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Technical Information

THIOCURE® PETMP

Description

THIOCURE® PETMP is a tetrafunctional Polythiol with low viscosity. It reacts with epoxy- and isocyanate groups as well as with double bonds of unsaturated compounds.

Chemical Description

Pentaerythritol tetra(3-mercaptopropionate)

Applications

THIOCURE® PETMP is used as a hardener in epoxy resins and in the formulation of solvent based paints, but particularly in the formulation of solvent free coatings, casting compounds, floorings and resin-based mortars for the construction industry, as well as in adhesives and sealants.

EP-Systems crosslinked with THIOCURE® PETMP are particularly suitable for low-temperature curing.

Catalysts such as tertiary amines (e.g. Versamine® EH 50) are of essential importance in this process, but mixtures with THIOCURE® PETMP are prone to degradation reducing the shelf-life time significantly.

Coatings, castings etc. can also be formulated with polyisocyanates or isocyanate prepolymers. THIOCURE® PETMP combined with aliphatic hardeners results in thiourethane-systems with good UV-stability. THIOCURE® PETMP can be used as main binder or in combination with conventional polyols. The reactivity of THIOCURE® PETMP is considerably higher than that of hydroxyfunctional polyols. Depending on the isocyanate a catalyst could be necessary. Particularly suitable are for example the aluminium complex K-Kat® 5218 (King Industries) or quarternary ammonium salts such as WorleeAdd 422 (Worlee Chemie GmbH) or BYK®-ES 80 (BYK Additives). Similarly, to the polyurethane systems, it is possible to inhibit the reaction, for example with phosphoric acid esters such as dibutylphosphate.

THIOCURE® PETMP can be used in combination with e.g. Acrylates, vinyl or allyl ethers (e.g. triallyl isocyanurate) for the formulation of radiation-curing thiol-ene systems. The so-called thiol-ene reaction is a radically initiated step-growth reaction. The advantages are, compared to conventional UV lacquers (which cure by a chain-growth reaction), the significantly lower oxygen inhibition and shrinkage tendency. Even with a proportionate use in free-radically curing UV systems (5-10% on total formulation), THIOCURE® PETMP can reduce the oxygen inhibition and increase the curing rate and film flexibility.

THIOCURE® PETMP can also be used with the above-mentioned reaction partners in stoving applications. Such a thiol-ene reaction can be initiated by means of peroxides or azo initiators.

A further possibility is the use of THIOCURE® PETMP in combination with acrylates for so-called thiol-Michael addition reactions. The catalysts used for such ambient curing systems are e.g. bases, for cure temperatures in a range of 80-120°C accordingly thermolatent bases.

It is important to monitor the shelf life of one pack formulations of THIOCURE® with unsaturated compounds and the use of stabilizers such as Irgastab® UV 22 (BASF) is recommended. Two pack formulations are preferred to benefit fully from the advantages of thiol-ene chemistry.

Solubility / Compatibility

THIOCURE® PETMP can be diluted with most organic solvents such as esters, glycol ethers and aromatic hydrocarbons. However, the solutions formed must be tested for their storage stability.

THIOCURE® PETMP can be mixed in any proportions with other THIOCURE® types.

General Informations

THIOCURE® PETMP is also available as PETMP I.o. and PETMP sl.

PETMP I.o. is an odor-optimized variant.

PETMP sl with controlled reactivity, is recommended for use in combination with isocyanates. This reaction inhibited type falls under the claim of the patent WO 2008/061839 from Akzo Nobel Coatings International BV. Therefore, granted Bruno Bock Chemical Factory GmbH its customers upon request a sublicense.

The specified characteristics of THIOCURE® PETMP I.o. and PETMP sl are unchanged from the standard version THIOCURE® PETMP.

Formulation and Processing Information

- ❖ Calculation of hardener content for Epoxy resins:

$$\text{THIOCURE}^{\circledR} [\text{g}] = \text{Epoxy value} \times \text{SH-equivalent}$$

(Epoxy value = 100/EP-Equivalent weight)

- ❖ Calculation of required Isocyanate-hardener:

$$\text{Isocyanate} [\text{g}] = \frac{\text{amount THIOCURE}^{\circledR} [\text{g}] \times \text{SH-content} [\%] \times 42}{33 \times \text{NCO-content} [\%]}$$

- ❖ Chemical conversion with double bonds (e.g. acrylate monomers, -oligomers etc.):

$$1 \text{ mol SH per mol double bond}$$

During the formulating and the processing of products containing THIOCURE® PETMP, care should be taken to avoid heavy metal contamination, especially with iron and nickel, which can lead to discoloration in clear coats and affect the reactivity of the system.

Specifications

Parameter	Unit	Range	Method	SOP-No.
Appearance		clear, colorless to slight yellow	Visual (5cm optical path)	
Color Number	APHA	max. 20	Hazen	PA-QW-013
Content	% w/w	min. 95.0	Iodometric	PA-QW-303
Mercapto Sulfur (SH)	% w/w SH	25.72 – 27.04	Iodometric	PA-QW-303
Acid number	mg KOH/g	max. 1.0	Alkalimetric	PA-QW-302
Refractive Index n ^d ₂₀		1.529 – 1.534	Electr. Refractometer	PA-QW-014

Other Properties

Parameter	Unit	Range	Method	SOP-No.
H-Equivalentweight	g/mol	125 – 128	calculated	
Nonvolatile content	% w/w	> 99.0	DIN EN ISO 3251 (1h 125°C)	
Viscosity	mPa s	400 +/- 100	ISO 2555, Brookfield Mandrel S 62, 20 RpM	
Density d ²⁰ ₄	g/cm ³	1.275 – 1.285	Oscillating Densitometer	PA-QW-005
Flash point	°C	215	DIN EN ISO 2719A	Ext. Lab
Water content	% w/w	< 0.1		

Handling, Storage conditions and Shelf-life

Consult the appropriate Material Safety Data Sheet for safety and handling guidelines for this product.

Storage at room temperature up to +25°C max. is recommended.

THIOCURE® PETMP can be stored for at least one year and PETMP I.o. for at least 6 months from the date of manufacture if kept closed in the original packaging. Expiration of shelf life time does not necessarily mean the product is no longer usable. However, prior to using THIOCURE® PETMP we recommend to testing it and verifying that it still meets the specification.

THIOCURE® PETMP should be stored in the original container. Alternatively, packaging in glass, HDPE, PP or inside-coated packaging can be used. Opened packaging should be closed tightly after use

Standard Packing

40451	PE-Can	kg	40.0
40361	PE-Drum	kg	270.0
40731	IBC	kg	1200.0

Regulatory Status

	Europe	Australia	China	Japan	Canada	Korea	New Zealand	Philip-pines	USA
	REACH	AICS	IECSC	ENCS	DSL	ECL	NZIoC	PICCS	TSCA
THIOCURE® PETMP	+	+	+	+	+	+	+	+	+
THIOCURE® PETMP I.o.	+	n/a	+	-	+	+	n/a	n/a	+
THIOCURE® PETMP sl	+	+	+	+	+	+	+	+	+

+ = registered
- = not registered
n/a = not applicable

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