

Amicure® IC-221 Curing Agent for Polyisocyanate Resin**DESCRIPTION**

Amicure IC-221 is an amine curing agent specifically designed for polyisocyanate resins. Preferred resins of choice are standard and low viscosity HDI trimer isocyanates for a range of industrial applications. Amicure IC-221 curing agent is designed to provide fast return to service and low temperature cure. Clear and pigmented topcoats based on Amicure IC-221 curing agent support high aesthetics, UV stability and rapid property development for fast return to service. The product is free of solvents, alkyl phenol derivatives and benzyl alcohol.

Coatings and floorings based on Amicure IC-221 curing agent are recommended to be used in combination with an epoxy primer, especially under damp conditions. Working and drying times are accelerated under high humidity conditions.

ADVANTAGES

- Extremely rapid hardness development
- Low color and excellent UV durability
- Low temperature cure
- Excellent surface appearance
- Low odor

APPLICATIONS

- Pigmented and clear floor coatings
- Emission compliant coatings and floorings

SHELF LIFE

At least 18 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. Recommended storage temperature is 0-40°C.

HANDLING PRECAUTIONS

Refer to the Safety Data Sheet.

TABLE 1: TYPICAL PROPERTIES

Color (APHA)	≤215
Amine Equivalent Weight (AEW)	373-385
Specific Gravity @ 21°C	1.06
Viscosity @ 25°C (cPs)	100-700

TABLE 2: TYPICAL HANDLING PROPERTIES

Isocyanate Resin	HDI Trimer*
Mix Ratio (curing agent to isocyanate by weight)	1.85 to 1
Use Level (phr)	185-195
Mix Viscosity (cPs @ 25°C)	1000-1500
Viscosity build (m) – time to 12000 cPs	22

TABLE 3: DRY FILM TIMES

10mil Thickness	22°C 55% RH	27°C 73% RH
Dry time, set to touch (m)	22	15
Dry time, tack free time (m)	45	27
Dry time, through cure (h)	2.5	2

TABLE 4: TYPICAL FINAL PROPERTIES

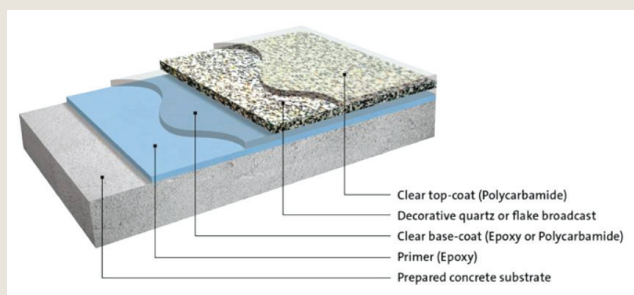
Persoz Hardness	190
UV Resistance (ΔE, QUV-A, 500h)	4.4
Gloss (20°)	89
Gardner Impact Resistance (Direct / Reverse)	>160/>160
Abrasion Resistance (mg loss, 1000 cycles, 1kg, CS17 wheel)	42
Hardness Development (1/8 in, 125 mil thick films, 20°C, 60% RH)	
Shore D — 6 h	46
Shore D — 12 h	72
Shore D — 24 h	75
Shore D — 24 h @ 0°C	50

* HDI Trimer = 21.8 wt% NCO, 2500 cPs @ 25°C

SUPPLEMENTARY DATA

POLYCARBAMIDE RESIN TECHNOLOGY - MODIFIED AMINE CURING AGENTS FOR POLYISOCYANATES:

The new polycarbamide resin technology offers the complete package for top coat application with Amicure IC-221 and Amicure IC-321 curing agents. Amicure curative based clear and pigmented coatings exhibit rapid property development, high UV stability and high aesthetics. Both products are specifically designed to deliver clear and pigmented coatings that can be applied up to 20 mils in a single pass, when cured with standard HDI trimer isocyanates. An epoxy primer is recommended for best performance and longevity of the flooring system.



