

**ANCAMINE® 2049** Curing Agent**DESCRIPTION**

Ancamine 2049 curing agent is an unmodified cycloaliphatic amine used to cure epoxy resins at elevated temperatures. It has been designed for use for large composite structural parts where longer pot life is required.

**ADVANTAGES**

- Low viscosity
- Long pot life at moderate temperatures
- Excellent mechanical properties following elevated temperature cure
- Good resistance against acids, alkalis, water, and hydrocarbon solvents when heat cured

**APPLICATIONS**

- Structural Composites
  - Larger Pipes & Composite Fittings
  - Wind Blades
  - Tanks
- Casting and Tooling

**RECOMMENDED PROCESSING**

- Resin Infusion
- Filament Winding
- Wet lay-up Laminates
- Resin Transfer Molding
- Prepreg

**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 Ancamine 2049 curing agent.

**TYPICAL CURE SCHEDULE**

- 1 hour at 80°C (176°F), then 2 hours at 150°C (302°F)
- 2 hours at 80°C (176°F), then 3 hours at 150°C (302°F)

**TYPICAL PROPERTIES**

Appearance	Clear Liquid
Color (Gardner)	1
Viscosity @ 77°F (25°C)	120 cP
Specific Gravity @ 77°F (25°C)	0.947
Amine Value	484
Flash Point (closed cup)	285°C / 545°F
Equivalent Wt/{H}	60
Use Level (1) (PHR)	32.0

**TYPICAL HANDLING PROPERTIES\***

Mixed Viscosity @ 77°F (25°C)	1,900 cP
Gel Time (150g mix @ 77°F / 25°C)	421 min
Time to 10,000cPS @ 104°F / 40°C	174 min

**THERMAL PERFORMANCE\***

Glass Transition Temperature (DSC second scan)	169°C / 336°F
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**MECHANICAL PERFORMANCE - CAST PANEL\***

Flexural Strength (psi)	127 MPa	1.85 ksi
Flexural Modulus (thousand psi)	2.7 GPa	0.4 Msi
Tensile Strength (psi)	77 MPa	11.2 ksi
Tensile Modulus (thousand psi)	2.6 GPa	0.37 Msi
Tensile Elongation @ Break	3.8%	
Compressive Strength	216 MPa	31 ksi
Compressive Modulus	2.1 GPa	0.3 Msi
Fracture Toughness $K_{1c}$	0.62 MPa*m <sup>1/2</sup>	564 psi*in <sup>1/2</sup>
Fracture Toughness $G_{1c}$	121 J/m <sup>2</sup>	0.68 in-lb/in <sup>2</sup>
Izod Impact Strength	43.0 J/m	0.8 ft-lb/in

**MECHANICAL PERFORMANCE - COMPOSITE PANEL\***

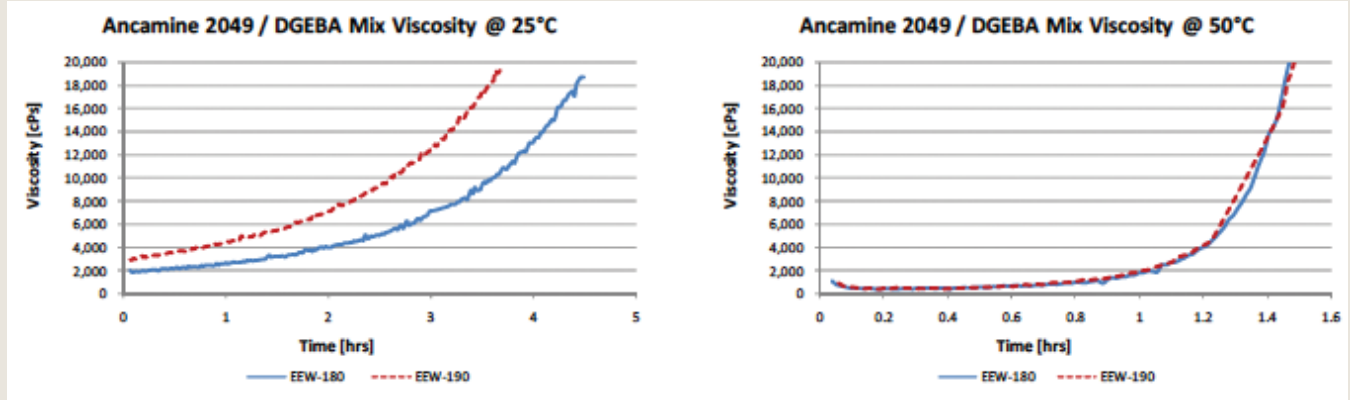
ILSS 0° Longitude	73.00 MPa	10.6 ksi
ILSS 90° Transverse	23.00 MPa	3.3 ksi
Flexural Strength - Composite 0° Longitude	1043 MPa	151 ksi
Flexural Modulus - Composite 0° Longitude	39.0 GPa	5.7 Msi

