

**Keep the moisture out,  
stop floor failures fast!**

**Ancamine® 2739**

**Ancamine® 2800**

**Ancamine® 2850**

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# Agenda

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- Background
- Moisture Vapor Barrier definition
- Moisture mitigation techniques
- Market trends and drivers
- New innovative curing agents and benefits
- Performance attributes of new curing agents
- Starting Point Formulations
- Summary

# What Problems are We Trying to Solve?

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## ▪ Floor failures

- Blisters in coatings: Entrapped moisture vapor
- Disbondment of tile/wood/carpet/laminate: Degradation of adhesives
- Mold/mildew growth: Indoor air quality
- Wet floor: Safety hazard



## ▪ Cost of failure to applicators

- Liability
  - To construction teams, manufacturers and project architects
- Remove and rebuild
  - Floor failures due to moisture accounts for hundreds of millions of dollars annually.
  - A moisture vapor barrier can save both money and time.



# Concrete and Moisture Vapor

- **Concrete composition**

- Air / Porosity ~1-7%
- Water ~ 12 -16%
- Cement ~10-15%
- Fine sand ~30-80%
- Coarse aggregate
  - Stone ~ 0-50%

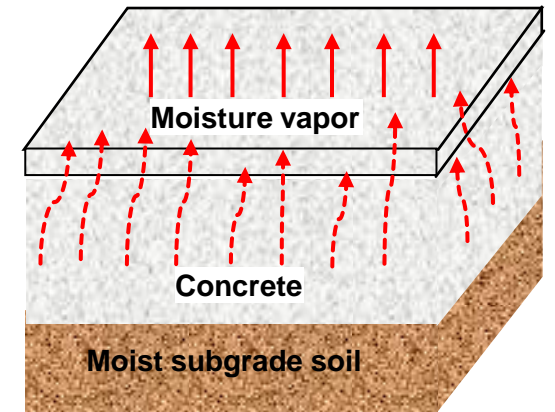
- **Moisture Source**

- **Concrete**

Hardened concrete slabs contain water in either a liquid or vapor form

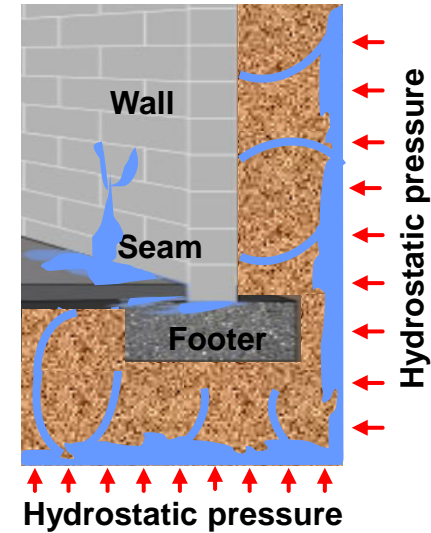
- **Ground/soil**

Liquid water below the slab can diffuse through the porous slab as vapor

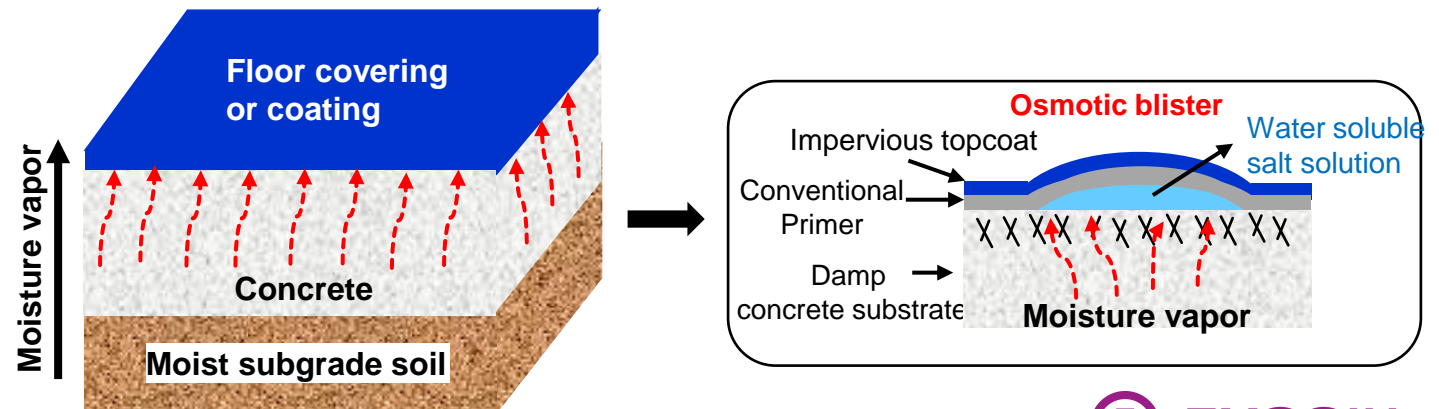


# Moisture Vapor Drivers

- **Hydrostatic Pressure:** Upward water pressure below concrete in conditions below ground (water) level
  - 10 m hydrostatic pressure ~ 15 psi
  - Capillary pressure ~ 30 psi
