

Ancamine® 2880: Fantastic and Friendly Floors, Fast!

Epoxy Curing Agent with Premium
Performance and Enhanced EHS

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April 15th, 2025



What are the Market Trends and Drivers in Epoxy Flooring?



Enhanced Performance

- Good aesthetics
- UV and color stability
- Good chemical resistance
- High pigment acceptance



Efficiency

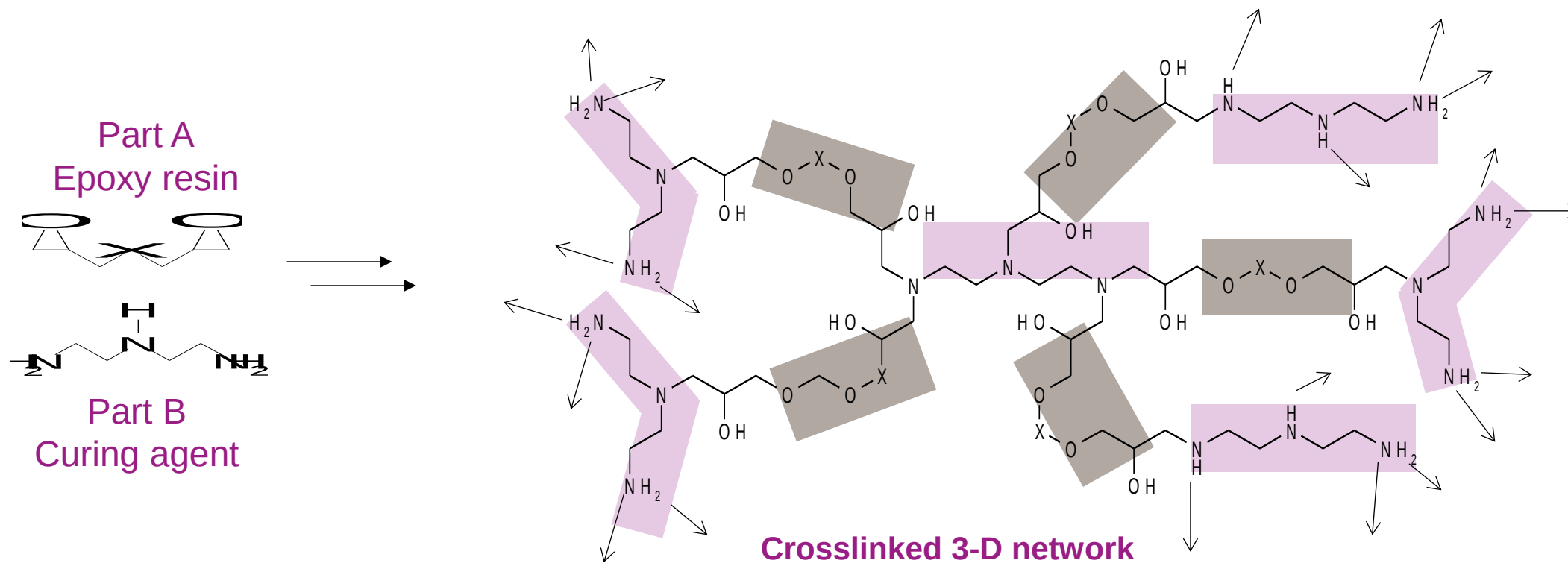
- Fast return to service
- Low temperature cure
- High surface tolerance
- Robust application



EHS, Eco and User Friendly

- Good EHS labeling
- Low to zero VOC
- Low emission for better indoor air quality
- Sustainability

Epoxy Chemistry and Applications



Market's Unmet Need for a Topcoat with Fast Cure Speed, Good Aesthetics, and Enhanced EHS Profile

Requirements	Commercial Product A	Commercial Product B
Fast return to service Fast cure speed with diluted LER 4-5h @ 23°C; 10h @ 10°C	✓✓✓	✓✓
Good carbamation resistance at day 1, rating >4 at 23°C and 10°C Excellent appearance	xxx	xx
Good UV resistance Color stability through service life	✓✓	✓✓✓
Enhanced EHS profile - No health hazard pictogram - Does not contain nonyl phenol, bisphenol-A, salicylic acid	xxx	xxx

