

# AMICURE® 101 Curing Agent

## DESCRIPTION

Amicure 101 curing agent for epoxy resins is a proprietary, non-MDA aromatic amine. It offers excellent pot life, short gel time at 300°F and it yields high heat distortion temperatures in the finished product. In addition, Amicure 101 curing agent is nonstaining and yields a low formulated viscosity at room temperature.

A comparison of Amicure 101 curing agent to other typical epoxy curing agents is shown in the adjacent table and in the performance data.

Amicure 101 curing agent provides several key advantages in fiber reinforced composites, electrical/electronic encapsulation, tooling, casting, molding, adhesives and coatings. It can be used as a multipurpose, low-viscosity liquid hardener in applications where good handling characteristics, moderate exotherms, high temperature performance and good chemical resistance are important.

## ADVANTAGES AND APPLICATIONS

**Fiber Reinforced Composites**—Amicure 101 curing agent is an excellent choice for fiberglass/epoxy filament wound pipe due to its superior resistance to alkaline conditions and high heat resistance. Its low room temperature mix viscosity allows resin bath temperature reductions, which can result in extended pot life and energy-saving cost reductions. Other applications are in filamentwound electrical insulators and in sports equipment.

**Electrical/Electronic Encapsulation**—Amicure 101 curing agent can be used to encapsulate stator and ignition coils, passive components and general-purpose electrical devices. It can also be utilized in heat-cured potting and casting compounds. These applications are possible because of the excellent electrical properties, high glass transition temperature and superior chemical resistance of the cured product.

**Tooling**—Amicure 101 curing agent is among the curing agents of choice for tooling compounds. The product is chosen because of the high glass transition temperatures needed in many tooling applications. In addition, Amicure 101 curing agent yields a faster, more complete cure at room temperature.

**Adhesives**—Amicure 101 curing agent is used in highperformance, heat-cured adhesives; especially in products intended for applications where the electrical properties of the cured matrix are an advantage.

**Coatings**—Amicure 101 curing agent provides excellent heat and chemical resistance, making it particularly suitable for coatings. Chemical resistance is especially good for alkaline conditions and most organic acids.

## SHELF LIFE

At least 24 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 101 curing agent.

TABLE 1: TYPICAL PROPERTY COMPARISON

	Amicure 101	DETDA*	MDA**
Appearance	Amber liquid	Red liquid	Brown solid
Viscosity, cP @ 77°F	120	400	N/A
Melting Point, °F	32-41	23-14	158-176
Odor	Amine	Amine	Amine
Amine Equivalent Weight	48.5	44-45	50-51
Recommended Use Level (phr)	26	24	27

\* Diethyltoluenediamine

\*\* Methylene dianiline

## SUPPLEMENTARY INFORMATION

**Performance Data:** A Sunshine gel meter and a Brookfield RVTD viscometer with a Thermosel component were used to generate the reactivity data. The formulation of resin and curing agent was hand stirred for one minute. 10 grams of the formulation were poured into the gel meter and into the Thermosel chamber. Data was generated simultaneously by the gel meter and the viscometer to get an accurate cure profile.

The glass transition temperature of each was measured by differential scanning calorimetry (DSC).

**Reactivity:** One of the features of Amicure 101 curing agent is its ability to be used in casting or potting applications where a controlled exotherm is essential, but low activation temperatures are required. This can be illustrated by examining reactivity profiles using a differential scanning calorimeter (DSC).

Samples of aromatic amines were mixed stoichiometrically with liquid epoxy resin (DGEBA), and the weighed formulations were placed immediately in a DSC cell. A scan was run from 82°F to 536°F at a ramp rate of 18°F/min. An analysis of four competitive systems is given in Figure 1.

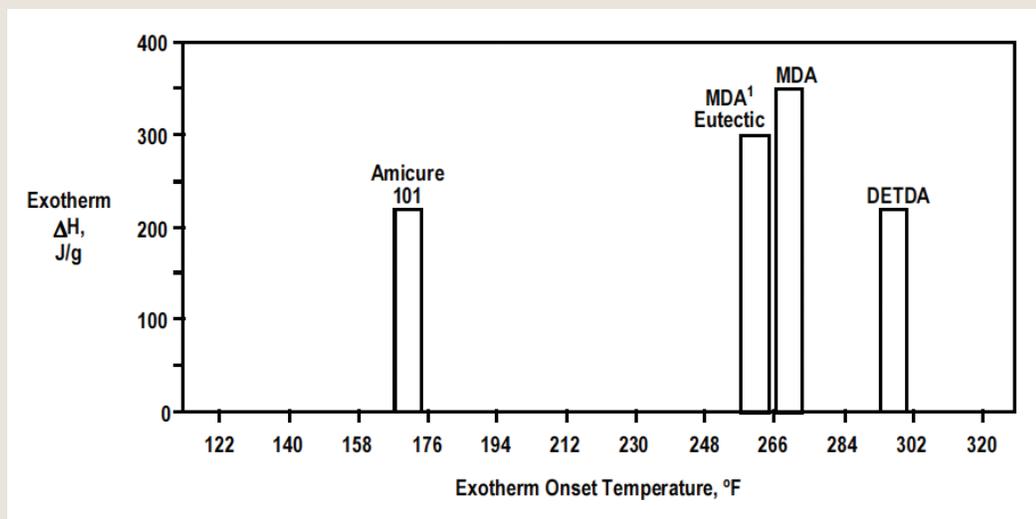
The onset of exotherm for Amicure 101 curing agent is at least 122°F lower than competitive aromatics, indicating lower temperature requirements for initiation of cure. However, the resulting exotherm of this highly reactive system is 25–35% lower than commercial MDA formulations. This lower exotherm allows an added margin for shrinkage and internal stress considerations.