  - Typical (primer) adhesive bond strength ranges 200 – 350 psi

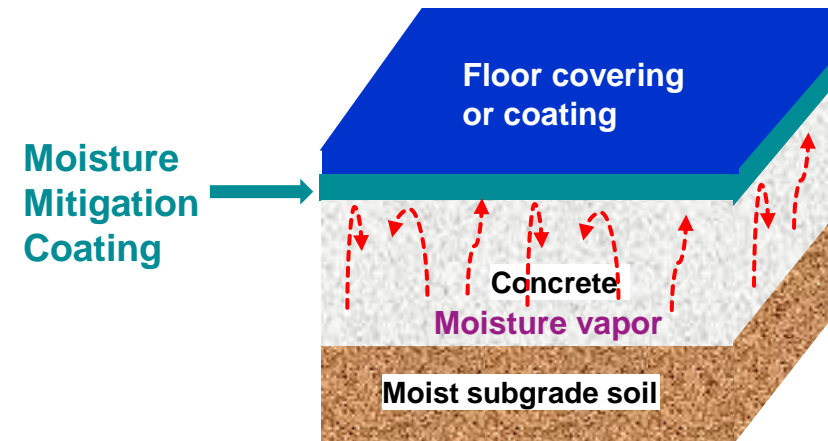


- **Osmotic Pressure:** A pressure-build generated by concentration gradient over membrane
  - Required for osmotic cell:
    - Water pressure (capillary osmosis)
    - Semi-permeable membrane (concrete)
    - Soluble component(s) (salts)



# Moisture Mitigation Techniques

- **Moisture Vapor Permeable (“Breathable”)**
  - Allows moisture vapor from concrete/ground soil to diffuse through
  - Suitable technique for concrete with high potential of osmotic pressure
  - Subsequent layers (coating & floor covering) need to be “breathable” to avoid failures
- **Moisture Vapor Barrier (“Blocking”)**
  - Restricts moisture vapor from concrete and/or ground soil to diffuse through
  - Best technique when subsequent layers are “non-breathable” (applies to most flooring systems)
    - Seamless flooring (ex. Broadcast, Terrazzo etc.)
    - Floor coverings (ex. Tiles, Carpet, Laminate etc.)



*American Concrete Institute recommends installing at least minimum vapor protection from concrete slab on grade (ACI 302.2R).*

# Moisture Vapor Barrier Definitions (ASTM F3010)

- Outlines performance and application of liquid applied moisture vapor reduction systems under floor coverings
- The ability of a material to suppress the diffusion of moisture vapor is measured in units known as "perms" or permeability
  - Specifies moisture vapor permeance of  $\leq 0.1$  perms (**ASTM E-96**)
    - The International residential code - **Class I moisture vapor retarder** : **<0.1 perms (grains·h<sup>-1</sup>·ft<sup>-2</sup>·inHg<sup>-1</sup>)**

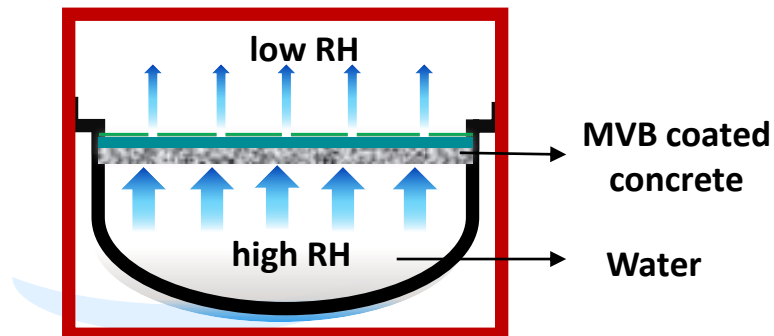
## Moisture vapor transmission (MVT)

$$\text{MVT} = \Delta\text{Mass} / (\Delta\text{time} \times \text{surface area of sample})$$