FAST RETURN TO SERVICE: Amicure IC-221 curing agent can be used with Amicure IC-321 to provide coatings with fast property development and extended working time. At 21°C and 5°C cure conditions, the return to service is demonstrated through the ability of the system to build hardness development. Figures 1 and 2 show the rapid early hardness build of Amicure IC-221 and IC-321 curing agent based systems, even at the low temperature condition. The fast return to service combined with the high performance attributes provide competitive advantages to formulator's product line.

FIGURE 1: SHORE D HARDNESS (1/8" CLEAR CASTING) AT 21°C

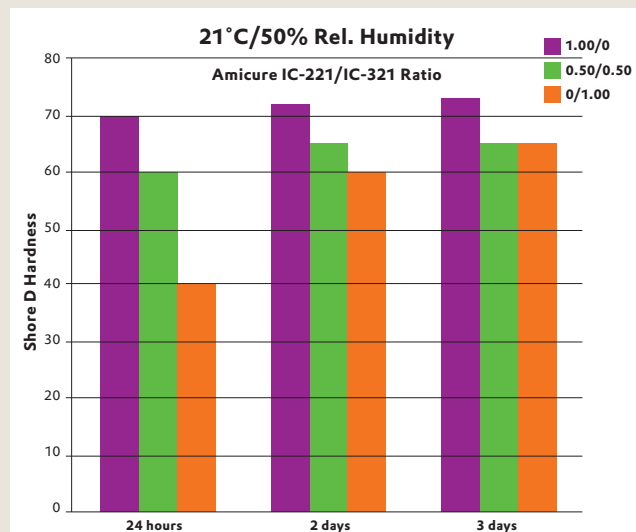
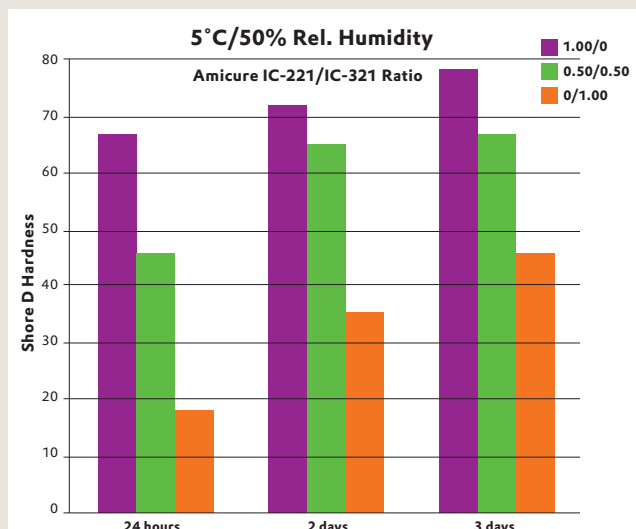


FIGURE 2: SHORE D HARDNESS (1/8" CLEAR CASTING) AT 5°C



BALANCE OF WORKING TIME AND CURE SPEED:

Amicure IC-321 curing agent can be used to extend potlife and open time of coatings based on Amicure IC-221 curing agent. Open time (or 'wet edge') is defined as the time duration after mixing components that the applied coating exhibits good flow and leveling without leaving visible application marks after cure. Amicure IC-321 curing agent based coatings demonstrate long working pot-life and an open time of ca. 18-20 minutes. Figure 3 and 4 show the impact of coating formulations with Amicure IC-221.

The walk-on time is determined by the dry to handle time according to ASTM D 1640. Amicure IC-321 curing agent based coatings offer fast cure speed and a walk-on time of ca. 6 h. Blends with Amicure IC-221 curative results in a further acceleration of walk-on time as shown in figure 5.

