	117	59	78	120
DP	Didecanoyl peroxide	●	126	62	80	120
LP	Dilauroyl peroxide	●	126	62	80	120
AIBN	2,2'-Azobis(isobutyronitrile)	●	130	62	80	120
DHPEH	2,5-Dimethyl-2,5-di(2-ethylhexanoylperoxy) hexane	●	137	67	84	125
PMBP	Di-4-methylbenzoyl peroxide	●	125	70	89	130
BP	Dibenzoyl peroxide	●	126	72	91	130
TAPEH	*tert*-Amyl peroxy-2-ethylhexanoate	●	126	72	91	130
TBPEH	*tert*-Butyl peroxy-2-ethylhexanoate	●	135	74	92	130
TBPIB	*tert*-Butyl peroxyisobutyrate	●	130	77	96	135
TBPM	*tert*-Butyl monoperoxymaleate	●	116	82	104	150
ACH	1,1-Di(*tert*-amylperoxy)cyclohexane	●	135	87	106	152
MIKP	Methyl isobutyl ketone peroxide	●	125	90	110	155
TAPEHC	*tert*-Amylperoxy-(2-ethylhexyl)carbonate	●	151	95	113	150
TMCH	1,1-Di(*tert*-butylperoxy)-3,5,5-trimethyl-cyclohexane	●	143	95	114	155
CH	1,1-Di(*tert*-butylperoxy)cyclohexane	●	138	97	117	160
TBPIC	*tert*-Butyl peroxyisopropyl carbonate	●	138	97	117	160
TBPIN	*tert*-Butyl peroxy-3,5,5-trimethylhexanoate	●	147	100	119	160
TBPEHC	*tert*-Butyl peroxy-2-ethylhexyl carbonate	●	128	100	122	175
TBPA	*tert*-Butyl peroxyacetate	●	149	102	121	160
TAPB	*tert*-Amyl peroxybenzoate	●	143	102	122	160
TBPB	*tert*-Butyl peroxybenzoate	●	143	104	124	165
BU	2,2-Di(*tert*-butylperoxy)butane	●	143	104	124	165
NBV	*n*-Butyl-4,4-di(*tert*-butylperoxy)valerate	●	141	110	131	175
EBU	Ethyl-3,3-di(*tert*-butylperoxy)butyrate	●	144	114	135	180
DCUP	Dicumyl peroxide	●	152	116	136	175
BCUP	*tert*-Butyl cumyl peroxide	●	154	118	138	180
DTAP	Di(*tert*-amyl) peroxide	●	129	118	142	190
DIPP	Di[2-(*tert*-butylperoxy)-isopropyl]benzene	●	142	120	142	190
DHBP	2,5-Dimethyl-2,5-di(*tert*-butylperoxy)hexane	●	142	120	142	190
DTBP	Di(*tert*-butyl) peroxide	●	152	125	146	190
DYBP	2,5-Dimethyl-2,5-di(*tert*-butylperoxy)hexyne-3	●	154	128	149	195
CUHP	Cumyl hydroperoxide	●	133	140	166	223
TBHP	*tert*-Butyl hydroperoxide	●	149	173	200	260
CUROX®CC-DC	2,3-Dimethyl-2,3-diphenylbutane	●	195	210	234	285

Colour code for storage temperature:
● = Deep refrigeration ● = Moderate refrigeration ● = Ambient temperature
For precise values see specific product data sheets

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