\* Ancamine 2049 curing agent formulated with standard Bisphenol-A based (DGEBA, EEW=180) epoxy resin

## VISCOSITY PROFILE

Ancamine 2049 curatives provide the longest pot life of any commercial cycloaliphatic amine. This inherent feature is due to the methyl group sterically hindering the reaction between the epoxy and amine, which makes it suitable for the fabrication of very larger composite structural parts. Figure 1 shows the viscosity build of the Ancamine 2049 curative with both EEW=180 and EEW=190 DGEBA resin at two different processing temperatures (25°C and 50°C).

**FIGURE 1: ANCAMINE 2049 / DGEBA MIX VISCOSITY @ 77°F (25°C) AND 122°F (50°C)**



## MECHANICAL PROPERTIES

In addition to the cure cycle and processing conditions used, the selection of an epoxy curing agent is a critical factor in determining the structural integrity of a composite part. Evonik offers a wide selection of amine based curing agents which can be used to maximize load-bearing capabilities, fatigue resistance, and fracture toughness in a fully formulated system. Mechanical properties of epoxy cured with Ancamine 2049 curative in the presence of E-glass fiber are shown in the following table.

### Composite Panel Fabrication

Method: Vacuum Assisted Resin Transfer Molding (VARTM)

Fiber Type: E-glass (275g/m<sup>2</sup>) unidirectional

Fiber Volume: 60 ± 3%

Cure Schedule: 1 hr @ 80°C, then 3 hrs @ 150°C

### Mechanical Performance - Composite Panel

	SI	English
Flexural Strength 0° Longitude (ASTM D790)	1043 MPa	151.3 ksi
Flexural Modulus 0° Longitude (ASTM D790)	39.0 GPa	5.7 Msi
Flexural Ultimate Strain % (ASTM D790)	2.6%	
ILSS 0° Longitude (ASTM D2344)	73.00 MPa	10.6 ksi
ILSS 90° Transverse (ASTM D2344)	23.00 MPa	3.34 ksi

**ANCAMINE® 2049** Curing Agent**CHEMICAL RESISTANCE**

DGEBA epoxy resin cured with Ancamine 2049 curative exhibits excellent chemical resistance in various reagents when cured at higher temperatures. Chemical resistance can be further improved by using a blend of Bis-F or multifunctional resin with DGEBA resin.

**Chemical Resistance Test**

Formulation: DGEBA Epoxy Resin Mix (EEW-180)

Cure Schedule: 2 hrs @ 80°C, then 3 hrs @ 150°C

Specimen: 1" X 3" X 1/8" bar

Test: % Weight gain after 120 days immersion @73°F / 24°C

**Reagent****% Weight Gain**

Reagent	% Weight Gain
Water (Distilled)	1.65%
Toluene	0.33%
Acetone	16.51%
Ethanol	1.47%
Methanol	9.86%
HNO <sub>3</sub> (10%)	5.72%
Acetic Acid (25%)	12.95%
NH <sub>4</sub> OH (10%)	1.59%

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