Introducing Evonik's New Ancamine 2880 to Fulfill Market Need

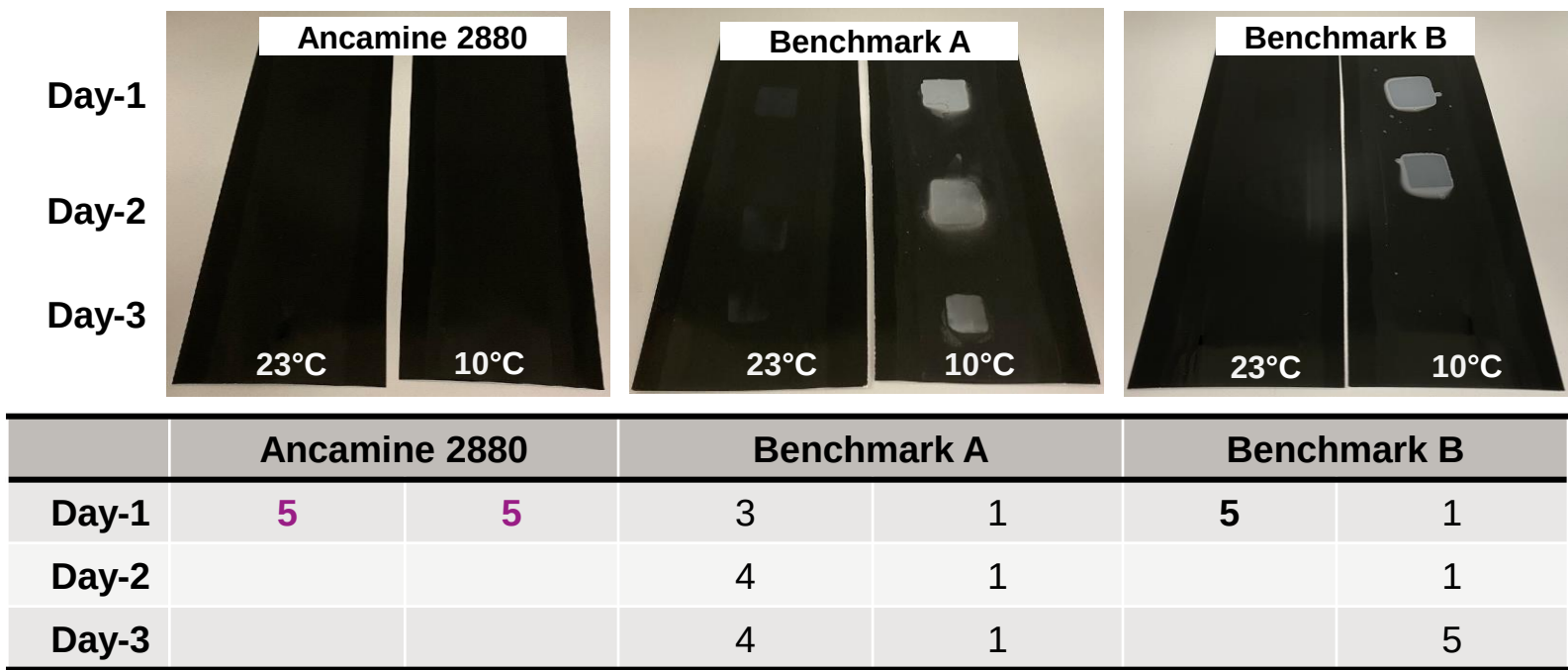
- **Fast cure speed at ambient and low temperature**
- **Best in class carbamation and water spotting resistance**
- **Good yellowing resistance**
- **Enhanced EHS profile**

Ancamine 2880: Handling Properties

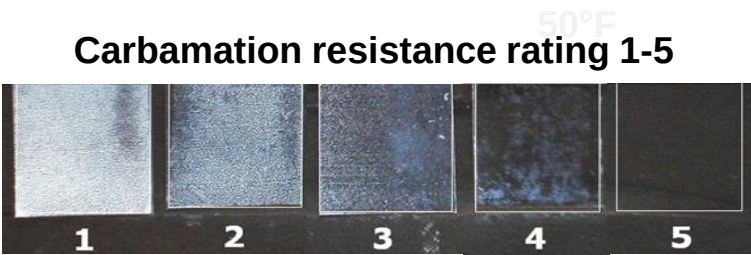
Property	Ancamine 2880	Benchmark A	Benchmark B
PHR	50	50	60
Neat Viscosity at 23°C (cps)	230	500	600
Mixed Viscosity at 23°C (cps)	2,000	3,000	4,000
Gel Time (150g mix at 23°C) (min)	37	35	40
Thin Film Set time at 23°C/50%RH (h)	4.5	4.5	5.5
Thin Film Set time at 10°C/60%RH (h)	10	10	14
Shore D Hardness at 23°C (Day 1)	80	80	80
Persoz Hardness at 23°C (Day 7)	335	326	319

Evaluated with diglycidyl ether of bisphenol A (DGEBA) resin (EEW = 190)

Ancamine 2880 Demonstrates Outstanding Carbamation Resistance



Evaluated with 90% DGEBA resin (EEW = 190) and 10% Epodil 748 diluent



- Ancamine 2880 shows the best film appearance/carbamation resistance.

Ancamine 2880 Offers High Humidity Tolerance

Properties	23°C/50%RH	10°C/ <u>60% RH</u>	10°C/ <u>80% RH</u>	10°C/ <u>85% RH</u>
Cure Speed	6.5 h	14 h	13 h	13 h
Carbamation resistance day 1	5	5	5	5
Water spotting resistance day 1	5	4	5	5

Evaluated with 90% DGEBA resin (EEW = 190) and 10% Epodil 748 diluent

- Cure speed, carbamation resistance and water spotting resistance were not affected by high humidity up to 85% RH at 10°C on day 1.

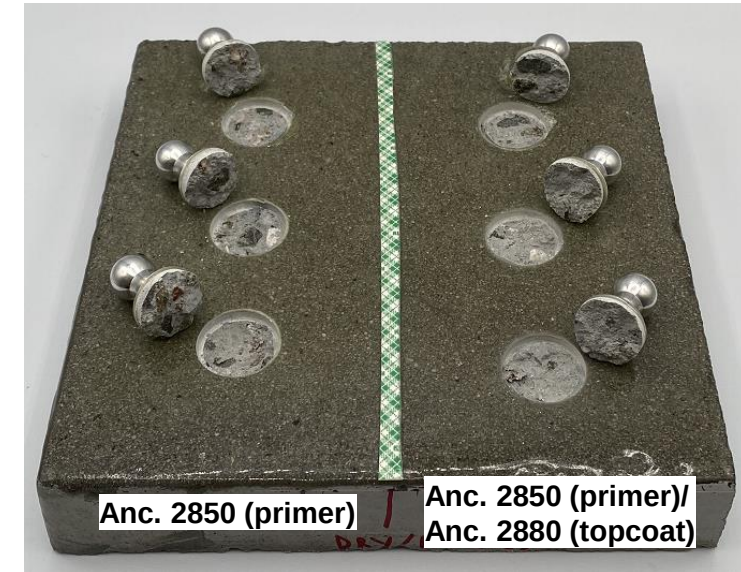
Fast Return to Service Enables One-Day Flooring