## Moisture vapor permeance

$$\text{MVP} = \text{MVT} / \text{vapor pressure differential across sample}$$

### ASTM E-96 Wet Cup Method



### Actual Test Specimen





# What are the Market Trends and Drivers in Epoxy Flooring?



## Enhanced Performance

- Good aesthetics
- Better 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

- Low to zero VOC
- Low emission for high indoor air quality
- Sustainability



# Current vs New Curing Agent Technology

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Thermoset Epoxy Coatings = Epoxy Resin (Part A) + Curing Agent or Hardener (Part B)

## Current Technology

- Polyamine + Plasticizer

### **Advantages**

- Complete conversion of epoxy/amine reaction
- Increase compatibility

### **Disadvantages**

- Emission of benzyl alcohol/other plasticizers
- Increased moisture vapor transmission



## New Technology

- Proprietary Polyamine
  - Requires low to no plasticizers
- **Advantages**
  - Retains advantages of current technology
  - **Low emissions**
  - **Improved moisture vapor barrier**

# New Low Emission Curing Agents for Moisture Vapor Barrier Application

- Ancamine 2739, 2800, 2850: epoxy curing agent based on low emission technology

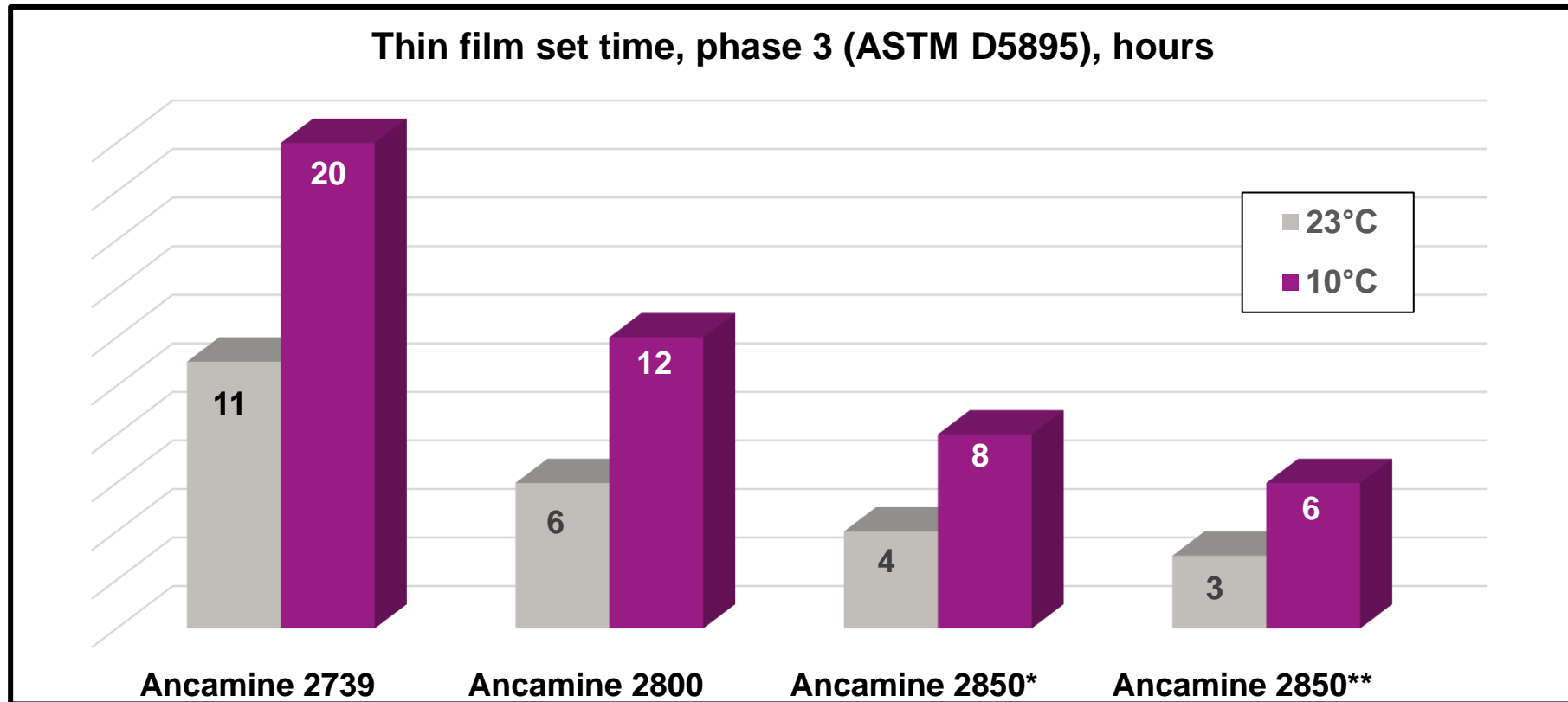
Handling properties	Ancamine 2739*	Ancamine 2800*	Ancamine 2850*	Ancamine 2850**
Neat Viscosity @25°C (cPs)	350	500	542	542
Mix Viscosity @25°C (cPs)	500	594	667	1050
Use level (PHR)	40-45	40-45	35-40	35-40
Gel Time, 150g mass @ 25°C (min)	85	41	30	28

