

# ANCAMINE<sup>®</sup> 2802

## Curing Agent

### DESCRIPTION

Ancamine 2802 curing agent is a modified polyamine intended for use as a curing agent for diluted liquid epoxy resin at ambient temperature application.

Systems based on Ancamine 2802 curing agent deliver excellent colour stability and high aesthetics which makes the product ideal for low yellowing epoxy coating and flooring applications. In addition, Ancamine 2802 curing agent was developed for use in emission compliant coatings and floorings.

### TYPICAL PROPERTIES

| Property                | Value               | Unit     | Method                                       |
|-------------------------|---------------------|----------|--|
| Appearance              | Light yellow liquid |          |  |
| Colour                  | ≤ 3                 | Gardner  | ASTM D 1544                                  |
| Viscosity @ 25°C        | 450-650             | mPa.s    | Brookfield RVTD, Spindle 4                   |
| Amine Value             | 410-475             | mg KOH/g | Perchloric Acid Titration                    |
| Specific Gravity @ 21°C | 1.02                |          |  |
| Equivalent              | 87                  | Wt/{H}   |  |
| Recommended use Level   | 45-50               | PHR      | With bisphenol-A based Epoxy resin (EEW 190) |

### ADVANTAGES

- Excellent yellowing resistance and UV durability
- High mechanical resistance
- Excellent flow

### APPLICATIONS

- Industrial floorings
- Decorative floorings
- Low emission coatings and coloured flooring systems

## 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.

## HANDLING PRECAUTIONS

Refer to the Safety Data Sheet for Ancamine 2802 curing agent.

## TYPICAL HANDLING PROPERTIES\* 23°C, 50% RH

| Property                         | Value     | Unit  | Method                                    |
|----------------------------------|-----------|-------|---|
| Mix Viscosity                    | 3000-3500 | mPa.s | Brookfield RVTD, spindle 4                |
| Gel Time                         | 35-40     | min   | Techne GT-3 Gelation Timer, 150 g mix     |
| Thin Film Set Time               | 5.0       | h     | ASTM D 5895 - BK Drying Recorder, Phase 3 |
| Persoz Hardness after 1 / 7 days | 308/359   | s     |   |
| Typical cure schedule            | 2-7       | days  |   |

## SUPPLEMENTARY DATA

### Ancamine 2802 Curing Agent Characteristics

Ancamine 2802 curing agent was specifically developed for industrial floor applications, providing a unique combination of excellent UV stability and the possibility to formulate low emission coating systems.

The supplementary data outlines several product features of Ancamine 2802 curing agent. As a point of reference, the performance of Ancamine 2802 curing agent is benchmarked against incumbent cycloaliphatic amine curing agent, "Cyclo-B". Cyclo-B is an industrial standard cycloaliphatic curing agent with HEW115 for ambient temperature conditions. Table 1 summarizes the basic properties of the curing agents evaluated in this technical datasheet. Figure 1 shows the results of the UV-exposed panels after 250 hours. Starting point formulations for flooring applications using Ancamine 2802 curing agent are included at the end of the technical datasheet.

### Handling and Cure Speed Properties

Clear coatings based on Ancamine 2802 curing agent provide good cure speed at ambient temperature condition (18-23°C) and are comparable to Cyclo-B. This is supported by cure speed results using a BK Drying Time Recorder as shown in Table 1. In addition, Ancamine 2802 provides similar carbamation resistance compared to Cyclo-B.

