

EPIKOTE™ Resin 04976

EPIKURE™ Curing Agent 04976

EPIKURE™ Catalyst 04976

Product Description

EPIKOTE™ Resin 04976 is a liquid epoxy resin.

EPIKURE™ Curing Agent 04976 is a low-viscosity anhydride hardener.

EPIKURE™ Catalyst 04976 is a low-viscosity catalyst.

Application Areas/Suggested Uses

EPIKOTE™ Resin 04976 in combination with the anhydride hardener EPIKURE™ Curing Agent 04976 and the accelerator EPIKURE™ Catalyst 04976 is a low viscous hot curing epoxy resin system suitable to produce composite fiber components using the filament winding technique and pultrusion. It is approved for Type III LNG / CNG tanks and suitable for Type IV.

The molding materials made with the EPIKOTE™ Resin 04976 matrix process good electrical and mechanical characteristics paired with good thermal ageing stability. For pultrusion we would recommend adding approximately 2 - 3% internal release agent, e.g. HELOXY™ Additive 112.

The processing, gel and curing times can be easily adjusted by varying the concentration of the EPIKURE™ Catalyst 04976. Curing reaction can be carried out at temperatures between 70 - 130 °C, depending on the amount of the accelerator.

Benefits

- Low viscosity
- Anhydride cure
- Good thermal deformation resistance
- Good electrical and mechanical characteristics
- Low moisture absorption

Typical Properties

EPIKOTE™ Resin 04976

Property		Unit	Value
Delivery form			liquid
Viscosity	at 25°C	mPa·s	11000 ± 1000
	at 40°C	mPa·s	1000 ± 100
	at 60°C	mPa·s	180 ± 30
Color Gardner	at RT	-	≤ 3
Refractive index	at 25°C	-	1,170 ± 0,003
Density	at 20°C	kg/l	1,17 ± 0,02

EPIKURE™ Curing Agent 04976

Property		Unit	Value
Delivery form			liquid
Viscosity	at 25°C	mPa·s	65 ± 10
	at 40°C	mPa·s	25 ± 5
	at 60°C	mPa·s	7 ± 3
Density	at 20°C	kg/l	1,21 ± 0,02

EPIKURE™ Catalyst 04976

Property		Unit	Value
Delivery form			liquid
Viscosity	at 25°C	mPa·s	10 ± 5
Density	at 20°C	kg/l	1,01 ± 0,01

Processing Details

Mixing ratio

Optimal moulding properties are obtained using the following mixing ratio:

EPIKOTE™ Resin 04976	100,0	parts by weight
EPIKURE™ Curing Agent 04976	80,0	parts by weight
EPIKURE™ Catalyst 04976	0,5- 2,0	parts by weight

Depending on required processing parameters, the amount of EPIKURE™ Catalyst 04976 accelerator used can be varied between 0.2 and 3.0 parts by weight in relation to the amount of the resin.

The resin, hardener and accelerator should be mixed at temperatures between room temperature and 40°C. Exceeding the recommended mixing temperatures over extended periods of time should be avoided due to possible exothermic reaction.

The reddish coloring of the formulation, that occurs on addition of the accelerator, disappears almost entirely during the curing process and has no detrimental effect on the performance of the final product.

Mixing tolerance

The maximum allowable mixing tolerance is +/- 2 pbw for resin and curing agent and +/- 0,5 pbw for the catalyst, however Westlake Epoxy recommends staying as close to the desired mixing ratio as possible to obtain the best performance. Resin, hardener and catalyst must be mixed very thoroughly until no clouding is visible. Pay special attention to the walls and bottom of the mixing container. Adding more or less curing agent will not result in a faster or slower reaction but in incomplete curing, which cannot be corrected in any way.

Material preheating

The best winding performance can be obtained when keeping the components under the following temperatures prior to mixing:

EPIKOTE™ Resin 04976	25-40°C
EPIKURE™ Curing Agent 04976	RT-30°C
EPIKURE™ Catalyst 04976	RT-30°C

The system exhibits good processing for RTM, LCM, pultrusion (with injection unit) in the temperature range between 60 and 80 °C, and for filament winding with impregnation bath in the temperature range between 25 and 40°C.