\* LER:Epodil 748:Epodil 749 - 80:10:10

\*\*LER:Epodil 748 - 90:10

- Ancamine 2739 offers longer working time
- Ancamine 2800 and Ancamine 2850 offer moderate working time

# Return to Service Comparison

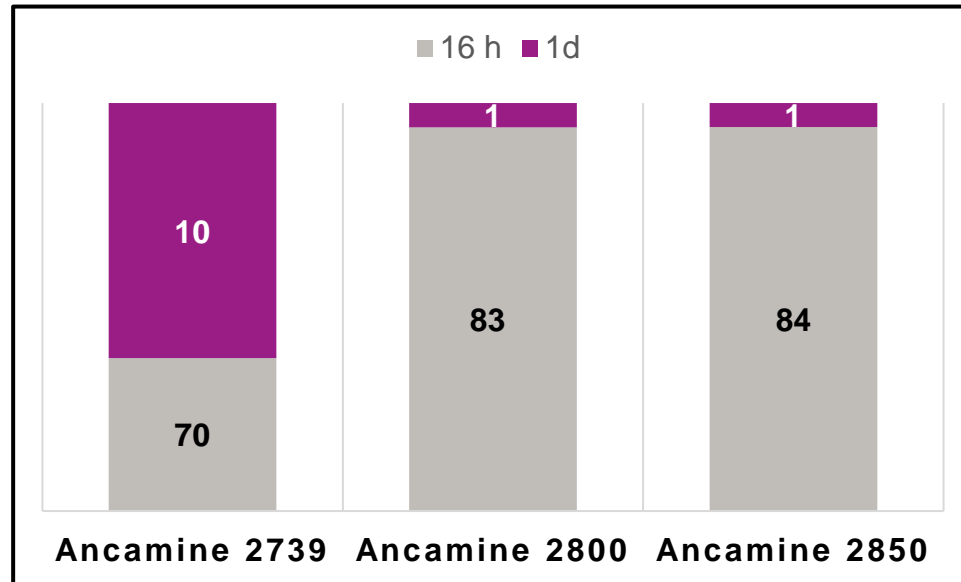


\*LER:Epodil 748:Epodil 749 - 80:10:10; \*\*LER:Epodil 748 - 90:10

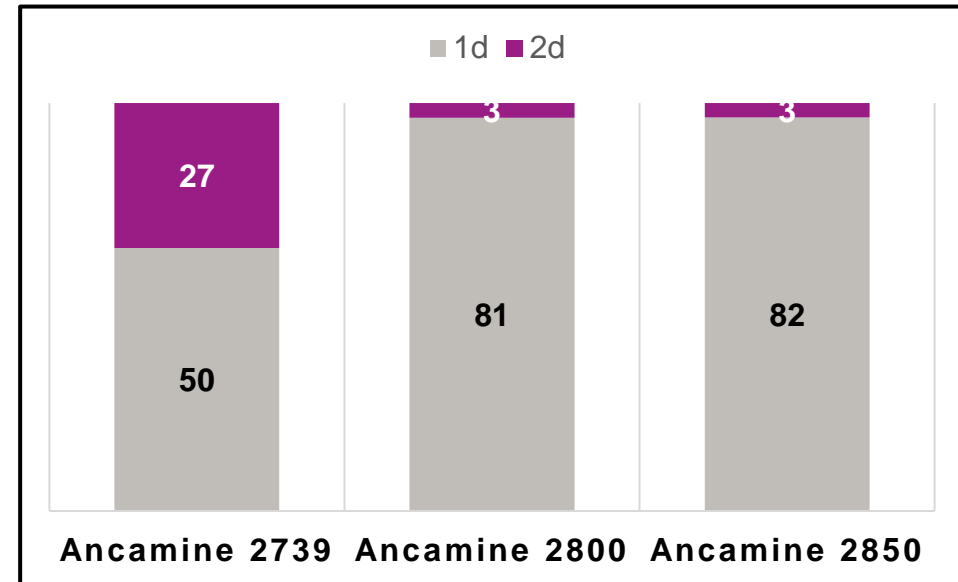
- Ancamine 2800 and Ancamine 2850 offer much faster cure speed
- Provide formulators versatility to choose a tailored system to meet specific requirements