Ancamine 2880 Exhibits Outstanding Intercoat Adhesion

Intercoat adhesion (ASTM D7234)	
Topcoat: Epoxy (<u>on dry concrete</u>)	
At 4 h, 23°C/50% RH	951 psi
At 8 h, 10°C/60% RH	829 psi
Topcoat: Epoxy (<u>on wet concrete</u>)	
At 4 h, 23°C/50% RH	837 psi
At 8 h, 10°C/60% RH	888 psi

10 mil topcoat over 6 mil primer

- Excellent intercoat adhesion, even at 10°C and on damp concrete
- Fast return to service, One-day coating
- Topcoat can be applied in 4 hours with excellent intercoat adhesion



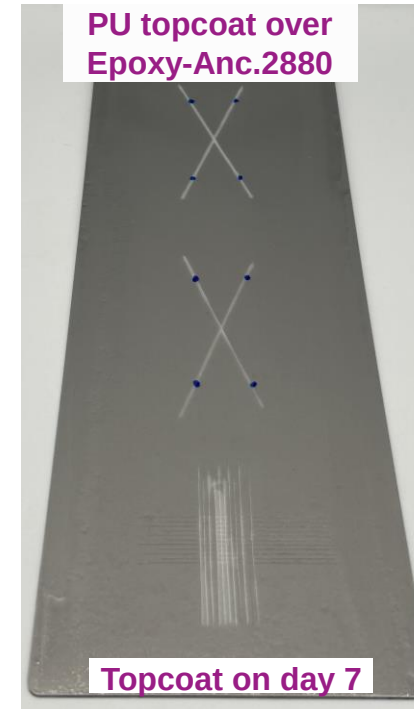
*Tested with DGEBA:Epodil 748 – 90:10
topcoat after 8 h, at 10°C, 60% RH*

Excellent Intercoat Adhesion with Polyurethane Topcoat

Ancamine 2880 Exhibits Outstanding Overcoatability

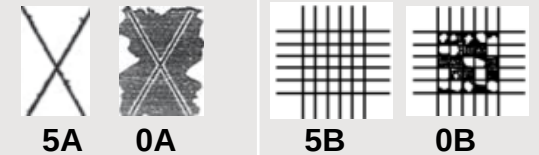
Intercoat adhesion (ASTM D3359, Tape adhesion)		
Topcoat: Polyurethane (over epoxy on steel*) 23°C/50% RH and 10°C/60% RH		
	X-cut	Cross-cut
Day 1	5A	5B
Day 3	5A	5B
Day 7	5A	5B

*ACT CRS B952 P60: Polished phosphate treated cold roll steel



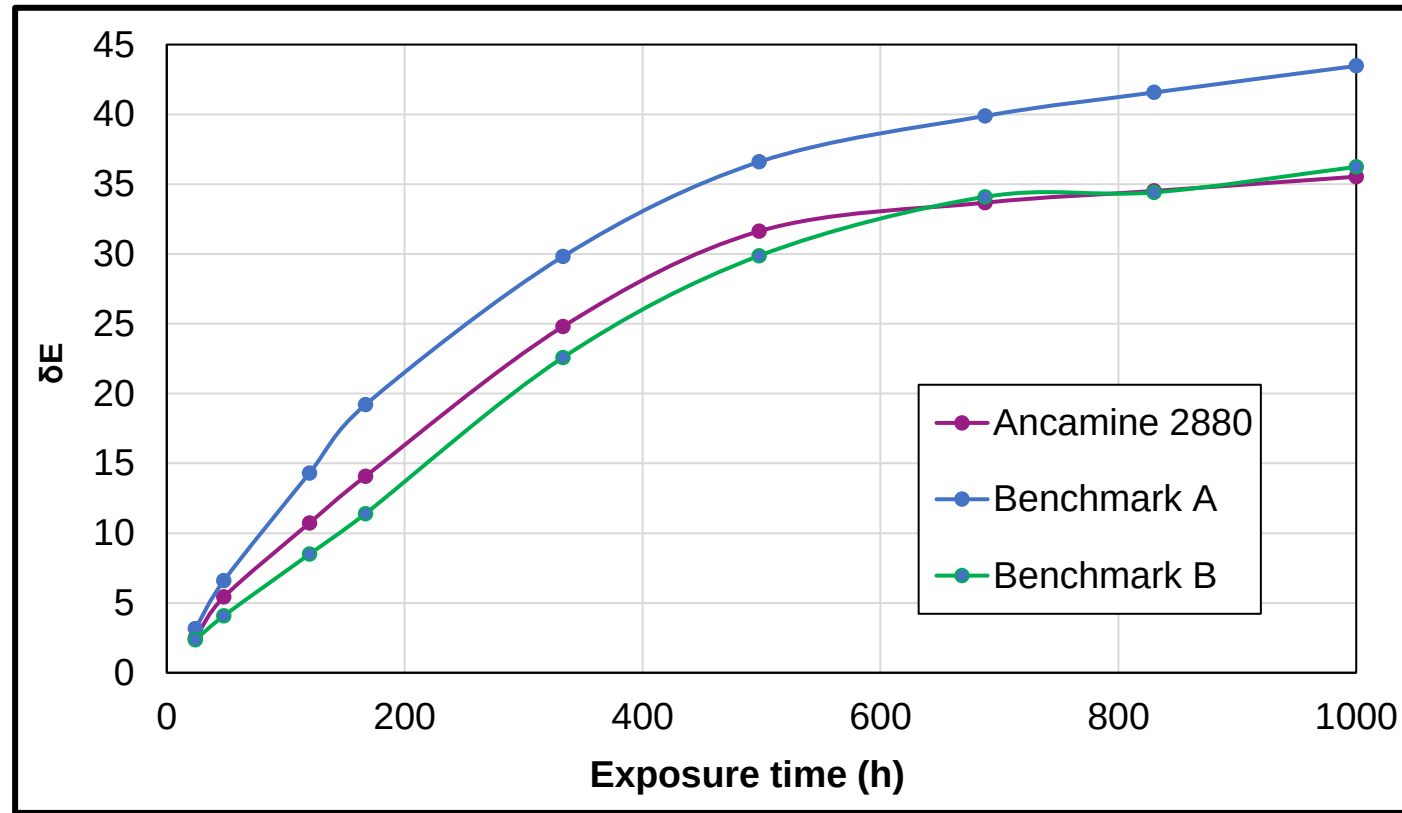
10 mil PU topcoat
over 10 mil epoxy
basecoat/primer

