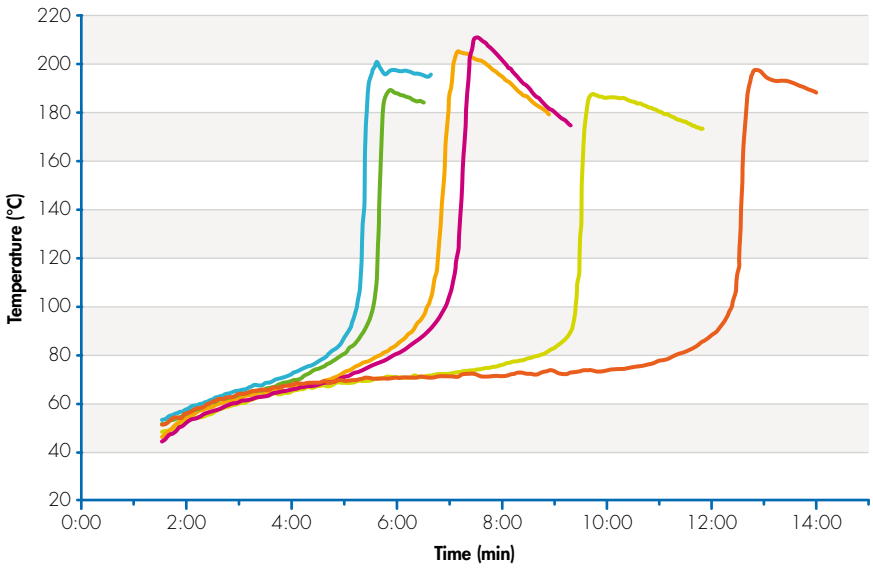
LUPEROX®
BY ARKEMA

# Curing of unsaturated polyester resins

# PEROXIDES FOR CURING OF UNSATURATED POLYESTER RESINS
# CURE PERFORMANCE AT 80°C COMPARISON

**CURE PERFORMANCE AT 80°C**
**IN A MEDIUM REACTIVITY ORTHOPHTHALIC RESIN**




| Tradename | Peroxide quantity | Cobalt 6% quantity | Gel time (min:s) | Cure time (min:s) | Peak exotherm (°C) | Pot life at 30°C (hours) |
|---|---|---|---|---|---|---|
| Luperox® K2 | **2 phr** | **No cobalt** | 05:47 | 07:35 | 201 | 06:00 |
| Luperox® K21 | **2 phr** | **No cobalt** | 05:48 | 07:03 | 203 | 06:00 |
| Luperox® 26M70 | **2 phr** | **No cobalt** | 08:36 | 10:26 | 190 | >24 |
| Luperox® ANS50G | **2 phr** | **No cobalt** | 12:37 | 13:22 | 197 | >24 |
| Luperox® DP10G | **2 phr** | **0.25 phr** | 05:17 | 05:58 | 190 | 14:09 |
| Luperox® DP40 | **2 phr** | **0.25 phr** | 04:40 | 05:28 | 204 | 10:30 |

## CONDITIONS OF EXPERIMENT

**Resin:** medium reactivity orthophthalic resin
**Peroxide:** 2%
**Cobalt (6% solution):** depending on test
**Resin initial temperature:** 25°C
**Testing temperature:** 80°C
**Resin sample:** 25 g