# Tailored Speed of Property Development

Shore D hardness build at 23°C, 50%RH



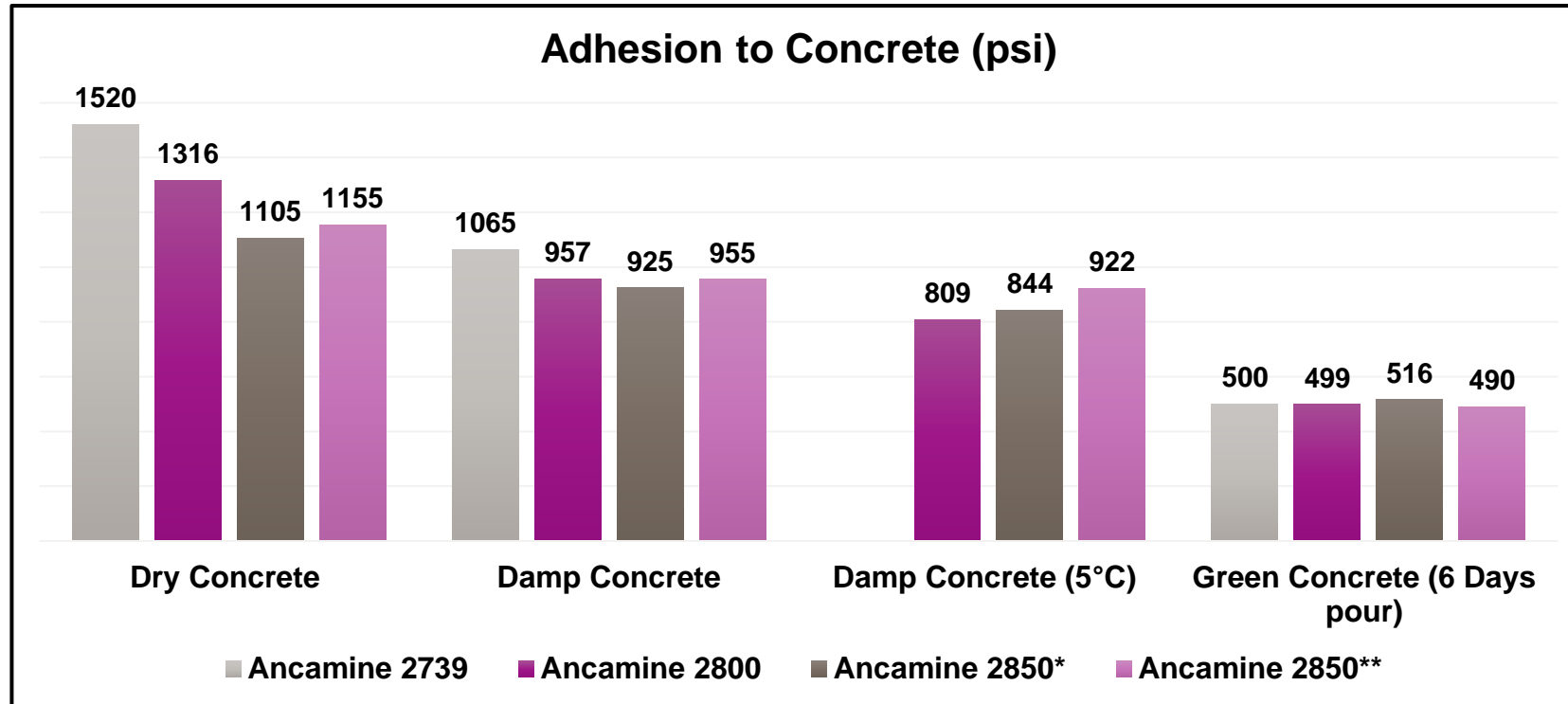
Shore D hardness build at 10°C, 60%RH



Cured with LER:Epodil 748 - 90:10

- Rapid early mechanical property build-up
- The slowest Ancamine 2739 meets the **shore D of 50** requirement for early “walk-on” between 1-2 days at 10C.

# Excellent Adhesion to Concrete



\* LER:Epodil 748:Epodil 749 - 80:10:10; \*\*LER:Epodil 748 - 90:10

- Concrete surface profile (International Concrete Repair Institute) – CSP3
- ASTM D7234 Dolley pull test – DeFelsco Positest AT-A automatic adhesion tester
- Damp concrete - ~ 10% surface moisture (EnnoLogic Moisture Meter eH710T)

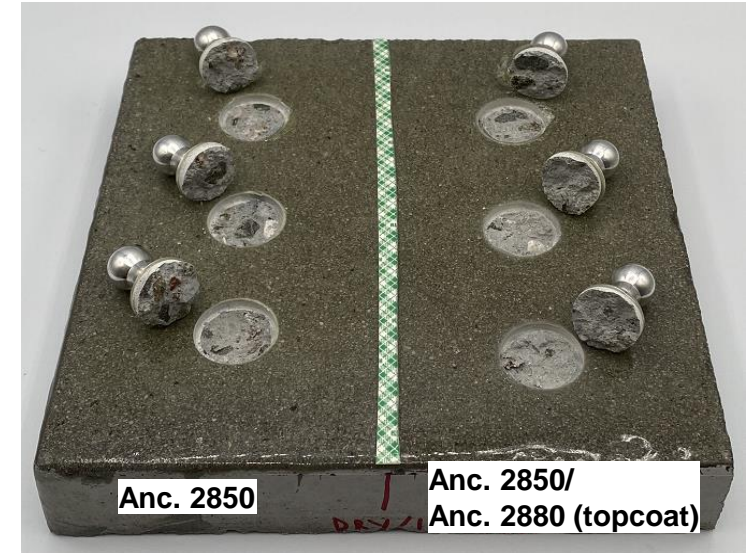


**ASTM D7234**  
– bulk concrete failures