Classification : Flaking / Peeling



- No peeling or removal of coating indicates excellent intercoat adhesion

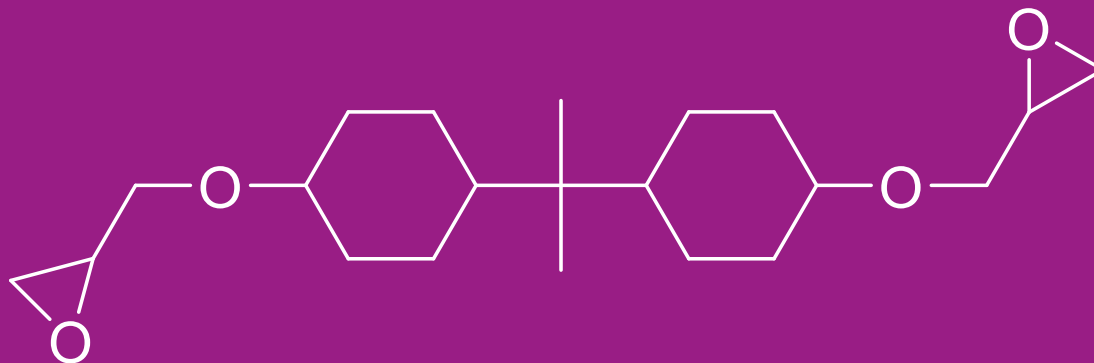
Good Yellowing Resistance with Bis-A Epoxy Systems



Evaluated with 90% DGEBA resin (EEW = 190) and 10% Epodil® 748 diluent

- Ancamine 2880 exhibits good yellowing resistance under UV exposure.