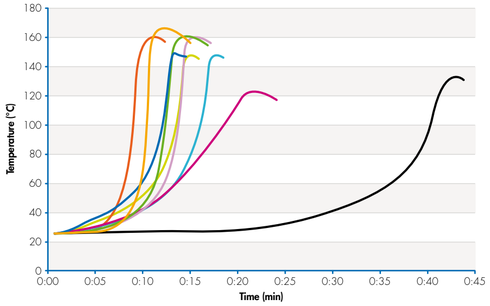
## Application guidelines

■ *Recommended*
□ *Other possible application*

| | Solvent | Active Oxygen (%) | Recommended maximum storage temperature (°C) | | Gel coats & top coats | Hand lay-up | Spray-up | Compound marble (blocks) | Polymer concrete | Casting | Resin transfer moulding (RTM) | Vacuum moulding / infusion | Centrifugal casting | Filament winding | Panels & sheets | Compound quartz (slabs) | SMC / BMC / DMC | Pultrusion | Varnishes | Putties | Vinylester & bisphenol resins | Acrylic resins | Buttons | Paper impregnation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METHYL ETHYL KETONE PEROXIDES** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® K18** | Dimethyl phthalate | 9.9 | 25 | Very high activity MEKP. Gives fast gel and cure time for a variety of ortho and isophthalic resin systems. | □ | ■ | ■ | □ | ■ | | □ | □ | ■ | □ | ■ | | | | ■ | | | | □ | |
| **Luperox® K10** | Dimethyl phthalate | 9.9 | 25 | High activity MEKP. Gives fast gel and cure time for a variety of ortho and isophthalic resin systems. | □ | ■ | ■ | □ | ■ | | □ | □ | ■ | □ | ■ | | | | ■ | | | | □ | |
| **Luperox® K1 S** | Dimethyl phthalate | 9.2 | 30 | Medium activity MEKP. Standard general-purpose hardener for a variety of ambient temperature applications. Low hydrogen peroxide content makes **Luperox® K1 S** ideal for use in gel coats. | ■ | ■ | ■ | □ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | □ | ■ |
| **Luperox® K1 G** | Aliphatic | 9.2 | 30 | Medium activity MEKP. It is same product than **Luperox® K1 S** but it is diluted with non phthalic solvent, so it is suitable for "phthalate-free" labeled applications. | ■ | ■ | ■ | □ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | □ | ■ |
| **Luperox® K12 G** | Aliphatic | 8.5 | 30 | Low activity MEKP that gives long gel times in a wide variety of ortho and isophthalic resin systems. Particularly suitable during the warm season and for very large molded pieces. Suitable for fast curing of vinyl ester resins to obtain blister free laminates. Diluted with non phthalic solvent, so it is suitable for "phthalate-free" labeled applications. | ■ | ■ | □ | | | ■ | □ | □ | ■ | ■ | □ | | | | | ■ | ■ | | □ | |
| **METHYL ISOBUTYL KETONE PEROXIDES** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® K2** | Dimethyl phthalate | 10.1 | 25 | MIBKP for short curing cycles at medium and high temperatures from 65°C to120°C even without cobalt accelerator. Mostly used for the manufacture of flat and corrugated sheets in continuous processes. | | | | | | | | | | ■ | ■ | | | ■ | □ | | | | ■ | |
| **Luperox® K21** | Dimethyl phthalate | 10.1 | 27 | As **Luperox® K2** but longer pot life when used with a cobalt accelerator. | | | | | | | | | | ■ | ■ | | | ■ | | | | | | |
| **ACETYL ACETONE PEROXIDE** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® K3** | Plasticizer | 4.1 | 27 | Rapid propagation from gel to exothermic peak in many resin systems. Fast curing and heat dissipation are particularly useful for continuous and semi continuous production processes. Its high activity makes it suitable during cold season. **Luperox® K3** / cobalt is the only alternative to a benzoyl peroxide / amine system if color stability as well as fast curing is required. It is not recommended for gel coats and vinyl ester resins. | | ■ | □ | □ | ■ | | ■ | ■ | ■ | ■ | ■ | | | | ■ | □ | | | | | □ |