# Excellent Intercoat Adhesion, Fast Return to Service

Curing agents	Ancamine 2739	Ancamine 2800	Ancamine 2850
<b>Topcoat: Aliphatic polyurea (ASTM D3359 on metal panels)</b>			
At 4 h, 23°C, 50% RH	MVB not cured	5A	5A
At 24 h, 23°C, 50% RH	5A	5A	5A
<b>Topcoat: Aliphatic polyurea (ASTM D7234 on concretes)</b>			
At 4 h, 23°C, 50% RH	-	-	637 psi
At 8 h, 10°C, 60% RH	-	-	858 psi
<b>Topcoat: Epoxy (ASTM D7234 on concretes)</b>			
At 4 h, 23°C, 50% RH	-	-	950 psi
At 8 h, 10°C, 60% RH	-	-	966 psi

- Excellent intercoat adhesion, even at 10°C environment
- **Fast return to service, One-day flooring**
  - Topcoat can be applied in 4 hours with excellent intercoat adhesion



**Epoxy topcoat at 8 h, 10°C, 60% RH**  
**Cured with LER:Epodil 748 - 90:10**

**<sup>1</sup>ASTM D3359**

10 mil thick polyurea, 7 day-cure

Cross hatch

5A/Best (no peeling or removal of coating)