Performance of Ancamine 2880 with Hydrogenated Resins

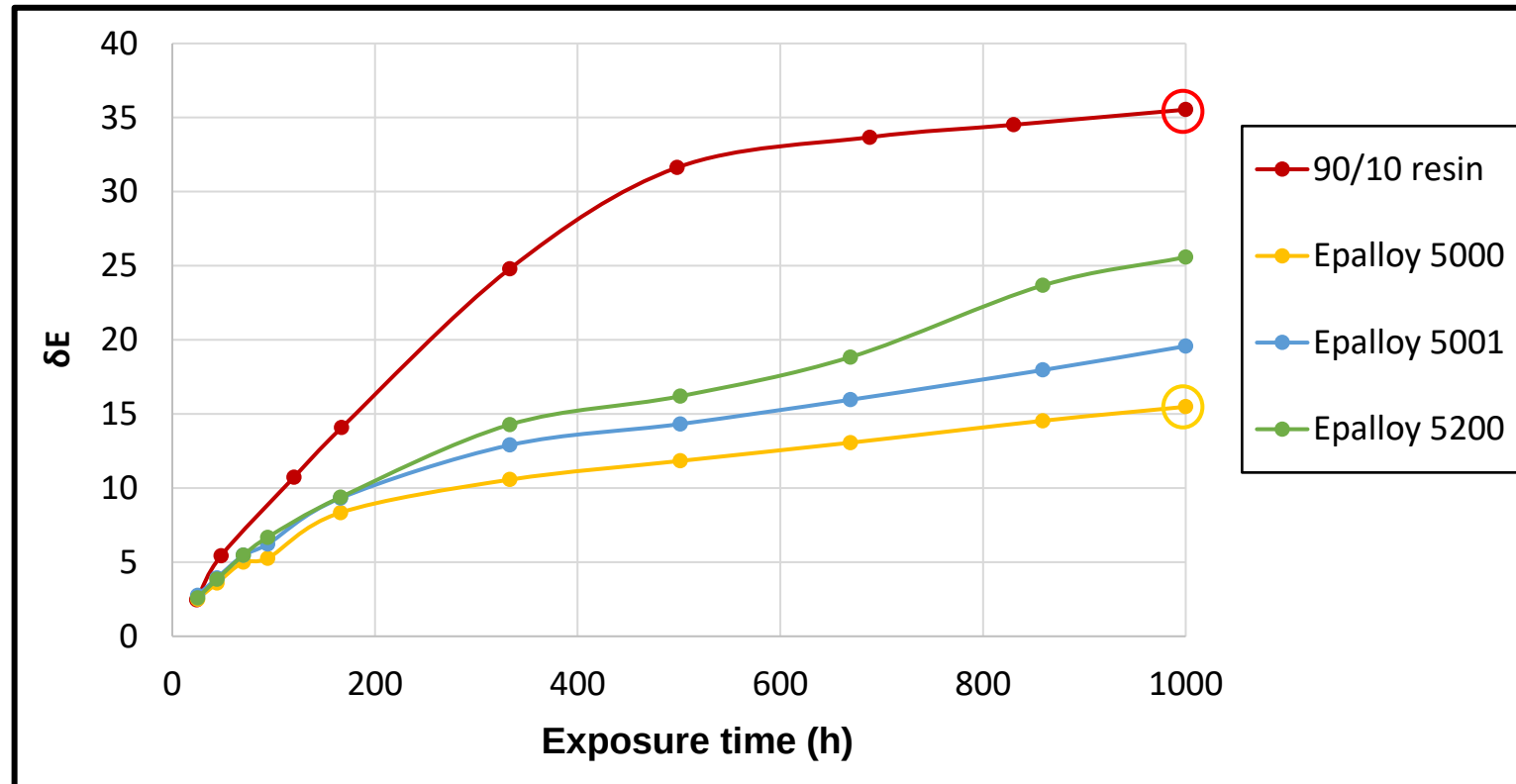


Handling Properties

Properties	Epalloy 5000	Epalloy 5001	Epalloy 5200
PHR	43	48	57
Gel Time (150g mix at 23°C) (min)	80	45	35
TFST, Phase-3 at 23°C/50%RH (h)	14	7	11
TFST, Phase-3 at 10°C/60%RH (h)	28	20	28
Shore D Hardness at 23°C (day 1)	70	75	65
Shore D Hardness at 10°C (day 1)	30	50	30

- Ancamine 2880 in combination with Epalloy 5001 provides:
 - Fastest cure speed
 - Walkable floors on day 1 even at 10°C environment

Improved Yellowing Resistance with Hydrogenated Epoxy Systems



- Ancamine 2880 provides better yellowing resistance with hydrogenated epoxies.
- Ancamine 2880 combined with Epalloy 5001 delivered best performance balance in:
 - Yellowing resistance (>2x better than non-hydrogenated resin)
 - Cure speed
 - Hardness development

Ancamine 2880 offers an Enhanced EHS profile

Hazard Statement	Ancamine 2880	Benchmark A	Benchmark B
Acute Toxicity (Oral)	Category 4	Category 4	Category 4
Skin Corrosion/Irritation	Category 1B	Category 1B	Category 1B
Serious Eye Damage /Eye Irritation	Category 1	Category 1	Category 1
Skin Sensitizer	Category 1	Category 1A	Category 1
Reproductive Toxicity		Category 2	Category 2
Pictogram			

- Ancamine 2880 does not contain CMR materials and has better EHS profile

Key Performance Attributes of Ancamine 2880

Main Benefits

- **Fast cure speed at ambient and low temperature environment**
- **Rapid development of carbamation and water spotting resistance**
- **Good yellowing resistance**
- **Better EHS profile**

Secondary Benefits

- Low viscosity
- Rapid hardness development
- Good mechanical properties
- Excellent resistance to abrasion
- Good resistance to different classes of chemical

Starting Point Formulations

High Performance White Self Leveling Floor

Part A Component		pbw
Epoxy Resin	EPON 828	50
Reactive Diluent	Epodil 748	5
Deaerator	Tego Airex 990	0.5
Wetting Agent	Tego Wet 260	0.5
Titanium Dioxide	Ti-Pure R960	11
Filler	Self leveling sand	33
Part B Component		
Amine Curing Agent	Ancamine 2880	27
TOTAL		127

Technical Data	
Mix Ratio A/B (w/w)	3.7 : 1
Mix Ratio A/B (v/v)	2.5 : 1
Pigment Volume Concentration (PVC, %)	17
Mix Viscosity (cps)	2100
Gloss 20°/60°	81/95
Carbamation Resistance (Scale 1-5, 5=best) Day 1, 23°C (wet patch)	5



White Self-Leveling floor

Pigmented White Topcoat - Excellent Hot Tire Pickup

Part A Component		pbw
Epoxy Resin	EPON 828	70
Reactive Diluent	Epodil 748	7
Deaerator	Tego Airex 990	0.5
Wetting Agent	Tego Wet 260	0.5
Titanium Dioxide	Ti-Pure R960	22
Part B Component		
Amine Curing Agent	Ancamine 2880	37.3
TOTAL		137.3

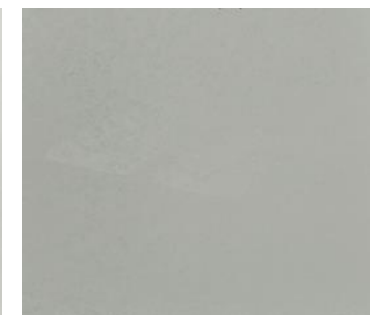
Scale 0-5, 5=best			
	Staining	Imprinting	Delamination
Day 1	5	4	5
Day 2	5	4	5
Day 7	5	4.5	5



Day 1



Day 2



Day 7

In-house hot tire pickup test: 40 psi, 50°C/2 hours

Starting Point Formulations for Decoupage Applications

	Raw Materials	Control	Formulation-1	Formulation-2	Formulation-3	Formulation-4 and 5
Part B	Anc. 2880	50	49.5	45.1	46.8	58.5
	Kumanox 3111F*		31.5	41.4	37.8	
	Benzyl Alcohol		9	5.5	4	11.3
	Epodil LV5					5.2
	Total Part B	50	90	92	90	75
Part A	DER 331	90	90			
	Epodil 748	10	10			
	Epalloy 5000			100	90	
	TMPTA				10	
	DER 354					80 80
	Epodil 749					20
	Epodil 750					20
	Total Part A	100	100	100	100	100
A/B Mix Ratio (v/v)		1.8 : 1	1 : 1	1 : 1	1 : 1	1 : 1

