Product information

AMICURE® DBUE

Curing Agent

DESCRIPTION

Amicure DBUE accelerator is a tertiary amine that functions as a cure accelerator for high performance epoxy resin systems.

TYPICAL PROPERTIES

Property	Value	Unit
Appearance	Clear, Light Yellow Liquid	
Specific Gravity @ 77°F (25°C)	1.11	
Freezing Point	< -172	°F
Boiling Point	498-500	°F
Viscosity @ 77°F (25°C)	14	cP
Vapor Pressure [mmHg @ 100°F (38°C)]	5.3	
Flash Point (Closed Cup. ASTM D56-70)	> 205	°F
Active Ingredient	> 98.0	%
Moisture (Karl Fischer)	< 0.5	%
Flash Point (Closed Cup. ASTM D56-70)	13.4	°F

ADVANTAGES

- Long room temperature pot life
- Fast cures at 146°F (80°C)
- High glass transition temperatures
- Improved toughness

APPLICATIONS

- Anhydride accelerator
- Electronic encapsulation and potting compounds
- Transfer molding formulations
- Protective coatings
- Civil engineering applications

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SHELF LIFE

At least 36 months from the date of manufacture in the original sealed container at ambient temperature. Store away from excessive heat and humidity in tightly closed containers.

STORAGE AND HANDLING

Refer to the Safety Data Sheet for Amicure DBUE curing Agent.

TYPICAL CURE SCHEDULE

5 hours at 212°F (100°C) plus 5 hours at 302°F (150°C)

SUPPLEMENTARY DATA

KEY FEATURES: Amicure DBUE accelerator is a bicyclic amidine having an extremely strong basicity-its ionization constant (pKa)* is 11.5 and pH (1% aqueous solution) is 12.8-nearly equivalent to sodium hydroxide. Chemically, this compound is designated as 1,8-Diaza-bicyclo (5,4,0) undecene-7.

* For reference information, pKa values of other tertiary amines are— pryidine 5.l3, N-methylmorpholine 7.4, ttriethylenediamine [1,4-Diaza-bicyclo (2.2.2) octane] 8.7.

Effect On Pot Life Of Typical Epoxy Formulations

TABLE 1: HEAT-SENSITIVITY OF DIFFERENT ACCELERATORS IN A DODECENYL SUCCINIC ANHYDRIDE (DDSA) EPOXY SYSTEM

Formulation	phr
Bisphenol-A Resin	100
DDSA	130
Accelerator*	5

* Accelerators include: Tris(dimethylaminomethyl) phenol (Ancamine K54 curing agent), N,N-dimethylbenzylamine (Ancamine BDMA curing agent), 1,8-Diaza (5,4,0) bicyclo-undecene-7 (Amicure DBUE cure accelerator), DBU phenol salt (Amicure SA-1 cure accelerator)

METHOD: 20 grams of the epoxy resin, 26 grams of DDSA, and 1 gram of the accelerator were added to a 100 ml beaker. The mixture was stirred vigorously for one minute, placed in an oven at five different temperature levels, and a gel time was determined. This procedure was repeated for each of the accelerators.

Note: The order of addition is important for formulations containing Amicure DBUE accelerator. Amicure DBUE accelerator is not recommended for pre-promotion of anhydrides. Prepromotion is accomplished with Amicure S series salts.

RESULTS:

TABLE 2: TEST TEMPERATURE (ºF)

* Accelerators include: Tris(dimethylaminomethyl) phenol (Ancamine K54 curing agent), N,N-dimethylbenzylamine (Ancamine BDMA curing agent), 1,8-Diaza (5,4,0) bicyclo-undecene-7 (Amicure DBUE cure accelerator), DBU phenol salt (Amicure SA-1 cure accelerator)

CONCLUSIONS: In the 140-176°F (60-80°C) range, Amicure DBUE accelerator showed slightly longer gel times than Ancamine K54 and Ancamine BDMA curing agents, demonstrating its latency at low temperatures. At elevated temperatures [212-248°F (100-120°C)], Amicure DBUE accelerator demonstrated equivalent gel times compared with the other accelerators. At lower accelerator levels (3 phr), these trends were the same with the actual gel times being longer.