| **CYCLOHEXANONE PEROXIDE** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® K4CE** | Dimethyl phthalate | 5.1 | 25 | High activity cyclohexanone peroxide, it gives relatively short gel times and gradual curing with a low peak temperature. This product ensures curing of even thick wall pieces without stress or crack formation. | □ | ■ | □ | | | ■ | □ | | □ | ■ | ■ | | | | ■ | ■ | | | | ■ | |
| **KETONE PEROXIDES BLENDS** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® Z11 S** | Dimethyl phthalate | 7.7 | 25 | Ketone peroxides blends for technologies requiring a comparable gel time with **Luperox® K1 S** but faster curing times with peak temperatures lower than those obtained with **Luperox® K3**. In a wide variety of resins, reactivity ranking is: **Luperox® Z33 S > Luperox® Z13 S > Luperox® Z11 S.** | □ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | □ | | | | ■ | | | | | | |
| **Luperox® Z13 S** | Dimethyl phthalate | 6.8 | 30 | | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | □ | | | | ■ | | | | | | |
| **Luperox® Z33 S** | Dimethyl phthalate | 5.6 | 30 | | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | □ | | | | ■ | | | | | | |
| **Luperox® Z11 G** | Aliphatic | 7.7 | 25 | Identical to **Luperox® Z11 S** but diluted with non phthalic solvent, so it is suitable for "phthalate-free" labeled applications. | □ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | □ | | | | ■ | | | | | | |
| **Luperox® Z390** | Plasticizer | 4.6 | 25 | High activity blend of acetyl acetone peroxide that allows full curing at temperatures above 60°C. This blend is suitable for continuous and semi-continuous processes. Reduces residual styrene content without need of post curing. | | | | □ | | | | | ■ | ■ | ■ | | | | | | | | | | |
| **Luperox® Z350** | Plasticizer | 4.3 | 25 | High activity blend of acetyl acetone peroxide that allows full curing at temperatures above 60°C. This blend is suitable for continuous and semi-continuous processes. Reduces residual styrene content without need of post curing. **Luperox® Z350** doesn't contain and doesn't generate any aromatic compound (BETEX) and it's faster than **Luperox® Z390.** | | | | □ | | | | | ■ | ■ | ■ | | | | | | | | | | |
| **Luperfoam® 329** | Water | - | 30 | Exclusive foaming system that transforms UPR in a foamed structural resin. Overall weight reduction, faster cycle times and better mold filling are its main advantages. Can be used in ortho or isophthalic resins, glass reinforced or not. | | | □ | | ■ | | ■ | ■ | □ | | □ | | | | | | | | | | |
| **Luperox® DP33G** | Aliphatic | 9.0 | 30 | | | | | | | | | | | | | | | | | | | | | |
| **HYDROPEROXIDES** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® CU80** | Cumene | 8.4 | 30 | Suitable at medium and high temperatures (120°C and more) where slow gelling and curing are required, with moderate heat evolution. May be used in combination with ketone peroxides / cobalt systems to reduce surface tackyness. | □ | | | | | | | | | | □ | | | | □ | | □ | | ■ | | |
| **Luperox® CU50VE** | Promoter | 4.7 | 30 | Especially developed for vinylester resins. Used without promoter. Much faster curing than CU80, it reduces exothermicity avoiding microcracks. Particularly suitable for the production of thick parts. | | | | | | | | | | | | | | | | ■ | | | | | |