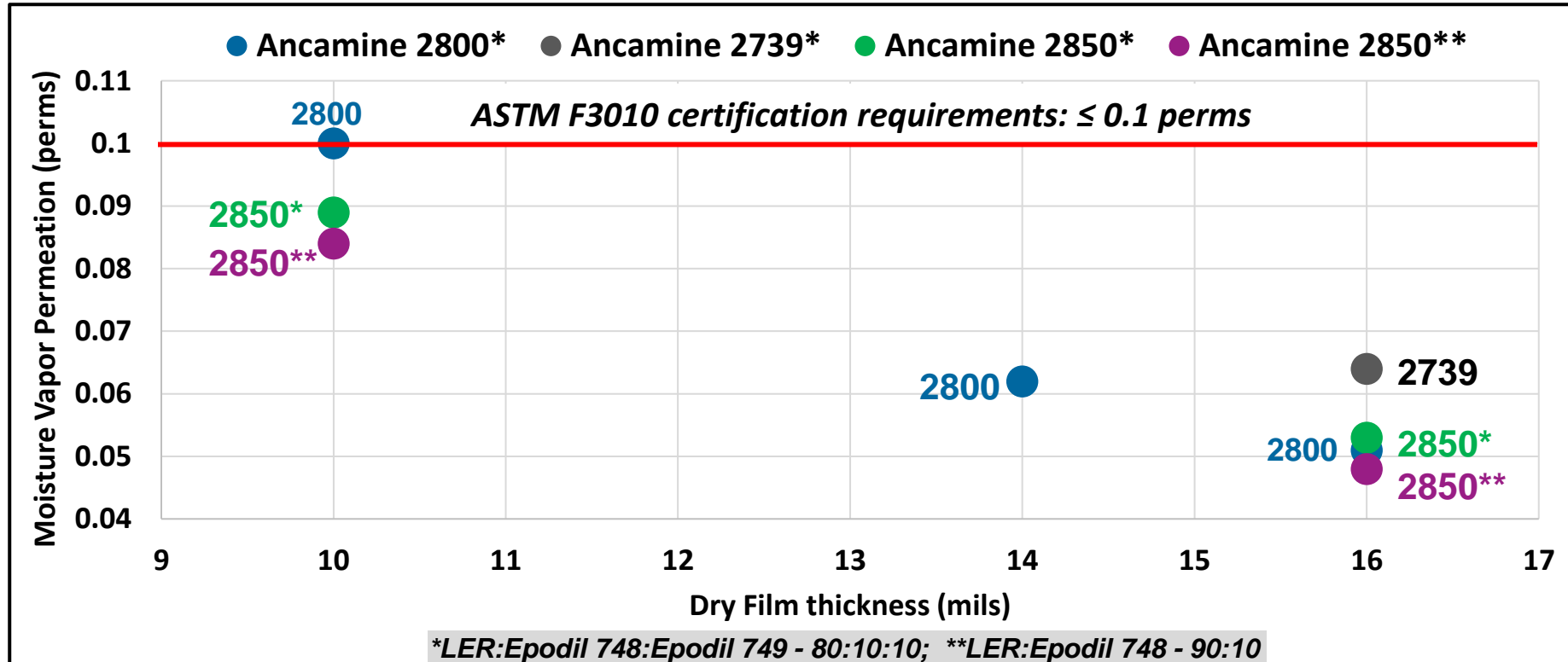
1A/Worst (complete removal coating)

**<sup>2</sup>ASTM D7234**

1/8" thick cementitious overlay, 14 day-cure

Dolly pull off

# Cost Effective Moisture Vapor Barrier Formulations



Testing done by independent lab for moisture vapor transmission (MVT) based on ASTM E-96 method

## Cost-in-use benefits:

- At 10 mil thickness: Ancamine 2800 and 2850 meet ASTM F3010  $< 0.1$  perms certification requirement.
- Allow 30-35% less product with thinner coating to meet  $\leq 0.1$  perms rating
- Use lower cost bisphenol A epoxy resin