Comparison of Accelerators in a Hexahydrophthalic Anhydride (HHPA)/Epoxy System

TABLE 3: HEAT-SENSITIVITY OF DIFFERENT ACCELERATORS IN A DODECENYL SUCCINIC ANHYDRIDE (DDSA) EPOXY SYSTEM

Formulation	phr
Bisphenol-A Resin	100
DDSA	80
Accelerator*	1 or 5

* Accelerators include: Tris(dimethylaminomethyl) phenol (Ancamine K54 curing agent), N,N-dimethylbenzylamine (Ancamine BDMA curing agent), 1,8-Diaza (5,4,0) bicyclo-undecene-7 (Amicure DBUE cure accelerator), DBU phenol salt (Amicure SA-1 Cure accelerator)

METHOD: 20 grams of the epoxy resin were placed in a 100 ml beaker and allowed to stand at 175°F (80°C) for 10 minutes. 16 grams of HHPA were melted into the hot resin at 140-160°F (60-70°C), and the accelerator was added and stirred for one minute. The mixture was put into an oven at 175°F (80°C) for determination of gel time. This procedure was repeated for each of the accelerators

RESULTS:

TABLE 4: GEL TIME (MIN)

Accelerator Level (phr)	5	1

TABLE 5: TEST TEMPERATURE (ºF)

Accelerator	175	175
No Accelerator	> 240	> 240
Ancamine K54	20	108
Ancamine BDMA	16	160
Amicure DBUE	27	230
Amicure SA-1	43	244

CONCLUSIONS: In the HHPA/epoxy formulation, Amicure DBUE and Amicure SA-1 accelerators demonstrated significantly longer gel times in the low temperature test [175°F (80°C)].

Effect On Heat Distortion Temperature

Curing at ambient and low temperature [140°F (5°C)] in an epoxy/polyamide/water formulation.

TABLE 6: CURING AT AMBIENT AND LOW TEMPERATURE [140°F (5°C)] IN AN EPOXY/POLYAMIDE/WATER FORMULATION

Formulation			
Bisphenol-A Resin	100	100	100
Liquid Polyamide Resin*	67	67	67
Accelerator**	0	7	13
Water	0.7 (or 0)	0.7	2 (or 0)

*Ancamide 350A curing agen
**Accelerators include: Tris(dimethylaminomethyl) phenol (Ancamine K54 curing agent)
1,8-Diaza (5,4,0) bicyclo-undecene-7 (Amicure DBUE cure accelerator)

METHOD: Formulations were applied on two glass plates (thickness of 1mm). One coated plate was allowed to stand at 77°F (25°C) and a gel time was measured. The other plate was held at 40 °F (5°C) for 24 hours and then examined for film transparency and cure state

RESULTS:

Formulation	Accelerator	Amount of Water (phr)	Gel Time @ 77°F (25°C) (min)	Film Cure State @ 40°F (4°C)	Film Transparency @40°F (4°C)
1	Control	0	67	Tack	Transparent
		0.7	40	Tack	Turbid
2	Ancamine K54	0.7	31	Tack Free	Turbid
	Amicure DBUE	0.7	30	Tack Free	Transparent
3	Ancamine K54	2.0	26	Tack Free	Turbid
	Ancamine K54	0	43	Tack Free	Transparent
	Amicure DBUE	2.0	35	Tack Free	Transparent
	Amicure DBUE	0	44	Tack	Transparent

CONCLUSIONS: In the presence of water, formulations with Amicure DBUE accelerator provided transparent coatings. Also, in the presence of water, systems with Ancamine K54 accelerator produced a turbid film with poor physical properties. Amicure DBUE accelerator yielded a more complete cure profile as compared with standard accelerators such as Ancamine K54 curing agent. Also, the catalytic activity of Amicure DBUE accelerator was enhanced in the presence of water and was nearly equivalent to that of Ancamine K54 curing agent without producing a high exotherm. This occurs mainly due to the hydrolysis of Amicure DBUE to form a ketimine analog

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