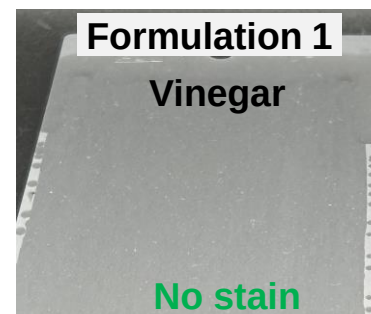
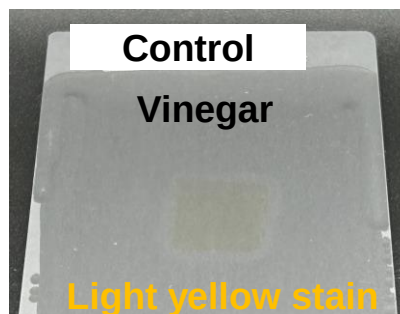
* Kumanox 3111F: Styrenated phenol, alternative to nonyl phenol

Decoupage Applications: Performance Properties

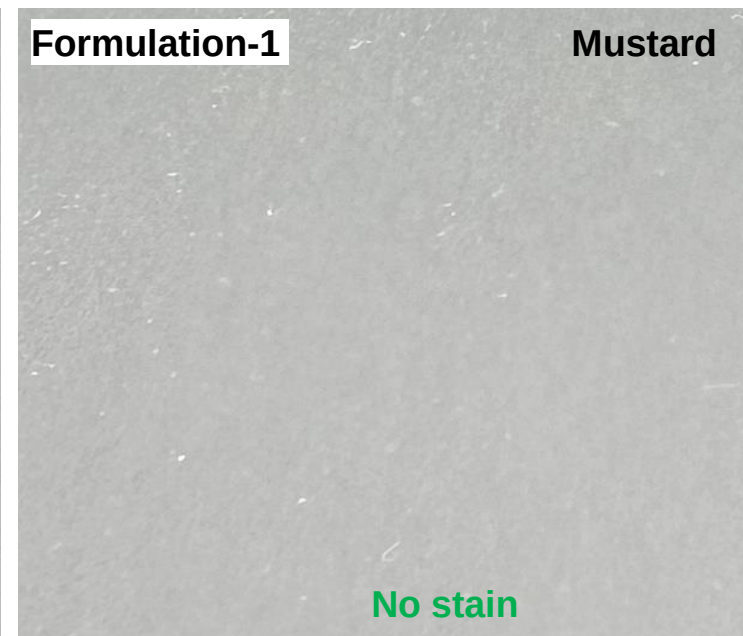
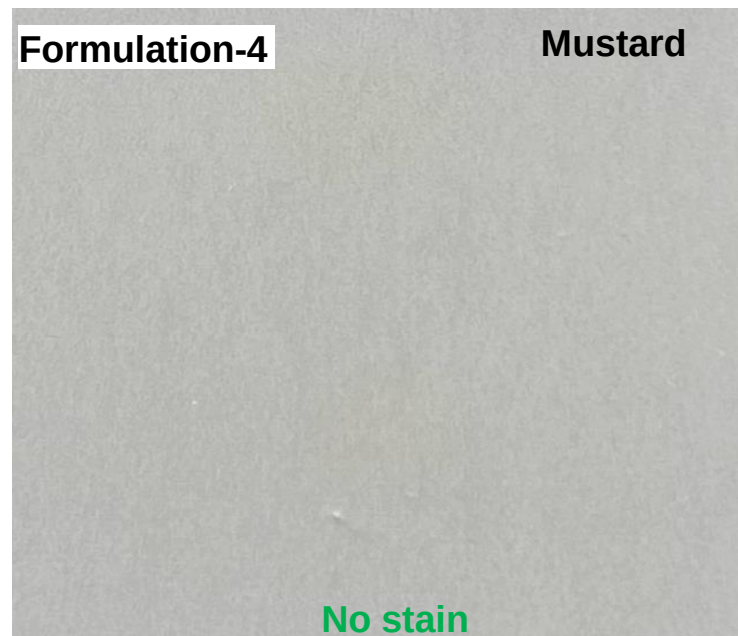
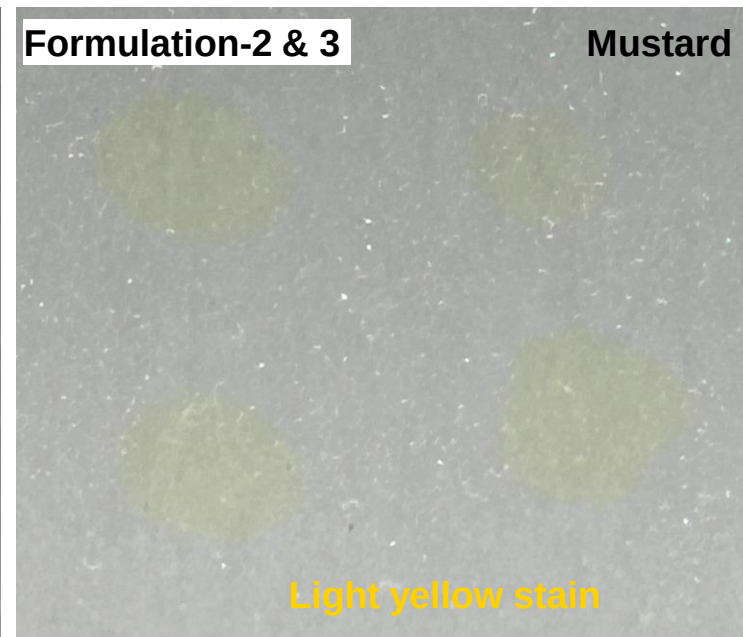
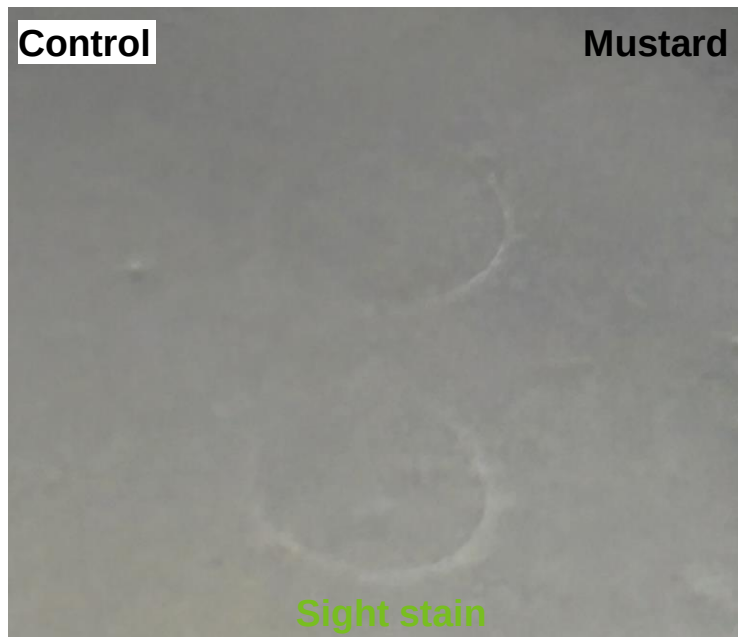
	Control	Formulation-1	Formulation-2	Formulation-3	Formulation-4	Formulation-5
Part A	DER 331 /Epodil 748	DER 331 /Epodil 748	Epalloy 5000	Epalloy 5000 /TMPTA	DER 354 /Epodil 749	DER 354 /Epodil 750
Part B	Anc. 2880	Anc. 2880 / Kumanox 3111F / Benzyl Alcohol			Anc. 2880 / Benzyl alcohol / LV5	
Curing agent Viscosity (cP)	230	760	1620	1450	125	
Mix Viscosity (cP)	750	1280	2080	2350	330	290
Mix Ratio (v/v)	1.8 : 1	1 : 1	1 : 1	1 : 1	1 : 1	1 : 1
Gel Time (min), 23°C, 150g Mass	37	30	35	25	44	40
Shore D Hardness (2/7 days)	80/80	70/75	60/70	55/65	65/75	55/75
Max Exotherm Temp (°C), 25°C, 150g Mass	128	95	110	70	77	118
Thin Film Set Time (hrs), 23°C	4.5	5	6.5	5	4	4
Thin Film Set Time (hrs), 10°C	10	16	24	14	24	24

