Product information **AMICURE[®] IC133 AND IC166** Curing Agents

DESCRIPTION

Amicure IC133 and IC166 curing agents are amine-based materials specifically designed to react with trimer isocyanates for high performance coating applications. Coatings using Amicure IC133 and IC166 have very fast dry times, rapid property development, and allow for low VOC formulations. Amicure IC133 and IC166 leverage Evonik's unique polycarbamide chemistry for optimum performance in a Variety of applications. Additionally, these coatings are much more flexible than standard polyaspartic or acrylic urethane coatings and demonstrate good wear properties.

Amicure IC133 and IC166 can be formulated into coatings that provide superior performance in C3 environments such as direct to metal (DTM) formulations, topcoats and clearcoats. Due to their similar equivalent weights, Amicure IC133 and IC166 can be easily combined in any ratio to customize properties such as dry time. Amicure IC133 provides is a slower curing product than Amicure IC166.

TYPICAL PROPERTIES

Property	Amicure IC133	Amicure IC166	Unit
Equivalent weight	256	267	
Solids Content	100	100	weight %
Viscosity @ 25°C, Spindle #21 cPs	1700	1500	
Specific Gravity @ 25°C	1.11	1.29	g/ml
APHA Color	<100	<100	
Recommended use Level*	126	132	phr

* With HDI Trimer, 21.8 wt% NCO, 2,500 mPa.s at 25°C. Based on a stoichiometry of 1.05:1 (isocyanate to amine)

ADVANTAGES

- Ultra-fast property development
- Low VOC formulations
- Low temperature cure
- · Excellent flexibility, hardness and abrasion resistance
- Good chemical resistance
- Excellent UV durability
- Excellent surface appearance



APPLICATIONS

Amicure IC133 and IC166 are designed for use in C3 environments as defined by ISO 12944 such as: • OEM

- Light industrial
- Structural steel
- External side of storage tanks
- Some marine applications

ISO 12944 is an international standard for protective coatings systems intended to protect steel structures from corrosion. The designations range from C2 to C5M, increasing in terms of atmospheric corrosivity intensity. C3 is a medium atmospheric corrosivity category.

- Direct-to-metal (DTM) coatings
- Pigmented topcoats
- Clearcoats

SHELF LIFE

At least 18 months from date of manufacture in the original sealed container at ambient temperature. Store away from excessive heat and humidity and avoid contact with moisture. Recommended storage temperature is 0-40°C.

STORAGE AND HANDLING

Refer to the Safety Data Sheet for Amicure IC133 and IC166 curing agents.

FORMULATING GUIDELINES

DTM FORMULATIONS

DTM formulations have become increasingly popular for many moderately corrosive environments driven by their ability to reduce system cost and increase productivity. DTM formulations are typically easy to apply and have reduced formulation complexity but still offer anticorrosive properties.

DTM coatings formulated with Amicure IC133 and IC166, compared with standard 2K polyurethane coatings, typically offer these advantages:

- Lower VOC formulations
- Faster dry times
- Improved QUV resistance without UV inhibitors
- No catalyst required

A typical starting formulation is shown below, formulated at a viscosity suitable for conventional and airless spray systems. This formulation can be modified to a suitable viscosity for other application methods. The coatings properties reflect general properties that can be achieved using Amicure IC133 and IC166.



SUPPORTING DATA FOR DTM FORMULATIONS

The below data in Chart 1 was generated using the above formulation (Table 1) and compared to an industry available 2K polyurethane DTM. All coatings were applied to zinc phosphated (Bonderite 952) steel to a dry film thickness of 3 mils. The coatings were dried at 70°F, 50% RH for 7 days prior to testing.



CHART 1: DRY TIMES FOR DTM COATINGS (HOURS)



TABLE 1: DIRECT-TO-METAL (DTM) COATING

Ingredients	Parts by Weight
Part A	
Amicure IC133 or IC166	100
Titanium dioxide (DuPont R960)	94.5
Heucophos ZAPP*	20
Methyl amyl ketone (MAK)	44
Part B	
HDI trimer (HDiT or N3300 ²)	100
(1) Heubach (2) Covestro	
Typical formulation properties using the above starting form	ulation:
NCO	1.05
Pigment volume concentration (PVC)	15.7%
Solids content by weight	86.9%
Solids content by volume	77.6%
VOC (calculated)	180 g/L
Zahn 2 cup viscosity at mixing	28 sec

* With HDI Trimer, 21.8 wt% NCO, 2,500 mPa.s at 25°C. Based on a stoichiometry of 1.05:1 (isocyanate to amine)

The dry times for the Amicure IC133 and IC166 based formulations, particularly the through-cure, are much faster than a commercial 2K PU. Additionally, the below Chart 2 shows the impact of UV exposure on DTM coatings, indicating the benefit of the Amicure IC133 and IC166 polycarbamide series.



