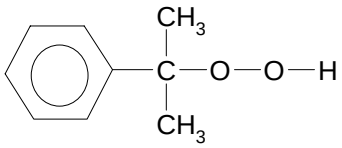
Trigonox® 239

Product description

Cumyl hydroperoxide, 45% solution in solvents



Molecular weight	: 152.2
Active oxygen content peroxide	: 10.51%
actual product	: 4.52-4.73%
CAS No.	: 80-15-9
EINECS/ELINCS No.	: 210-254-7
TSCA status	: listed on inventory

Specifications

Appearance	: Clear liquid
Color	: 250 Pt-Co max.
Assay	: 43.0-45.0%

Characteristics

Density, 20°C	: 1.040 g/cm^3
Viscosity, 20°C	: 5 mPa.s

Storage

Due to the relatively unstable nature of organic peroxides a loss of quality can be detected over a period of time. To minimize the loss of quality, Akzo Nobel recommends a maximum storage temperature (T_s max.) for each organic peroxide product.

For *Trigonox* 239 T_s max. = 25°C

When stored under the recommended storage conditions, *Trigonox 239* will remain within the Akzo Nobel specifications for a period of at least three months after delivery.

Thermal stability

Organic peroxides are thermally unstable substances, which may undergo self-accelerating decomposition. The lowest temperature at which self-accelerating decomposition of a substance in the original packaging may occur is the Self-Accelerating Decomposition Temperature (SADT). The SADT is determined on the basis of the Heat Accumulation Storage Test.

For *Trigonox* 239 SADT : 55°C

The Heat Accumulation Storage Test is a recognized test method for the determination of the SADT of organic peroxides (see Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria - United Nations, New York and Geneva).

Major decomposition products

Acetophenone, phenylisopropanol, methane, water

Packaging and transport

The standard packaging is a 30 l HDPE can (Nourytainer®) for 30 kg peroxide solution.

Both packaging and transport meet the international regulations. For the availability of other packed quantities contact your Akzo Nobel representative.

Trigonox 239 is classified as Organic peroxide type F; liquid, Division 5.2; UN 3109.

Safety and handling

Keep containers tightly closed. Store and handle *Trigonox* 239 in a dry well-ventilated place away from sources of heat or ignition and direct sunlight. Never weigh out in the storage room.

Avoid contact with reducing agents (e.g. amines), acids, alkalis and heavy metal compounds (e.g. accelerators, driers and metal soaps).

Please refer to the Material Safety Data Sheet (MSDS) for further information on the safe storage, use and handling of *Trigonox* 239. This information should be thoroughly reviewed prior to acceptance of this product.
The MSDS is available at www.akzonobel-polymerchemicals.com.

Applications

Trigonox 239 is a peroxide mixture based on cumene hydroperoxide. *Trigonox* 239 is especially developed for the cure of vinylester or phenacryl resins in combination with a cobalt accelerator.

Trigonox 239 can successfully be used instead of generally applied keton peroxides like Butanox® LPT with the following features:

- No ‘gassing’ after the peroxide is mixed in the preaccelerated vinylester resin. This phenomenon is very often recognized as a disadvantage of ketone peroxides in vinylester resins.
- The use of an amine accelerator is in general not necessary to achieve a good cure.
- A fast cure in thin coatings and laminates up to a thickness of approx. 6 mm.
- A low peak exotherm in thick laminates.

Dosage

Depending on working conditions, the following peroxide and accelerator dosage levels are recommended:

Trigonox 239	2 - 3 phr *
Accelerator NL-51P	0.2 - 1 phr

* phr = parts per hundred resin

Cure Characteristics

The cure characteristics of Trigonox 239 have been determined in comparison with the for this application area generally applied peroxide Butanox LPT in the 2 commonly used vinylester resins:

Vinylester resin I = bisphenol A based type
Vinylester resin II = novolak based type

Gel times at 20°C

Vinylester resin	100	100	100	100
Trigonox 239	2	2		
Butanox LPT			2	2
Accelerator NL-51P (6% cobalt)	0.5	1	0.5	0.5
Accelerator NL-63-100				0.1
Gel time at 20°C (min.)				
Vinylester resin I	28	18	32	16
Vinylester resin II	15	10	22	12

Long gel times of several hours, which can be necessary for filament winding operations, can easily be obtained by the extra addition of Promotor C as inhibitor.

Vinylester resin	100	100	100	100	100	100
Trigonox 239	2	2	2			
Butanox LPT				2	2	2
Accelerator NL-51P	0.5	0.5	0.5	0.5	0.5	0.5
Promotor C		0.1	0.3		0.1	0.3
Gel time at 20°C (min.)						
Vinylester resin I	28	90	260	32	90	360
Vinylester resin II	15	120	400	22	90	390

Cure of 1 mm pure resin layer at 20°C

Cure experiments have been performed in 1 mm pure resin layers at 20°C. The development of the hardness is expressed as the time to reach a Persoz hardness of 60 and 120 s. respectively.