Higher processing temperatures are possible but will shorten the pot life. A rise in temperature of 10 °C reduces the pot life by approx. 50%. Different temperatures during processing have no significant effect on the mechanical properties of the hardened product.

Do not mix large quantities at elevated processing temperatures as this can lead to an uncontrolled exothermic reaction where the mixture may heat up very quickly to more than 200 °C in the mixing container.

Processing Temperature and Pot Life

Processing Data		Unit	Value
Viscosity of the formulation	at 25°C	mPa·s	900 ± 200
Pot life of the formulation	at 25°C	h	> 8h
Gelation time of the formulation	at 80°C	min	55 ± 5
B-Time of the formulation (hot plate)	at 110°C	min	13 ± 1

For pultrusion applications following processing parameters are recommended:

Resin bath: room temperature
 Tool temperature: 180 - 200 °C / 356 - 392°F
 Speed: approx. die length per minute (for die length of 1 m ~ 1 m/min)

Recommended curing cycles

The following table shows an overview of the minimum curing time at given temperatures: Curing time depends on the amount of the accelerator and processing temperature.

x pbw EPIKURE™ Catalyst 04976	0.3	0.5	1.0	2.0
Curing Temperature	Curing time [h]			
at 60°C	40-45	30-35	20-25	10-15
at 80°C	20-25	15-20	8-10	4-6
at 100°C	6-8	4-5	2-3	1-2
at 120°C	3-4	2-3	1-2	0.5-1

Additional post-curing at 120 – 160 °C may be required to obtain the maximum thermal and mechanical properties of the resin system. Post-cure time depends on processing conditions and part geometry.

Typical Properties of the cured, non-reinforced system

Cure cycle: 30min @ 80°C + 8h @ 110°C

Mixing ratio: 100 : 80 : 1.5 parts by weight

Property	Unit	Value	Test Method
T _g , DSC first run Onset	°C	134 ± 2	DIN EN ISO 11357 DSC (10K/min)
Tensile test @ room temperature			
Tensile modulus	MPa	3175 ± 100	DIN EN ISO 527-1
Tensile strength	MPa	90 ± 10	
Elongation at break	%	7,5 ± 2	
Bending test @ room temperature			
Flexural strength at max	MPa	150 ± 10	DIN EN ISO 178
Flexural modulus	N/mm ²	3200 ± 100	
Fracture Toughness @ room temperature			
K _{IC}	MPa·m ^{-1/2}	0,5 ± 0,1	SENB
G _{IC}	J/m ²	110 ± 5	ISO 13586

Safety, Storage & Handling

Please refer to the MSDS for the most current Safety and Handling information.

EPIKOTE™ Resin 04976 should be stored at room temperature in its carefully sealed original containers. Under these conditions, the shelf life is a minimum of three years from date of certification.

EPIKURE™ Curing Agent 04976 should be stored at room temperature in its carefully sealed original containers, so that moisture is excluded. Under these conditions, the shelf life is a minimum of two years from date of certification. Care should be taken to avoid storage environments resulting in moisture contamination. Exposure to moisture will cause an increase in viscosity and reactivity, the degree of increase depending on the amount of moisture, which has been absorbed.

EPIKURE™ Catalyst 04976 should be stored at room temperature in its carefully sealed original containers. Under these conditions, the shelf life is a minimum of six months from date of certification.

Occasionally, it is possible that the resin crystallizes at temperatures below 15°C. The crystallization is visible as clouding or solidification of the content of the container. Before processing, the crystallites must be removed by warming up. Slow heating up to 50 - 60°C under mild stirring will homogenize the resin mass without any loss of quality. Do not use products containing crystallized resin. While heating up enable equalization of pressure. Never warm up over open flame! Always use appropriate safety equipment as indicated in the applicable MSDS.

Contact Information

For further Technical Inquiries on the properties and performance of this matrix system in reinforced composites, please contact your local technical service representative.