TABLE 2: COMPARATIVE SUMMARY

	Amicure 101	DETDA	MDA
<b>Formulations (phr)</b>			
Epoxy Resin*	100	100	100
Curative	26	24	27
<b>Formulation Properties</b>			
Viscosity, cP @ 77°F	6,900	8,000	—
Gel Time; min @ 77°F	185	>600	>600
Gel Time; min @ 140°F	80	>500	170
<b>Recommended Cure Schedule</b>			
Initial; hr/°F	2/176	2/212	2/176
Final; hr/°F	3/302	4/347	3/302
<b>Initial Performance Data</b>			
Tg, °F	311	323	315

\* DGEBA, EEW=190

FIGURE 1: DSC REACTIVITY PROFILE FOR AROMATIC AMINE/DGEBA FORMULATIONS

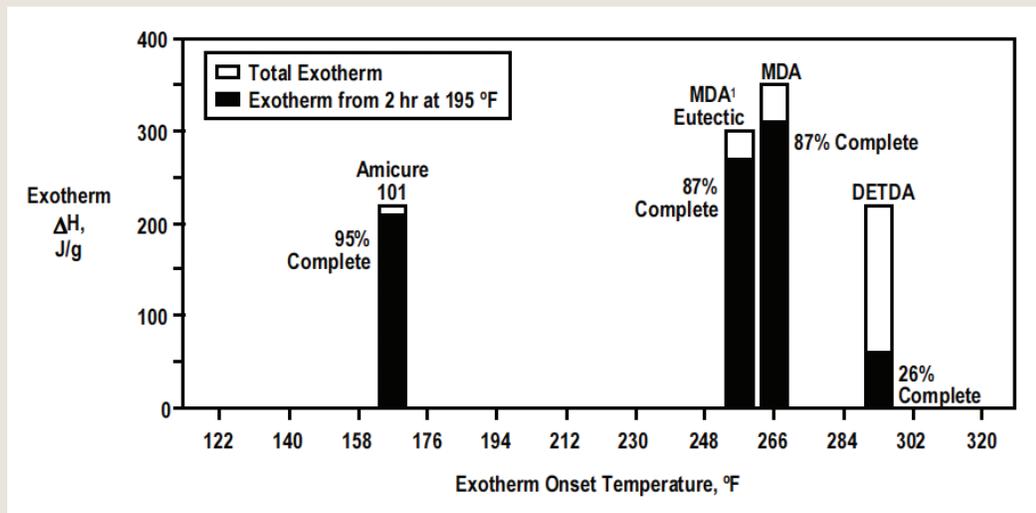


(1) Ancamine Z Curing Agent

**Development of Cure:** Like other aromatic amines, Amicure 101 curing agent requires a staged cure to achieve full properties. Unlike other aromatics, development of cure is much faster with Amicure 101 curing agent. Following an initial cure cycle of two hours at 195°F, competitive formulations were allowed to cool and were then examined by DSC. Scans were run from 82°F to 536°F at a ramp rate of 18°F/minute.

Figure 2 shows the percent of total exotherm completed during the initial two-hour cure at 195°F. When a higher percent of the total exotherm is completed during the initial stage of cure, higher temperature post-cures will yield more moderate exotherms. The data shows that epoxy resins cured with Amicure 101 curing agent will provide very moderate exotherms through the post-cure cycle. This allows for development of high-temperature properties without concern for damage to sensitive encapsulated parts, excessive shrinkage or development of high internal stresses.

**FIGURE 2: DEVELOPMENT OF CURE FOR AROMATIC AMINE/DGEBA FORMULATIONS**



(1) Ancamine Z Curing Agent

**Post-Cure Performance Data:** Table 3 illustrates that Amicure 101 curing agent can be post-cured to yield high glass transition temperatures. An extended second stage cure at 300°F can yield improved high-temperature performance properties.

Glass transition temperatures were measured using a DSC.

**TABLE 3: TG, °F BY DSC AROMATIC/AMINE/DGEBA**

Curing Agent	Cure Schedule: 2 hr @ 195°F		
	+ 1 hr @ 300°F	+ 1 hr @ 300°F	+ 1 hr @ 300°F
Amicure 101*	153	154	160
MDA Eutectic	156	156	15
MDA	168	168	169
DETDA	145	150	154

Epoxy Curing Agents and Modifiers

# AMICURE<sup>®</sup> 101 Curing Agent

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