\*With bisphenol-A based Epoxy resin (EEW 190)

TABLE 1 – HANDLING AND CURE SPEED PROPERTIES OF ANCAMINE 2802 CURING AGENT

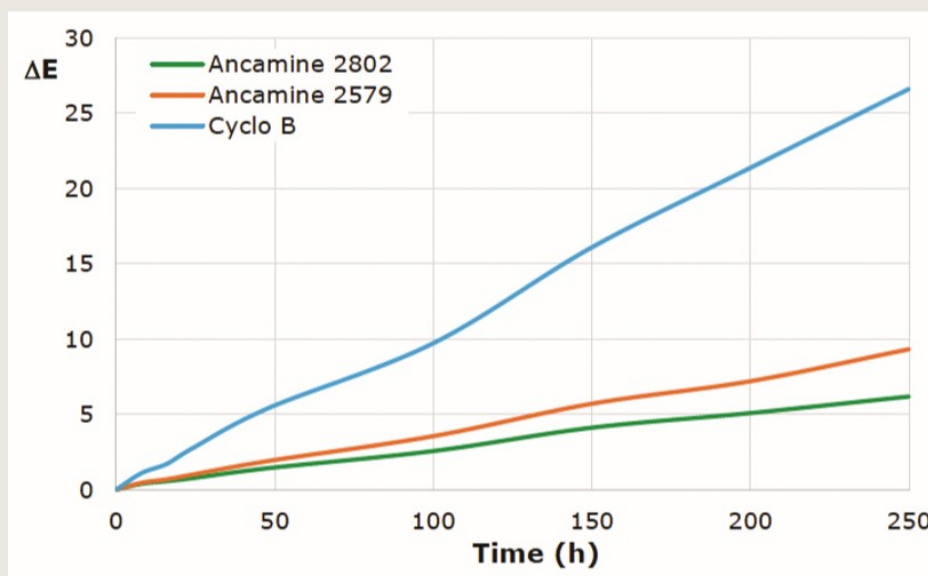
|                                    |         | Ancamine 2802 Curing Agent* | Cyclo-B Curing Agent* |
|------------------------------------|---------|-----------------------------|-----------------------|
| AHEW/[H]                           |         | 87                          | 115                   |
| PHR                                |         | 47                          | 60                    |
| <b>Ambient (23°C – 50% RH)</b>     |         |                             |                       |
| Gelation time, 150g mix            | minutes | 59                          | 80                    |
| Mix Viscosity                      | mPa.s   | 690                         | 550                   |
| TFST                               | Phase 3 | h                           | 10.0                  |
| Carbamation                        | Day 1   | 1-5, 5=best                 | 5                     |
| <b>Sub Ambient (18°C – 50% RH)</b> |         |                             |                       |
| TFST                               | Phase 3 | h                           | 17.5                  |
| Carbamation                        | Day 2   | 1-5, 5=best                 | 5                     |

\*With Bisphenol A/F diglycidyl ether blend, Epodil® 748 reactive diluent diluted, EEW195, n 900 mPa.s

### UV Durability

Coatings based on Ancamine 2802 curing agent provide excellent UV stability over time compared to incumbent cycloaliphatic amine curing agents. This is demonstrated in Figure 1 where the colour change ( $\Delta E$ ) was measured as a function of exposure time following ASTM G154 and D4587. The coatings were exposed to UVA-351nm light at 45 °C with an irradiance of 0.89 W/m<sup>2</sup>/nm to mimic sunlight filtered through window glass. The white self leveling floors were applied onto stainless steel panels by casting a 3 mm thick coating and left to cure for 14 days prior to testing.

FIGURE 1 – COLOUR CHANGE OVER TIME OF COATINGS BASED ON ANCAMINE 2802 CURING AGENT



### Accelerated emission testing

For the evaluation of emission components, the concept of “lowest concentration of interest (LCI)” LCI is defined as a critical parameter for assessing healthy indoor air quality for inhabitants and users during long-term continuous use. LCI values have been determined for many chemical substances and based on these values, the German AgBB committee has introduced an interpretation scheme. In accordance with EN-ISO 16,000 the following definitions are used:

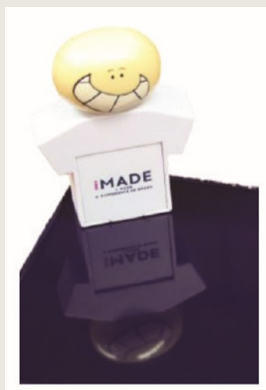
- VOC: Volatile Organic Component ranging between C<sub>6</sub>-C<sub>16</sub>
- TVOC: Total VOC, accumulated VOC of products  $\geq 5 \mu\text{g}/\text{m}^3$  ranging between C<sub>6</sub>-C<sub>16</sub>
- SVOC: Slow-Volatile Organic Component  $> \text{C}_{16}\text{-C}_{22}$
- $\Sigma\text{SVOC}$ : Total SVOC, accumulated SVOC of products  $\geq 5 \mu\text{g}/\text{m}^3$  with  $> \text{C}_{16}\text{-C}_{22}$

Ancamine 2802 curing agent has been designed to allow low VOC coating and flooring formulations with low emissions during service life. Starting point formulation 2 based on Ancamine 2802 delivers low VOC and is expected to result in low emissions following AgBB testing protocol. Floorings based on Ancamine 2802 curing agent have potential for use in the electronics industry or areas where low air contamination is of importance such as schools, hospitals and nursing homes.

### Coloured floorings

Ancamine 2802 curing agent has excellent compatibility with pigment paste IJmocolor EP (De IJssel Coatings). The pigment paste combination of choice can be easily incorporated into a Ancamine 2802 curing agent based self leveling floor formulation. This allows for a wide colour palette making systems based on Ancamine 2802 curing agent very versatile for use in highly decorative solution for concrete protection.

FIGURE 2 –ANCAMINE 2802 CURING AGENT BASED SELF LEVELING FLOOR



### Flow of Self Leveling Floor Formulations

Starting point formulation 2 based on Ancamine 2802 curing agent provides excellent flow. Determination of flow was done by casting 20 g of the mixed formulation onto a substrate pretreated by application of a primer. After curing of the self leveling floor formulation the diameter of the obtained circle was measured. For comparison, a typical cycloaliphatic self leveling floor has a flow of 10 cm where starting point formulation 2 has a flow of 12 cm.

### Mechanical properties

Mechanical strength properties of epoxy castings were determined using a floor mounted dual column materials testing machine (Instron 3382) equipped with 100 kN load cell and and LVDT deflection sensor in compressive mode. Tests were conducted according to ASTM D695 at 2.5 mm/ min cross-head speed. Epoxy castings (25x25x25 mm) were prepared at 23°C and left to cure for 7 days prior to testing. High compressive strength is paramount for epoxy systems used in industrial floorings in order to protect the concrete structure and avoid structural damages. Epoxy castings based on Ancamine 2802 curing agent and diluted epoxy resins provide high compressive strength as shown in Table 2. Compared to conventional cycloaliphatic technology, Ancamine 2802 curing agent provides >40% higher compressive strength and 25-30% higher modulus. Formulations based on Ancamine 2802 curing agent introduce floorings with increased resilience and mechanical resistance.