| **Luperox® TBH70X** | Water | 12.4 | 30 | Always used in combination with ketone peroxides / cobalt systems. It reduces curing speed and peak temperature keeping good curing quality. By post curing it greatly reduces residual styrene content. | | □ | | □ | | | | | ■ | □ | □ | | | | | □ | ■ | □ | | | |
| **PERESTERS PEROXIDES** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® 26** | - | 7.2 | 20 | Hot curing above 60°C. Requires transport and storage controlled in temperature. | | | | | | | | | | ■ | □ | ■ | ■ | | | | ■ | | | ■ |
| **Luperox® 26M70** | Aliphatic | 5.1 | 20 | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® 26SR90** | Inhibitor | 6.7 | 20 | Activity like **Luperox® 26,** but longer pot life in prepregs. | | | | | | | | | | | ■ | ■ | ■ | | | | | | | |
| **Luperox® P** | - | 8.1 | 30 (can freeze below 6°C) | For hot press molding between 130 - 160°C. Suitable when high gloss surfaces are required. | | | | | | | | | | ■ | | ■ | ■ | | | | | | | ■ |
| **Luperox® DP10 G** | Promoter | 6.2 | 30 | Typical molding temperature of 60 - 100°C with cobalt accelerator. A substitute for **Luperox® 26** where storage and transport of this peroxide present a problem. Especially suitable for polymer concrete and artificial marble process system. | | | | | | | ■ | | ■ | ■ | ■ | ■ | | ■ | | | | | | | |
| **Luperox® DP40** | Promoter | 6.3 | 30 | Like **Luperox® DP10G,** but it doesn't generate BTEX. | | | | | | | ■ | | ■ | ■ | ■ | ■ | | ■ | | | | | | | |
| **PEROXYCARBONATES** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® TBIC70M** | Aliphatic | 6.8 | 30 | For hot press molding between 130 - 160°C. | | | | | | | | | | | | ■ | | | | | | | | |
| **Luperox® TBEC** | - | 6.2 | 30 | | | | | | | | | | | | | ■ | | | | | | | | |
| **Luperox® MC** | - | 6.0 | 30 | Faster molding cycles and lower residual styrene in the final article compared to **Luperox® TBEC.** | | | | | | | | | | | | ■ | | | | | | | | |
| **PERKETALS** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® 231M50** | Isododecane | 5.3 | 30 | As **Luperox® P** but lower molding temperatures. Used when heavy metals are present which affect the pot life of peresters peroxides. | | | | | | | | | | | | ■ | ■ | | | | | | | |
| **Luperox® 331M50** | Isododecane | 6.1 | 30 | | | | | | | | | | | | | ■ | ■ | | | | | | | |
| **Luperox® 331MO50** | Isododecane | | | | | | | | | | | | | | | | | | | | | | | |
| **BENZOYL PEROXIDES** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Luperox® A75 (powder)** | Water | 4.9 | 30 (can freeze below 5°C) | Dibenzoyl peroxide is used to cure both at room temperature and medium temperatures. At ambient temperatures it requires the use of tertiary aromatic amines as activator. The peroxide + amines system gives quick gel and cure times and it is mainly used for polyester repair putties and mine bolts. In hot press molding, benzoyl peroxide can be used alone and gives quick cycles at 100 - 120°C. Pastes are available in different colours. | | | | | ■ | | | | | | | | □ | | | | ■ | | |
| **Luperox® ANS50G (paste)** | Dibutyl maleate + emulsifiers | 3.3 | 30 (can freeze below 5°C) | | | □ | | | ■ | □ | □ | □ | □ | ■ | | | □ | □ | ■ | □ | ■ | | | |