Decoupage Applications: Stain Resistance Results

	Control	Formulation 1	Formulation 2	Formulation 3	Formulation 4	Formulation 5
Part A	90% DER 331 /10% Epodil 748	90% DER 331 /10% Epodil 748	Epalloy 5000	90% Epalloy 5000 /10% TMPTA	90% DER 354 /10% Epodil 749	90% DER 354 /10% Epodil 750
Part B	Ancamine 2880	Ancamine 2880 / Kumanox 3111F / Benzyl Alcohol			Anc. 2880 /Benzyl alcohol /LV5	
Ketchup	No stain	No stain	No stain	No stain	No stain	No stain
Mustard	Slight stain	No stain	Light yellow stain	Light yellow stain	No stain	Slight yellow stain
Orange Juice	No stain	No stain	No stain	No stain	No stain	No stain
Grape Juice	No stain	No stain	No stain	No stain	No stain	No stain
Soy Sauce	No stain	No stain	No stain	No stain	No stain	No stain
Balsamic Vinegar	Light yellow stain	No stain	No stain	No stain	No stain	No stain
Coke	No stain	No stain	No stain	No stain	No stain	No stain
Hot Coffee	No stain	No stain	No stain	No stain	No stain	No stain



Spot test on film cured for 7 days
at 23°C / 50%RH





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<https://crosslinkers.evonik.com/en/products/ancamine/ancamine-2880>



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Leading Beyond Chemistry

Chemical Resistance

Chemicals	Ancamine 2880	Benchmark A	Benchmark B
Acetone	4	5	4
Methanol	5	5	3
Ethanol	5	5	4
Methyl Ethyl Ketone	4	5	1
Xylene	5	5	5
Toluene	4	5	5
30% Ammonium Hydroxide	4	2	3
50% Sodium Hydroxide	5	5	5
6% Sodium Hypochlorite	5	4	5
10% Nitric Acid	4	4	4
10% Hydrochloric Acid	4	5	4
50% Sulfuric Acid	4	4	4
10% Acetic Acid	3	3	4
10% Lactic Acid	4	3	4

- Ancamine 2880 offers similar chemical resistance to various test chemicals and better resistance to ammonium hydroxide

*Evaluated with 90% DGEBA resin (EEW = 190) and 10% Epodil 748 diluent
Spot test on film cured for 7 days at 23°C/50%RH
Rating film appearance (5: Best; 1: Worst)*