FIGURE 3 – AVERAGE COMPRESSIVE STRENGTH (ASTM D695) OF ANCAMINE 2802 CURING AGENT

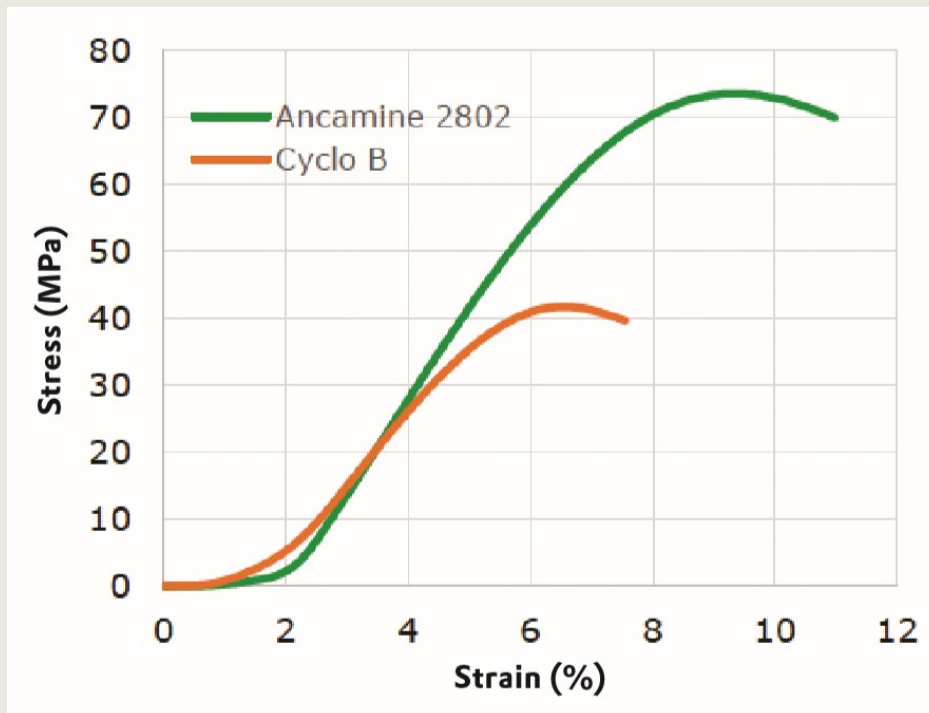


TABLE 2 – COMPRESSIVE STRENGTH (ASTM D695) OF ANCAMINE 2802 CURING AGENT

|                      | Ancamine 2802 Curing Agent* |             | Cyclo-B Curing Agent* |
|----------------------|-----------------------------|-------------|-----------------------|
| Compressive strength | MPa                         | 73 (1)      | 41 (3)                |
| Compressive strain   | %                           | 7.0         | 4.6                   |
| Young's Modulus      | GPa                         | 1.47 (0.10) | 1.18 (0.06)           |

\*With Bisphenol A/F diglycidyl ether blend, Epodil® 748 reactive diluent diluted, EEW195, n 900 mPa.s

### Formulation Guidelines

The following recommendations are offered to streamline further technical work with Ancamine 2802 curing agent.

TABLE 5: FORMULATION GUIDELINES AND TROUBLE SHOOTING

#### Stoichiometry

Ensure the appropriate stoichiometry of Epoxy resin is used with Ancamine 2802 curing agent

Recommendation is to start with a stoichiometry of 1:1 (Epoxy to amine) and adjust based on application trials

#### Choice of reactive diluent

Use of reactive diluents can improve handling properties of the epoxy resin. Recommended reactive diluents include Epodil 748 (C12-C14 alcohol glycidyl ether); Epodil 749 (diglycidyl ether of neopentyl glycol); Epodil 750 (1,4-butanediol diglycidyl ether)

Commercial diluted epoxy resin grades such as Ancarez RZ4308 are also compatible with Ancamine 2802

Improved hardness build and resistance to carbamation and waterspotting have been obtained when using difunctional glycidyl ether diluents

Improved hardness build and mechanical strength have been obtained when using polyfunctional glycidyl ether diluents

The following additives for substrate wetting and leveling are compatible with Ancamine 2802 curing agent based coatings and castings: Dynol™ 980 surface active agent and Tego® Flow 425

The following additive for deaeration is compatible with Ancamine 2802 curing agent based coatings and castings: Tego® Airex 990

## TRADEMARK REFERENCE

|  |   |
|--|---|
| Evonik                                 | Ancamine® Curing Agent<br>Ancarez™ Epoxy Resin<br>Dynol™ Surfactant<br>Epodil® Reactive Diluent®<br>Tego® |
| De IJssel Coatings BV                  | IJmocolor EP  |
| Deutsche Baryt Industrie GmbH & Co. KG | Barytmehl   |
| SCR Sibelco NV                         | Millisil®   |