CHART 2: AESTHETIC PERFORMANCE FOR DTM



TOPCOATS

Pigmented topcoats formulated with Amicure IC133 and IC166, compared with standard acrylic urethane topcoats, typically offer these advantages:

- Lower VOC formulations
- Faster through-cure
- Improved flexibility
- No catalyst required

A typical starting formulation is shown below, in Table 2, formulated at a viscosity suitable for conventional and airless spray Systems. This formulation can be modified to a suitable viscosity for other application Methods. The coatings properties reflect general properties that can be achieved using Amicure IC133 and IC166.

TABLE 2: PIGMENTED GLOSS WHITE TOPCOAT

Ingredients	Parts by Weight		
Part A			
Amicure IC133 or IC166	100		
Titanium dioxide (DuPont R960)	114.5		
Methyl amyl ketone (MAK)	44		
Part B			
HDI trimer (HDiT or N3300 ²)	78		
(2) Covestro			
Typical formulation properties using the above starting formulation:			
NCO	1.05		
Pigment volume concentration (PVC)	15.1%		
Solids content by weight	86.9%		
Solids content by volume	77.5%		
VOC (calculated)	180 g/L		
Zahn 2 cup viscosity at mixing	28 sec		



SUPPORTING DATA FOR TOPCOATS

The following data (Chart 3) was generated using the above formulation in Table 2 and compared to an industry available 2K polyurethane DTM. All coatings were applied to zinc phosphated (Bonderite[®] 952) steel to a dry film thickness of

3 mils. The coatings were dried at 70°F, 50% RH for 7 days prior to testing.

CHART 3: DRY TIMES FOR TOPCOATS (HOURS)





The speed of the formulations using the Amicure IC133 or IC166 is significantly faster than an acrylic urethane topcoat, particularly for through-cure. The below Chart 4 shows the improvement in flexibility a formulator can gain by using the Amicure IC133 of IC166 products, important for applications such as ships and tanks where temperature cycling is a concern.



CHART 4: FLEXIBILITY MEASUREMENTS FOR TOPCOATS



CLEARCOATS

Clearcoats can be formulated with Amicure IC133 and IC166.

A typical starting formulation is shown below, in Table 3, formulated at a viscosity suitable for conventional and high volume low pressure (HVLP) spray. This formulation can be modified to a suitable viscosity for other application methods. The coatings properties reflect general properties that can be achieved using Amicure IC133 and IC166.

TABLE 3: CLEARCOAT STARTING FORMULA

Ingredients	Parts by Weight
Part A	
Amicure IC133 or IC166	100
Methyl amyl ketone (MAK)	44
Part B	· · · ·
HDI trimer (HDiT or N3300 ²)	78
(2) Covestro	
Typical formulation properties using the above starting formulation:	
NCO/active hydrogen	1.05
Solids content by weight	80.1%
Solids content by volume	74.6%
VOC (calculated)	200 g/L
Zahn 2 cup viscosity at mixing	28 sec



GENERAL FORMULATED DATA

The following properties were obtained by mixing the above coatings and then applying onto zinc phosphated (Bonderite[®] 952) steel to a dry film thickness of 3.0 mils. The coatings were dried at 70°F, 50% RH for 7 days prior to testing.

Property	Amicure IC133	Amicure IC133	Amicure IC133
	Clearcoat	Topcoat	DTM
Admixed viscosity, Zahn #2 (seconds) ASTM D 4212	28	28	28
Dry time (hour)(*) ASTM D 5895			
Set-to-touch	1	0.5	0.5
Tack free	4	4	4
Dry hard	8	5	5
Through Cure	11	7	7
60° gloss ASTM D 523	93	86	86
Water resistance, 24 hour Immersion	Pass, no effect	Pass, no effect	Pass, no effect
Tape adhesion; dry, wet ASTM D 3359	5A, 5A	5A, 5A	5A, 5A
Direct, reverse impact flexibility (in-lbs)	160, 160	160, 140	100, 100
Mandrel bend (inch) ASTM D 522	Pass 1/8	Pass 1/8	Pass 1/8
Persoz pendulum hardness ANS/ISO 1522-98(E)	135	161	196
Pencil hardness ASTM D 3363	Н	ЗH	ЗH
MEK and toluene resistance, 24 hour Immersion	Pass, no effect	Pass, no effect	Pass, no effect

(*) Amicure IC166 is designed to dry and develop properties very rapidly. Amicure IC166 topcoat dry times: Set-to-touch 0.3 h, tack free 0.5 h, dry hard 0.8 h, through cure 1 h. Amicure IC133 and IC166 can be blended to customize dry time properties.



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