# Starting Point Formulation and Basic Properties

Part A		Anc 2739	Anc 2800	Anc 2850*	Anc 2850**
Epoxy resin	Bis A resin	80.0	80.0	80.0	90.0
Reactive Diluent	Epodil 748	10.0	10.0	10.0	10.0
Reactive Diluent	Epodi 749	10.0	10.0	10.0	
Air Release				0.1 - 0.3	
Wetting Agent (optional)				0.1 - 0.3	
Part B					
Curing Agent		50	44	37	36.5
Total parts		150	144	137	136.5
Technical data					
Mix ratio A/B	By wt.	2.00	2.27	2.71	2.74
	By vol.	1.91	2.09	2.50	2.50

- Recommendations:
  - Air release: Tego Airex 990, Tego Airex 944
  - Wetting agent: Tego Wet 260, Tego Wet 270, Dynol 980

# Starting Point and Basic Properties of Ancamine 2850

## 2 to 1 Volume Mix Ratio Formulation

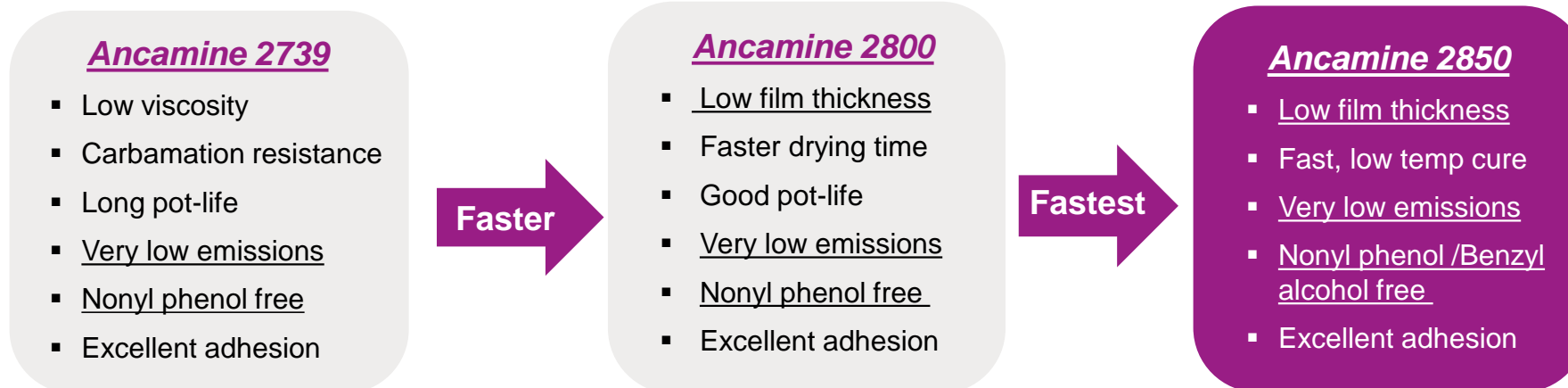
Part A		Form 1	Form 2
Epoxy Resin	Bis F resin	100.0	60.0
Epoxy Resin	Bis A resin		30.0
Reactive Diluent	Epodil 749		10.0
Air Release* (optional)		0.1 - 0.3	
Part B			
Ancamine 2850		42.3	43.3
Total parts		142.3	143.3
Technical data			
Mix ratio A/B	By wt.	2.36	2.31
	<b>By vol.</b>	<b>2.00</b>	<b>2.00</b>

\* Recommendations – Air release: Tego Airex 990, Tego Airex 944

Properties	Form 1	Form 2
Neat Viscosity @25°C (cPs)	542	542
Mix Viscosity @25°C (cPs)	1600	1200
Gel Time, 150g mass @ 25°C (min)	23	23
Thin film set time @ 22°C/10°C, phase 3 (hrs)	3 / 6	3.5 / 6.5
Permeance (3 <sup>rd</sup> party testing) ASTM E96 wet method	Not tested	

# Summary

- Three complementary curing agents provides the following benefits:
  - Low emission – EHS friendly
  - Excellent moisture vapor barrier under
    - Seamless flooring systems (e.g., epoxy terrazzo, epoxy/polyurea broadcast etc.)
    - Floor coverings (e.g., tile, vinyl, laminate, hardwood etc.)
  - Allow 30-35% less product with thinner coating to meet  $\leq 0.1$  perms rating
  - Fast return to service – one-day flooring
- Provide formulators versatility to choose a faster or slower system to meet specific requirements





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