FIGURE 3: WALK-ON TIME OF AMICURE IC-221 AND IC-321 CURING AGENT

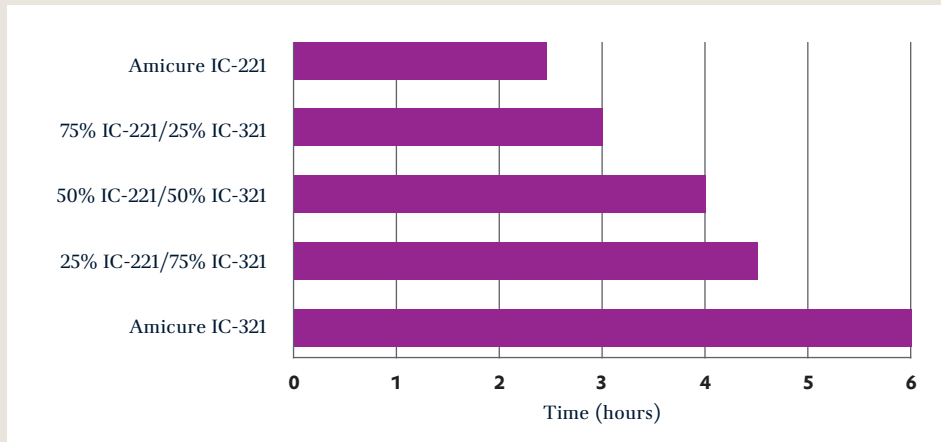


FIGURE 4: OPEN TIME OF AMICURE IC-221 AND IC-321 CURING AGENT

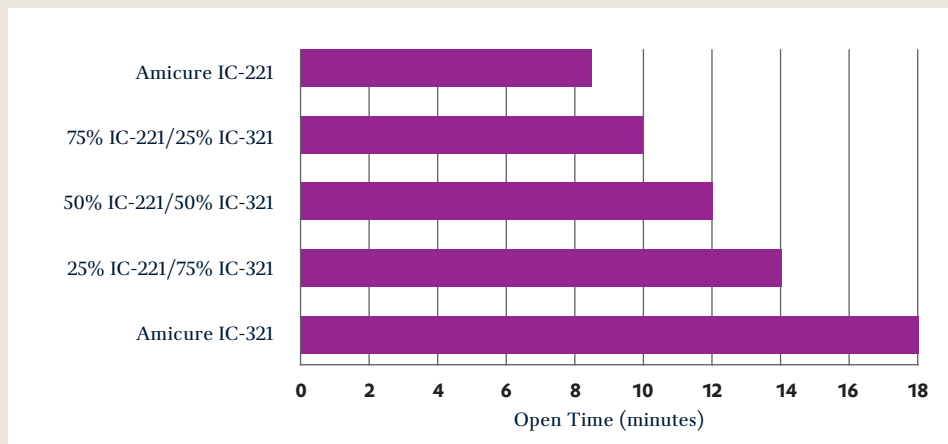
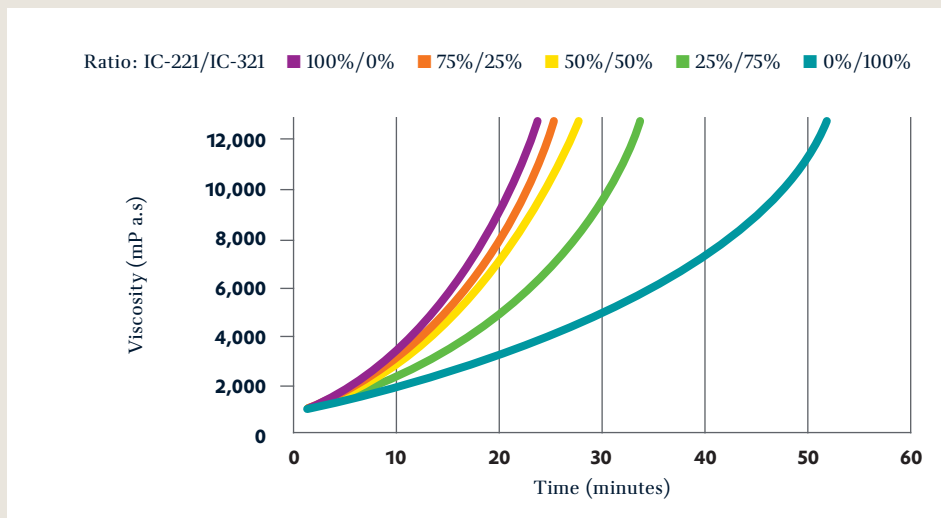