Vinylester resin I	100	100		
Vinylester resin II			100	100
Trigonox 239	2		2	
Butanox LPT		2		2
Acc. NL-51P (6% Cobalt)	1	0.5	1	0.5
Acc. NL-63-100		0.1		0.1
Gel time at 20°C (min.)	18	16	10	12
Time to reach a Persoz hardness of				
60 s. (hours)	1.25	1.75	<<1	<<1
120 s. (hours)	1.75	2.50	<1	<1
Residual styrene contentafter a cure time at 20°C of				
24 hours (%)	7.7	10.5	1.2	4.4
4 weeks (%)	4.0	6.2	0.6	2.3
4 weeks + 8 h 80°C (%)	0.1	0.1	0.1	0.1

Cure of 4 mm laminates at 20°C

4 mm laminates have been made with a 450 g/m^2 chopped strand mat. The glass content in the laminates is 30% (w/w).

The following parameters were determined:
- Time-temperature curve.
- Speed of cure expressed as the time to achieve a Barcol hardness (934-1) of 0-5 and 25-30 respectively.
- Residual styrene content after 24 h at 20°C and a subsequent postcure of 8 h at 80°C.

Vinylester resin I	100	100		
Vinylester resin II			100	100
Trigonox 239	2		2	
Butanox LPT		2		2
Acc. NL-51P (6% Cobalt)	1	0.5	0.5	0.3
Acc. NL-63-100		0.1		0.1
Time temperature curve				
Gel time (min.)	27	32	16	15
Time to Peak (min.)	99	88	35	21
Peak exotherm (°C)	43	38	68	122
Time to Barcol 934-1 of				
0-5 (hours)	1.5	2.5	<1	<1
25-30 (hours)	5	30	<1	<1
Residual styrene content				
after a cure of 24 h at 20°C (%)	7.0	8.0	1.8	1.0
plus a postcure of 8 h at 80°C (%)	0.12	0.25	0.2	0.4

Cure of 10 mm laminates at 20°C

10 mm laminates have been made with a 450 g/m^2 chopped strand mat. The glass content in the laminates is 30% (w/w).

The following parameters were determined:
- Time-temperature curve.
- Speed of cure expressed as the time to achieve a Barcol hardness (934-1) of 0-5 and 25-30 respectively.
- Residual styrene content after 24 h at 20°C and subsequent postcure of 8 h at 80°C.

Vinylester resin I	100	100		
Vinylester resin II			100	100
Trigonox 239	2		2	
Butanox LPT		2		2
Acc. NL-51P (6% Cobalt)	0.25	0.15	0.2	0.2
ACC. NL-63-100		0.05		
	0.15			
Gel time at 20°C (min.)	44	45	30	30

Time temperature curve				
Time to Peak (min.)	243	125	59	34
Peak exotherm (°C)	35	62	130	160
Barcol 934-1 hardness				
after a cure time of 24 hours	28	24	48	48
Residual styrene content				
after a cure time of 8 days at 20°C (%)	6.1	5.8	0.3	0.1
plus a postcure of 8 h at 80°C (%)	0.1	0.8	0.3	0.1

Time temperature curves

Time temperature curves have been determined at 20°C in 30 mm and 50 mm thick castings, with a diameter of 100 mm, based on a 1:1 mixture of vinylester resin/quartz flour.

The results can be used as an indication for the cure characteristics of thick laminates.

Vinylester resin I	100	100		
Vinylester resin II			100	100
Quartz flour	100	100	100	100
Butanox LPT	2		2	
Trigonox 239		2		2
Accelerator NL-51P (6% Co)	0.2	0.5	0.2	0.2
Accelerator NL-63-100 (DMA)		0.1		
	0.15			
Gel time in the pure resin (min.)	30	30	28	30
<u>30 mm thick castings</u>				
Time-temperature curve				
Gel time (min.)	21	19	17	24
Time to Peak (min.)	69	100	24	42
Peak exotherm (°C)	113	89	144	130
<u>50 mm thick castings</u>				
Time-temperature curve				
Gel time (min.)	14	17	17	28
Time to Peak (min.)	59	70	29	49
Peak exotherm (°C)	136	110	150	130

- Gel time in 15 gram pure resin.
- Time-temperature curves in resin/quartz flour mixtures.

Pot life at 20°C

The pot life of a mixture peroxide/vinylester resin will vary considerably with the temperature, the peroxide addition level, the type of the vinylester resin involved and the batchsize. The following indication for the pot life at 20°C in a 25 kg batch of non-preaccelerated vinylester resin can be given.

Vinylester resin	100	100	100	100
Trigonox 239	2	4		
Butanox LPT			2	4
Pot life at 20°C (days)				
Vinylester resin I	30	23	5	3
Vinylester resin II	25	17	2	1

Trigonox is a registered trademark of Akzo Nobel Chemicals BV or affiliates in one or more territories.

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