## TECHNICAL DATA

|                 |                   |                             |
|-----------------|-------------------|-----------------------------|
| Mixed Viscosity | 500 – 1,000 mPa.s | Brookfield RVTD, spindle 4  |
| Working Time    | 33 minutes        | ISO 9514 – Time to 40°C     |
| Walk on time    | 24 hours          | ASTM D 1640 – Dry To Handle |
| Gloss (<20°)    | 97 GU             |                             |

## STARTING POINT FORMULATIONS

### CLEAR TOPCOAT FOR INDUSTRIAL FLOORING

#### Starting Point Formulation 1

| Part A                         | Parts by Weight |
|--------------------------------|-----------------|
| 1 Ancamine® 2802 Curing Agent  | 47.0            |
| Part B                         |                 |
| 2 Ancarez™ RZ4021 Epoxy Resin  | 85.0            |
| 3 Epodil® 748 Reactive Diluent | 15.0            |
| 4 Tego® Flow 425               | 0.2             |
| 5 Tego® Airex 990              | 0.2             |
| <b>Total Parts</b>             | <b>147.4</b>    |

**Manufacturing Procedure Part B:** Charge components 2, 3, 4 and 5 and stir homogeneous at low shear.

**Application Instructions:** Mix Part A and B at slow speed for 2-3 minutes. Once thoroughly mixed, pour onto substrate and spread by squeegee or roller.

## WHITE, GLOSSY SELF LEVELING FLOOR

Starting Point Formulation 2

| Part A                        | Parts by Weight |
|-------------------------------|-----------------|
| 1 Ancamine® 2802 Curing Agent | 13.0            |
| Part B                        |                 |
| 2 Ancarez™ RZ4305 Epoxy Resin | 26.5            |
| 3 IJmicolor EP100             | 5.0             |
| 4 Dynol™ 980                  | 0.2             |
| 5 Tego® Airex 990             | 0.3             |
| 6 Barytmehl F                 | 25.0            |
| Part C                        |                 |
| 7 Millisil M6                 | 30.0            |
| <b>Total Parts</b>            | <b>100.0</b>    |

**Manufacturing Procedure Part B:** Charge components 2, 3, 4 and 5 and stir homogeneous at low shear. Increase speed to 1000 rpm and add component 6 gradually. Mix until homogeneous.

**Application Instructions:** Mix Part A and B at slow speed until homogeneous. Increase speed to 1000 rpm and gradually add Part C. Once thoroughly mixed, pour onto substrate and spread by trowel. Deaeration can be facilitated by using a spike roller.



## HANDLING PROPERTIES

|                      |             |                              |
|----------------------|-------------|------------------------------|
| Mixed Viscosity      | 3,000 mPa.s | Brookfield DV-I, spindle T-C |
| Working Time         | 33 minutes  | ISO 9514 – Time to 40°C      |
| Pigment Volume Conc. | 31.56%      |                              |
| Density mixture      | 1.76 g/ml   |                              |

FIGURE 4 – ANCAMINE 2802 BASED SELF LEVELING FLOORS



## TECHNICAL DATA

### Ambient (23°C – 50% RH)

|                                |             |  |
|--------------------------------|-------------|--|
| Walk on time                   | 16-24 hours | ASTM D 1640 – Dry To Handle                      |
| Gloss (<20°)                   | 85 GU       |  |
| Carbamation (day 1)            | 5           | ISO 2812 (wet patch method), Scale 1-5, 5 = best |
| Shore hardness (day 1 / day 7) | 76 D / 87 D | ASTM D 2240                                      |

### Sub Ambient (18°C – 50% RH)

|                                |             |  |
|--------------------------------|-------------|--|
| Walk on time                   | 16-24 hours | ASTM D 1640 – Dry To Handle                      |
| Gloss (<20°)                   | 71 GU       |  |
| Carbamation (day 1)            | 4           | ISO 2812 (wet patch method), Scale 1-5, 5 = best |
| Shore hardness (day 1 / day 7) | 70 D / 86 D | ASTM D 2240                                      |

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