FIGURE 5: VISCOSITY TIME PROFILE OF AMICURE IC-221 AND IC-321 CURING AGENT



CHEMICAL AND SOLVENT RESISTANCE: Amicure IC-221 was evaluated for chemical resistance using spot test method (ASTM D 1308). The test consisted of soaking a white felt paper and placing it directly on the panel and covering with a watch glass. Following 24 hours and 7 days exposure, reagents are removed and the surface area dried with a cloth. Clear coatings of 8-10 mils dry film thickness were applied on standardized steel panel or cementitious fiberboard and cured for 7 days at 23°C and 50% Relative Humidity. Coatings were evaluated on alterations in the surface, such as discoloration, change in gloss, blistering or loss of adhesion. The results are shown in tables 5 and 6.

Amicure IC-221 curing agent based coatings offer good resistance to a wide range of household chemicals such as coffee, cola, ammonia and bleach solution. Coatings also demonstrated good resistance to water and organic acids, such as sulfuric and hydrochloric acid. Amicure IC-221 curing agent based coatings offer limited resistance to xylene and methyl ethyl ketone and are not recommended for areas with prolonged exposure to these solvents.

TABLE 5: RESULTS HOUSEHOLD CHEMICALS (ASTM D 1308, SPOT TEST METHOD)

CHEMICAL	24 Hours	7 Days
Coffee	No Change	No Change
Cola	No Change	No Change
Grape Juice	No Change	No Change
Ketchup	No Change	No Change
Mustard	Transient Yellowing	Transient Yellowing
Citrus Cleaning Solvent	No Change	Slight Blisters
Bleach Solution (5-10%)	No Change	No Change
Ammonia (28%)	No Change	No Change
Motor Oil	No Change	No Change
Unleaded Regular Gasoline	No Change	No Change
Brake Fluid	No Change	Slight Blisters

TABLE 6: RESULTS INDUSTRIAL CHEMICALS AND SOLVENTS (ASTM D 1308, SPOT TEST METHOD)

CHEMICAL	24 Hours	7 Days
Tap Water	No Change	No Change
10% Acetic Acid Solution	No Change	Blisters
85% Lactic Acid Solution	No Change	Down Gloss
100% Ethanol	No Change	No Change
50% Sulfuric Acid Solution	No Change	No Change
38% Hydrochloric Acid Solution	No Change	No Change
50% Sodium Hydroxide Solution	Transient Yellowing	Transient Yellowing
Methyl Ethyl Ketone (MEK)	Delamination	Delamination
Xylene	Delamination	Delamination
Mineral Spirits	No Change	No Change
Skydrol® PE-5	No Change	No Change
Sodium Chloride Solution (10%)	No Change	No Change

FORMULATION GUIDELINES: The following recommendations are offered to streamline further technical work with polycarbamide resin technology. Note that working and drying times of coatings and floorings based on Amicure IC-221 are accelerated under conditions of high humidity.

