



# connora

## Recyclamine® R101 Curing Agent

**RECYCLABLE EPOXY CURING AGENT FOR  
COMPOSITES MANUFACTURING**

### Applications

Recyclamine® curing agents enable recyclable thermosetting epoxy. Recyclamine® R101 is a low viscosity hardener for general infusion, compression molding, lamination, and RTM/ HP-RTM Processing of epoxy based composites.

### WHY CHOOSE Recyclamine®

#### Zero-Landfill Manufacturing:

- Composite manufacturing waste can be recycled, and re-integrated back into the composites supply chain. Reduce landfill costs, and decrease lost margin from waste.

#### Create Downstream Value:

- Connora Recycling uses a low energy, solution-based process that allows both the resin and fiber reinforcements to be reclaimed in a high quality, virgin-like state, preserving performance and value.

#### Cradle-To-Cradle Solution:

- Composite products made with Recyclamine® are fully recyclable through Connora Technologies.

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## Physical Properties

### Recyclamine® R101 (Infusion, RTM, Comp Molding Processes with Heat Assisted Post Curing)

AEW	40.5
Viscosity (Brookfield, 25 °C)	5-15 cP
<b>Formulation with EPON 828 Epoxy Resin (EEW 188)</b>	
PPH amine / 100 part resin	22
Mixed Viscosity (5 min; Brookfield, 25 °C)	736 cP
Pot life (100 g mass, 25 °C)	57 min
Peak exotherm temperature (100 g mass, 25 °C)	177 °C
<b>Gel time (hot plate method)</b>	
100 °C	2-2.5 min
120 °C	1-1.5 min
<b>*Mechanical Properties – 24hr @ 22°C, then 3 hr 100 C</b>	
Tg., °C	95-100
Tensile Strength, psi (MPa)	10,190 (70.3)
Tensile Modulus, psi (GPa)	497,240 (3.4)
% Elongation at break	5.9
Flexural Strength, psi (MPa)	15,230 (105)
Flexural Modulus, psi (GPa)	4.4 X 10 <sup>5</sup> (3.0)

*\* Mechanicals obtained according to ASTM Standards; Tg determined by DSC.*

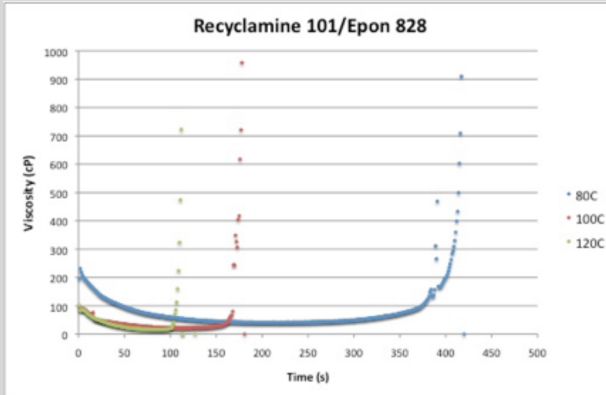
### Recommended Cure Cycles (Infusion, RTM, Comp Molding Processes with Heat Assisted Post Curing)

The suggested curing temperature range for Recyclamine® R101 is between 20-120 °C.

### Viscosity Development Profile at Elevated Temperature

Viscosity profiles were generated using a Brookfield viscometer equipped with a temperature controlled small sample chamber. Profiles were recorded by injecting 10 ml of previously mixed resin/hardener into the small temperature controlled chamber preheated to the target temperature.

*All technical information is provided in good faith and is based on Connora Technologies, Inc. best knowledge. Connora Technologies, Inc. does not guarantee any of this data nor the misuse of its products or the consequences because of conditions that are beyond its control.*



**HP-RTM APPLICATIONS:  
ReCYCLAMINE® R101 AS HP-RTM Curing Agent  
(WITH STANDARD LIQUID EPOXY RESINS)**

**Product Overview**

RECYCLAMINE® R101 Curing Agent is applicable as a low-viscosity, recyclable amine curing agent for use with any standard liquid epoxy resin in high pressure resin transfer molding processes (HP-RTM). Resulting formulations will have excellent wetting and adhesion to glass and carbon fiber. Benefits include low viscosity during infusion (2min <100 cp @ 100 °C), short cure cycles, and fast demolding (e.g. 2 min @ 140 °C).

This Recyclable Epoxy System is suitable for use in high volume production of structural and non-structural composite parts, including automotive applications.

**Recommended HP-RTM Mold Temperature/Demold Time\***

Mold Temperature	Demold Time
140 °C	2.5 min
125 °C	5 min
100 °C	12 min

\* Resin temperature = 60 °C; Curing agent temperature = 30 °C;  
Injection time = 20 sec

**Key Neat Resin Properties in an HP-RTM Tool**

- Liquid Handling & Injection: KraussMaffei Rimstar 8/4/8 HPRTM
- Press: Dieffenbacher CompressPlus 2500 ton servo-hydraulic press

**Recyclamine® R3101 Curing Agent with standard DGEBA Epoxy Resin (ie, Connora E1903 or Epon 828)**

<b>Mix Ratio</b> (parts by weight)		
Epon 828 Liquid Epoxy Resin		100
Recyclamine R3101		21.5
<b>Mixed Viscosity</b>		
2 min @ 100 °C		<100 cp
<b>Gel time @ 140 °C Mold Temperature @ 2.2 mm thickness</b>		
Resin/Curing Agent Temp = 60°C / 30 °C		35 sec
Resin/Curing Agent Temp = 80°C / 40 °C		26 sec
<b>Mechanical Properties – U.D. 2.2 mm*, Carbon Fiber Laminate</b>		
Demold Time**		2.5 min
Carbon Fiber Volume Content		46.6%
Demold Tg	DSC	88 °C
90° Tensile Strength, psi (MPa)	DIN EN 2561	61.1 MPa
90° Tensile Modulus, psi (GPa)	DIN EN 2561	8.1 GPa
0° Tensile Strength, psi (MPa)	DIN EN 2597	1493.4 Mpa
0° Tensile Modulus, psi (GPa)	DIN EN 2597	117.8 GPa
0° Compression Strength	DIN EN 14126	786.5 MPa
0° Compression Modulus	DIN EN 14126	101.8 GPa
0° Flexural Strength	DIN EN ISO 14125	1115.4 MPa
0° Flexural Modulus	DIN EN ISO 14125	102.0 GPa
90° Flexural Strength	DIN EN ISO 14125	94.8 MPa
90° Flexural Modulus	DIN EN ISO 14125	8.8 GPa

\*300 GSM SGL Fabric \*\*Mold Temp = 140 °C, Resin temperature = 60 °C; Curing agent temperature = 30 °C;  
Injection time = 20 sec

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## **Safety and Handling**

Recyclamine® hardeners are amine derived curing agents, as such they to be treated as a corrosive and an inhalation hazard. All persons who use, store, or transport these materials should properly understand the handling precautions and recommendations as stated in the MSDS.

Shelf life should be no less than 12 months when stored in closed containers, in a dry place, out of direct sunlight, and at temperatures between 15-35°C. The appearance on a white solid around the container opening is not unusual. Containers with Recyclamine® should be left tightly closed when not in use to minimize the white solids formation, especially on the edges of the container.

## **Industrial Recycling**

Recycling is performed using a low energy, solution-based process. Process can be performed by end user in specialized equipment. Outputs of the recycling process are: an epoxy thermoplastic and all constituent components in a near virgin state including reinforcements.

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