UNITED INITIATORS

driving your success

CUROX®

Thermoset Applications

Product Code	Chemical Structure	Active Oxygen content	Peroxide continent	Safety Information: Recommended max. storage temperature*	Safety Information: SADT	Application temperature: HandLay-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)	Artificial marble	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		30	60	●	●	●	●	●		●		●		●					
CUROX®M-403 *	Faster gel & cure than CUROX®M-303	9.7		30	60	●	●	●	●	●		●		●		●					
CUROX®M-503 *	Faster gel than CUROX®M-403	9.5		30	60	●	●	●						●		●					
CUROX®M-370	Mixture with similar gel time but faster cure than CUROX®M-312	7.7		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		30	60	●	●	●	●	●		●		●		●					
CUROX®M-102 *	MEKP designed for UP, VE resins, less foaming	8.6		30	60	●	●		●				●	●		●					
CUROX®M-202	General purpose MEKP	9.1		30	60	●	●	●	●	●		●		●		●				●	
CUROX®M-402 *	Faster gel than CUROX®M-403	9.8		30	60	●	●	●						●		●					
Acetylacetone peroxide (CAS No. 13704-51-5)																					
CUROX®A-300 *	Standard AAP	4.1		10-25	60	●	●	●				●		●		●					
CUROX®A-140	Low exotherm temp AAP, longer gel & cure than CUROX®A-300, for thicker laminates	3.1		5-25	70	●	●	●				●		●							
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-200	MIBKP in aliphatic hydrocarbons	10.7		max 25	50	●	●	●	●			●				●	●		●		
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	30	60	●	●					●				●			●		
CUROX®CP-50 *	Promoted CUROX®CUHP for fast curing of some VE resins	4.5		30	60	●	●					●		●		●			●		
CUROX®CM-50 */CM-70 *	Lower exotherm temp, longer gel & cure than CUROX®CM-75, for thicker laminates	8.8/9.3		30/30	60/60	●	●					●		●					●		
CUROX®CM-75 *	Lower exotherm temp, long gel time, good final cure, for thicker laminates	8.9		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	●		●		●	●	●	●	●					●	●	
BP-50-FT (FT1)	50% BPO powder with phthalate (free flowing)	3.3	50	30	60	●		●		●	●		●	●					●	●	
BP-30-FT1	30% BPO powder with phthalate, free flowing	2.2	30	30	60			●		●	●									●	

* Available as colored-discolorizing system for improved homogenization during mixing. Natural resin color is restored during curing (optional).

** Available on request

● = Recommended application ● = Other possible application

Product Code	Chemical Structure	Active Oxygen content	Peroxide continent	Safety Information: Recommended max. storage temperature*	Safety Information: SADT	Application temperature: HandLay-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)	Artificial marble	Continuous Laminating	Pultrusion	SMC, BMC, GMC, TMC	Special Resins: Vinylesters	Acrylic Resins
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	30	60												●	●			
1,1-Di(tert.butylperoxy)cyclohexane (CAS No. 3006-86-8)																					
CH-80-AL	Higher concentrated version, moderate exothermal reaction	9.7	80	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	30	60												●	●			
TMCH-HA-M1	Accelerated curing performance	5.8	mix	max 20	50												●	●			

● = Recommended application ● = Other possible application

SAFETY INFORMATION

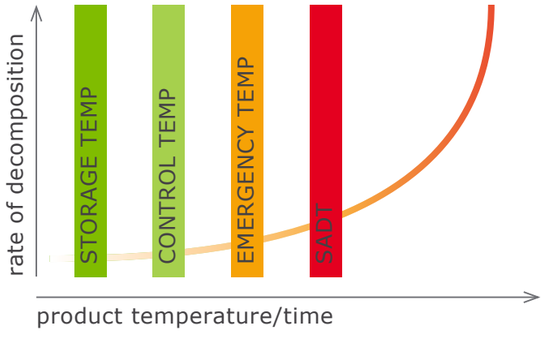
Half-life

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:

$k_d = A \bullet e^{-EA/RT}$ 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	Cumylperoxy-neodecanoate	●	115	38	55	90
TOPND	1,1,3,3-Tetramethylbutylperoxy-neodecanoate	●	117	40	57	92
TAPND	tert. Amylperoxy-neodecanoate	●	113	44	62	100
*)	Peroxidicarbonates	●	144	47	61	90
TBPND	tert. Butylperoxy-neodecanoate	●	121	47	64	100
TBPNH	tert. Butylperoxy-neoheptanoate	●	116	51	69	107
TAPPI	tert. Amylperoxy-pivalate	●	121	53	71	110
DCLBP	Di(2,4-dichlorobenzoyl)peroxide	●	121	54	72	110
TBPPI	tert. Butylperoxy-pivalate	●	121	56	74	110
INP	Di(3,5,5-trimethyl-hexanoyl)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.Amylperoxy-2-ethylhexanoate	●	126	72	91	130
TBPEH	tert.Butylperoxy-2-ethylhexanoate	●	135	74	92	130
TBPIB	tert.Butylperoxy-isobutyrate	●	130	77	96	135
TBPM	tert.Butyl-monoperoxy-maleate	●	116	82	104	150
ACH	1,1-Di(tert.amylperoxy)cyclohexane	●	135	87	106	152
CUROX ®I	Methylisobutylketoneperoxide	●	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.Butylperoxy-isopropylcarbonate	●	138	97	117	160
TBPIN	tert.Butylperoxy-3,5,5-trimethyl-hexanoate	●	147	100	119	160
TBPEHC	tert.Butylperoxy-(2-ethylhexyl)carbonate	●	128	100	122	175
TBPA	tert.Butylperoxy-acetate	●	149	102	121	160
TAPB	tert.Amylperoxy-benzoate	●	143	102	122	160
TBPB	tert.Butylperoxy-benzoate	●	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.Butylcumyl-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

*)	Peroxidicarbonates			
EHPC	Di(2-ethylhexyl)peroxydicarbonate	●	CHPC	Dicyclohexylperoxydicarbonate
SBPC	Di(sec-butyl)peroxydicarbonate	●	NBPC	Di(n-butyl)peroxydicarbonate
BCHPC	Di(4-tert.butylcyclohexyl)peroxydicarbonate	●	MYPC	Dimyristylperoxydicarbonate
CEPC	Dicetylperoxydicarbonate	●		

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

UNITED INITIATORS

driving your success

Germany
United Initiators GmbH
Pullach
T: +49 89 74 422 237
cs-initiators.eu@united-in.com

France
United Initiators SAS
Chalon-sur-Saône
cs-initiators.eu@united-initiators.com

Turkey
Hidrojen Peroksit A.S
Bandirma
T: +90 266 7210312
yduzmekik@united-in.com

India
UI VR Private Limited
Ahmedabad
T: +91 9909724733
sales@vrpersulfates.com

USA
United Initiators Inc.
Elyria, OH

United Initiators Inc.
Helena, AR

United Initiators Inc.
Mobile, AL

United Initiators Inc.
Houston, TX

T: +1 800 231 2702
cs-initiators.nafta@united-in.com

Canada
United Initiators Canada Ltd.
Prince George, BC
T +1 250 561 4200
MLPRGCustomerService@united-in.com

China
Persulfates/Office
United Initiators (Shanghai) Co. Ltd.
Baoshan District Shanghai

Persulfates/Plants:
United Initiators Hefei Co. Ltd.
Hefei
T: +86 21 6117 2758

United Initiators (Huaibei) Co. Ltd.
Anhui
T: +86 561 7888 168
cs-initiators.cn@united-initiators.com

Organic Peroxides:
Shanghai United Initiators Trading Co. Ltd.
Shanghai
T: +86 21 3429 3909
cs-initiators.cn@united-initiators.com

Austrailia
United Initiators Pty Ltd.
Banksmeadow
T: +61 2 9316 0046
cs-initiators.au@united-initiators.com

www.united-initiators.com

Rev. 7.0