TABLE 7: FORMULATION GUIDELINES AND TROUBLESHOOTING

STOICHIOMETRY	
Ensure the appropriate stoichiometry of polyisocyanate is used with Amicure IC curing agents	
Recommended is to start with a stoichiometry of 1.05:1 (isocyanate to amine) and adjust based on application trials	
EWNCO = 4200/(%NCO)	
$EW = (pbwA+pbwB)/(pbwA.EWA+pbwB.EWB)$	
Parts Amine (per 100 NCO) = $(100/1.05)*(EWAmine/EWNCO)$	
Parts by weight (pbw); % isocyanate (NCOi); equivalent weight per active hydrogen (EW/{H}) or per isocyanate (EWNCO)	
COATING HAZINESS RELATED BINDER COMPONENTS	
Use the recommended standard HDI trimer polyisocyanate resin (eg Vestanat HT 2500/100, Desmodur N3300, Tolonate HDT)	
Alternatively, lower viscosity HDI trimers may be used (eg Vestanat HT2500 LV, Desmodur N3600, Desmodur N3900, Tolonate HDT-LV) as well as solvent-based HDI trimers (eg Vestanat HT2500E, Desmodur N3390)	
Addition of other components such as polyols, diluents, modifiers and/or other amines could cause incompatibility or effect working time	
THE FOLLOWING ADDITIVES FOR WETTING, LEVELING AND DEFOAMING ARE COMPATIBLE WITH TOLONATE/AMICURE BASED COATINGS AND CASTINGS	
Tego® Airex 931 (Evonik Industries)	Byk 065, 066N (Byk Chemie)
Tego® Wet 250 and 500 (Evonik Industries)	100F Additive (Dow Corning)
Borchi® Gol 0011 (OMG Borchers)	
USE OF SOLVENTS	
Solvents are optional and can be added to Amicure IC-221 and Amicure IC-321 curing agent based formulations to reduce viscosity and increase pot life. Recommended solvents include hydrocarbon and ester-based materials such as: t-butyl acetate; para-chlorobenzotrifluoride; dimethyl carbonate; hydrocarbon solvent (Aromatic 100); or xylene.	
When using solvent(s), care should be taken to review solvent entrapment during cure. Minimize solvent entrapment by applying thin film coating (<10 mils)	

TRADEMARK REFERENCE

Evonik Degussa GmbH	Amicure® Vestanat® Tego®
Covestro	Desmodur®
Byk Chemie GmbH	Byk®
Chemours	Ti-pure®
OMG Borchers	Borchi®
Vencorex	Tolonate™

TECHNICAL DATA

Mixed Viscosity	800-1,200 cPs
Walk-on time	2-3 hours
Working Time	10-20 minutes
Gloss (20°)	80-85 GU

STARTING POINT FORMULATIONS:

**CLEAR TOPCOAT FOR INDUSTRIAL FLOORING
STARTING POINT FORMULATION**

PART A	Parts by Weight
1 HDI Trimer Isocyanate (22 wt% NCO)	100
PART B	
2 Amicure IC-321 curing agent	187
Air release agent*	2
TOTAL PARTS	289

*The use of an air release agent should be tested for recoatability and film clarity especially in thicker films

MANUFACTURING PROCEDURE PART B

Charge components 2 and 3 and stir homogeneous at low shear.

APPLICATION INSTRUCTIONS

Mix Part A and B under slow speed for 2-3 minutes taking care not to introduce excessive air and moisture. Once thoroughly mixed, pour onto substrate and spread by squeegee or trowel and back roll for proper leveling as required, taking care not to excessively roll.

Epoxy Curing Agents and Modifiers

Amicure® IC-221 Curing Agent for Polyisocyanate Resin

EVONIK CORPORATION

7201 Hamilton Blvd.
Allentown, PA 18195
1 800 345-3148
Outside U.S. and Canada 1 610 481-6799

For Technical Information and Support:

Americas: picus@evonik.com

For Samples: Americas: prodinfo@evonik.com

Disclaimer

The information contained herein is offered without charge for use by technically qualified personnel at their discretion and risk. All statements, technical information and recommendations contained herein are based on tests and data which we believe to be reliable, but the accuracy or completeness thereof is not guaranteed and no warranty of any kind is made with respect thereto.