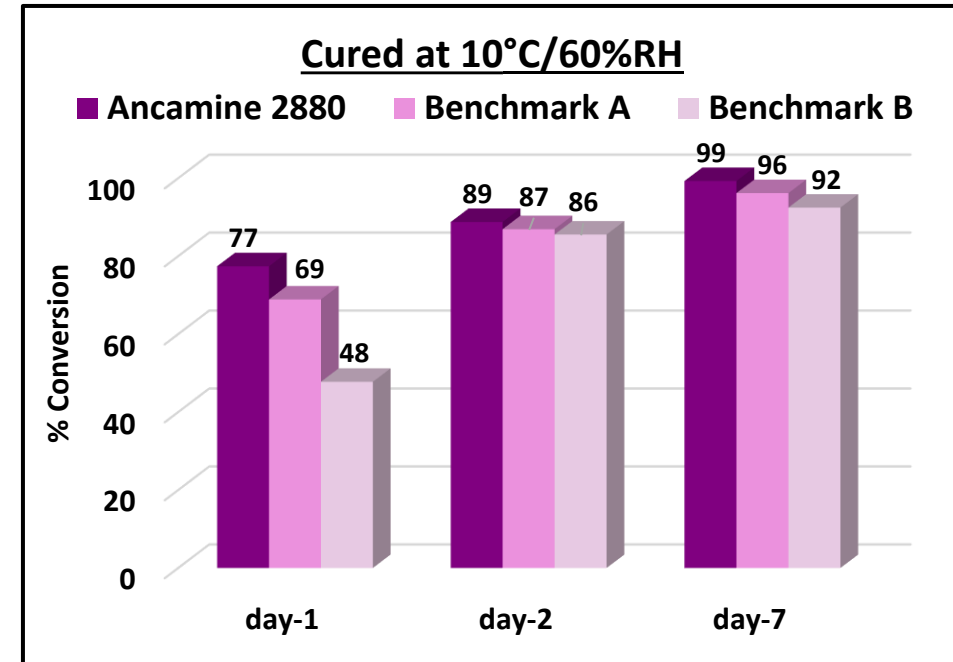
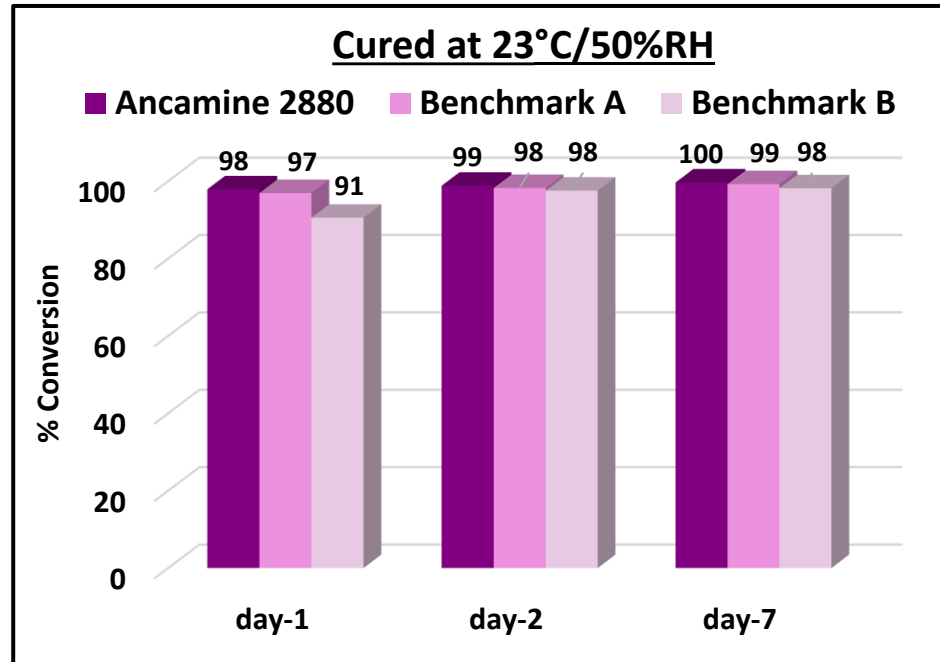
Ancamine 2880 Provides Good Mechanical Properties

Properties	Ancamine 2880	Benchmark A	Benchmark B
Compressive strength (MPa)	81	76	80
Compressive Modulus (kpsi)	284	225	260
Tensile Strength (psi)	9,670	9,488	9,008
Tensile Modulus (kpsi)	405	406	396
Flexural Strength (MPa)	94	88	87
Flexural Modulus (kpsi)	454	438	439

Evaluated with DGEBA resin (EEW = 190)

- Ancamine 2880 provides similar mechanical properties to those of benchmark products.

Ancamine 2880 Exhibits High Degree of Cure even at Low Temperature



Evaluated with 90% DGEBA resin (EEW = 190) and 10% Epodil 748 diluent

- Ancamine 2880 shows higher degree of cure on day1 at 10°C environment and indicates rapid early property development.

Ancamine 2880 Offers High Abrasion Resistance

Curing agent	Resin 1*	Resin 2*	Resin 3*
Ancamine 2880	27	42	30
Benchmark A	38	42	37
Benchmark B	33	42	32

6 mil wet film thickness (WFT), cure for 7 days at 23°C/50%RH

ASTM D4060 using CS 17 wheels (2 kg) for 500 cycles

** Resin 1: DGEBA resin (EEW = 190)*

Resin 2: 90% DGEBA – 10% Epodil 748

Resin 3: 50% DGEBA – 50% Novolac epoxy

- Ancamine 2880 cured with DGEBA and with 50% DGEBA - 50% Novolac epoxy renders slightly better abrasion resistance.