## KETONE PEROXIDES FOR CURING OF UNSATURATED POLYESTER RESINS CURE PERFORMANCE AT ROOM TEMPERATURE COMPARISON

**CURE PERFORMANCE AT 25°C, 2% PEROXIDE, 1% Cobalt-1% IN A MEDIUM REACTIVITY ORTHOPHTHALIC RESIN**



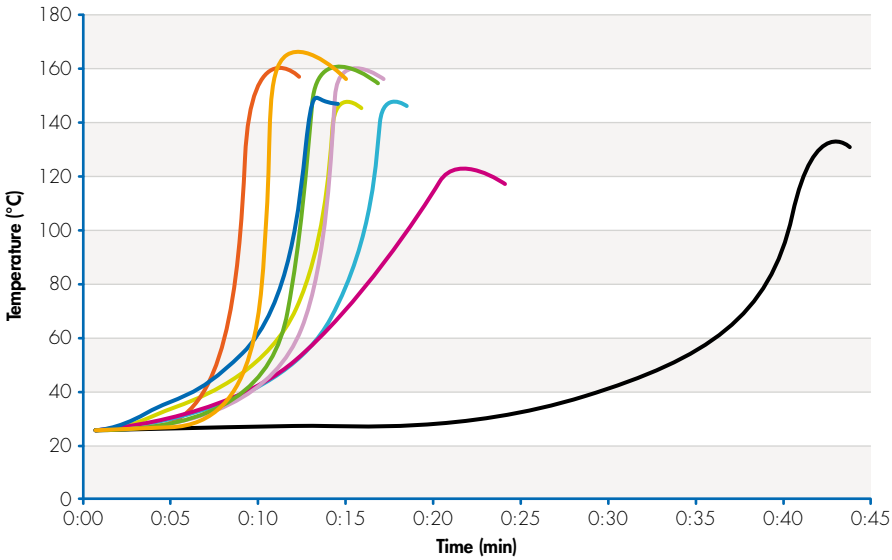

| Tradename | Gel time (min:s) | Cure time (min:s) | Peak exotherm (°C) |
|---|---|---|---|
| Luperox® K1S/K1G | 09:24 | 17:21 | 146 |
| Luperox® K18 | 06:52 | 13:29 | 150 |
| Luperox® K10 | 07:32 | 15:01 | 147 |
| Luperox® K12G | 27:48 | 42:23 | 135 |
| Luperox® K3 | 06:48 | 11:10 | 162 |
| Luperox® K4CE | 08:34 | 21:21 | 126 |
| Luperox® Z11S/Z11G | 09:33 | 15:57 | 161 |
| Luperox® Z13S | 08:52 | 14:39 | 158 |
| Luperox® Z390 | 08:22 | 12:08 | 166 |

### CONDITIONS OF EXPERIMENT

**Resin:** medium reactivity orthophthalic resin
**Peroxide:** 2%
**Cobalt (1% solution):** 1%
**Resin initial temperature:** 25°C
**Resin sample:** 50 g

# KETONE PEROXIDES FOR CURING OF UNSATURATED POLYESTER RESINS
# CURE PERFORMANCE AT ROOM TEMPERATURE COMPARISON

**CURE PERFORMANCE AT 25°C, 2% PEROXIDE, 1% Cobalt-1% IN A MEDIUM REACTIVITY ORTHOPHTHALIC RESIN**

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| Luperox® K4CE | 08:34 | 21:21 | 126 |
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| Luperox® Z13S | 08:52 | 14:39 | 158 |
| Luperox® Z390 | 08:22 | 12:08 | 166 |

## CONDITIONS OF EXPERIMENT

**Resin:** medium reactivity orthophthalic resin
**Peroxide:** 2%
**Cobalt (1% solution):** 1%
**Resin initial temperature:** 25°C
**Resin sample:** 50 g

# SAFETY HANDLING OF ORGANIC PEROXIDES

1. Observe exact **storage temperature** indicated on product label.
2. Keep away from sources of ignition and heat.
   Store in a cool dark place - well **separated** from accelerators and other flammable material.
3. **Danger of explosion:** never mix peroxides and accelerators together; add each component separately to the resin.
4. Store peroxides in **original containers.** Contact with rust, ash, dirt, accelerators and many other chemicals can cause violent decompositions.
5. Even in diluted form peroxides have a **corrosive** effect on the skin and eyes. Always **wear gloves** and protective **goggles** when handling peroxides.

**Smoking and naked flames strictly prohibited in work and storage areas!**

# IN CASE OF ACCIDENTS: FIRST AID

## EYES
In case of eye contact, rinse immediately with large quantities of water for at least 10-15 minutes.
Contact an ophthalmologist immediately.

## INGESTION
In case of accidental swallowing, do not induce vomiting. Administer water in small sips and charcoal tablets in addition. Call a doctor immediately.

## SKIN • BODY
Remove soaked clothes immediately.
Wash skin with plenty of water and cover skin with sterilized bandages. Seek medical advice.

## SPILLAGE
If peroxide is spilled, absorb with inert material e.g. Vermiculite or clean sand immediately and destroy in accordance with local regulations.

## FIRE
Suitable extinguishers are waterspray and foam.
In case of large fires: Fight fire from safe distance (10-15 m). Cool containers/tanks with water spray.
Call fire brigade immediately.

**Consult Safety Data Sheets before handling organic peroxides**

A global chemical company and France's leading chemicals producer, **Arkema** is building the future of the chemical industry every day.
Deploying a responsible, innovation-based approach, we produce state-of-the-art specialty chemicals that provide customers with practical solutions to such challenges as climate change, access to drinking water, the future of energy, fossil fuel preservation and the need for lighter materials. With operations in more than 40 countries, some 14,000 employees and 10 research centers, Arkema generates annual revenue close to 6.5 billion, and holds leadership positions in all its markets with a portfolio of internationally recognized brands.



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ARKEMA
INNOVATIVE CHEMISTRY

420, rue d'Estienne d'Orves
92705 Colombes Cedex – France
Tel.: 33 (0)1 49 00 80 80
Fax: 33 (0)1 49 00 83 96
arkema.com

**luperox.com**