

DTM Coatings Trends and Challenges: Closing the Performance Gap

June 12, 2019



Overview

- 1K water-based acrylic – DTM status
- Next generation: close the gap
- Formulation consideration: key factors
- Benchmark
- Conclusions

Water-based acrylics PROS & CONS

- ✓ Used in low end DTM.
 - ✓ Low VOC → Meet a market need.
 - ✓ Cost savings → High emissions = high cost.
-
- Water-based modified acrylics have limited wet adhesion.
 - Water-based modified acrylics don't match barrier properties of solventborne coatings.
 - Require controlled application conditions to perform at their best.

Water-based modified acrylics: typical performance

ASTM B117



100 μ m DFT, 216hr

Wet Adhesion

Aluminum



Galvanized



CRS



Next gen is needed to match market demand!

Next generation: close the gap

Key characteristics

- Outstanding adhesion (dry and wet)
- Consistent barrier properties
- Low VOC

Next generation: wet adhesion



Prototype A



Prototype B

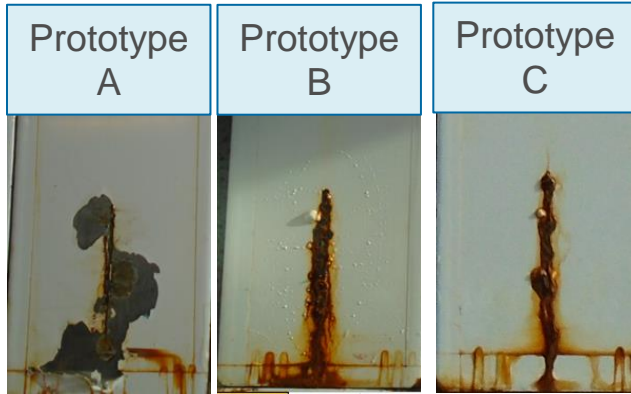


Prototype C

Wet-adhesion leverage factors:

- Monomer composition
- Functional monomers
- Surfactant

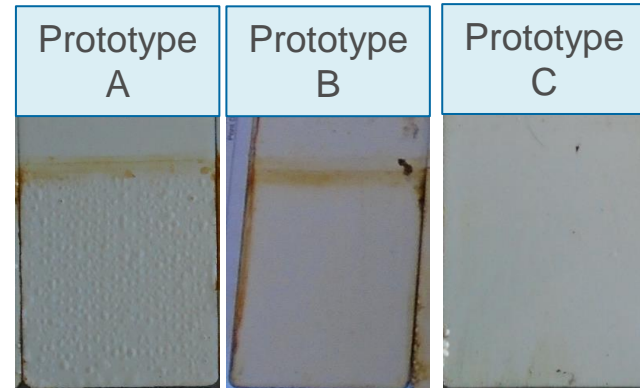
Next generation: barrier properties



Wet-adhesion leverage factors:

- Monomer composition
- Functional monomers
- Surfactant

Corrosion resistance.
NSST and Condensation
cabinet



Next generation binder: EPS[®] 595

- Solids: 50% NVM
- pH: 8-9
- Viscosity: <500 mPa.s
- MFFT: 22°C
- Recommended coalescent (on resin solids):
 - 7.5% Butyl cellosolve
 - 6.5% Dowanol DPM + 3% Dowanol DPnB or Texanol

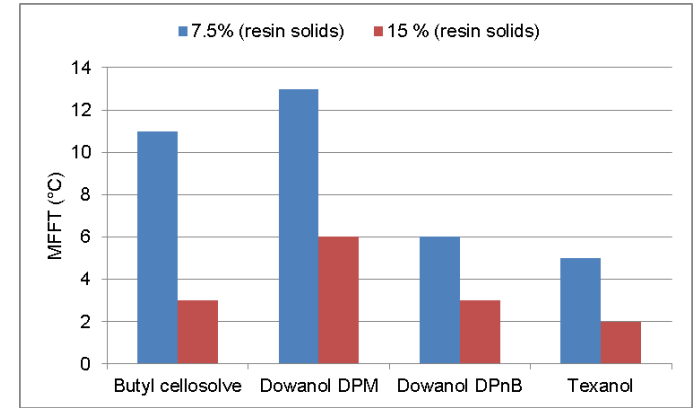
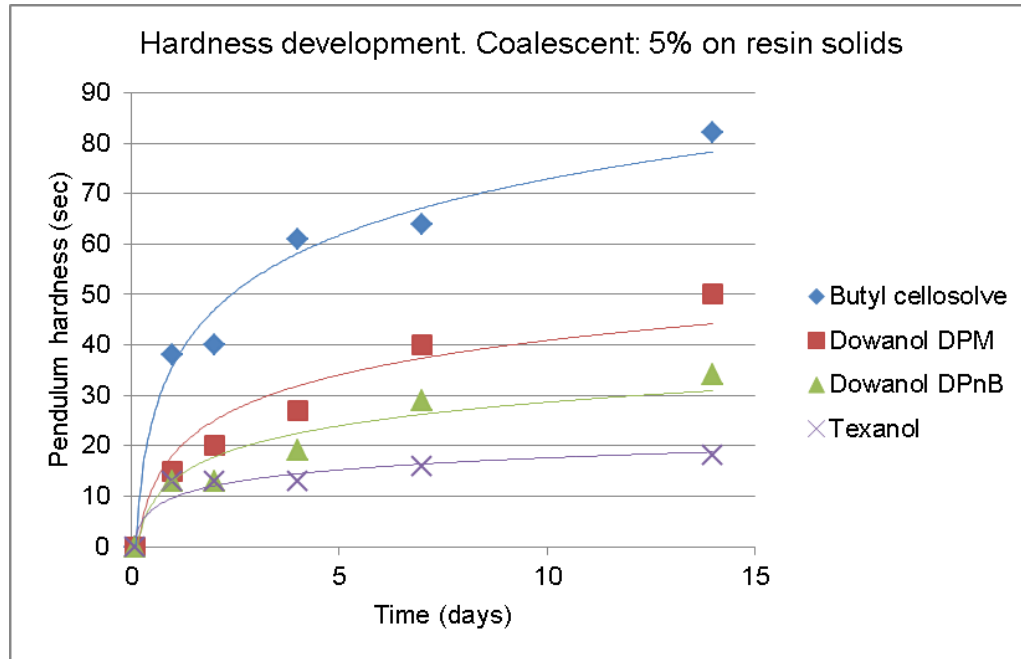
Formulation consideration

Key factors to meet the high expectations.

- Binder – EPS® 595
- Dispersing agent
- Anticorrosive additive

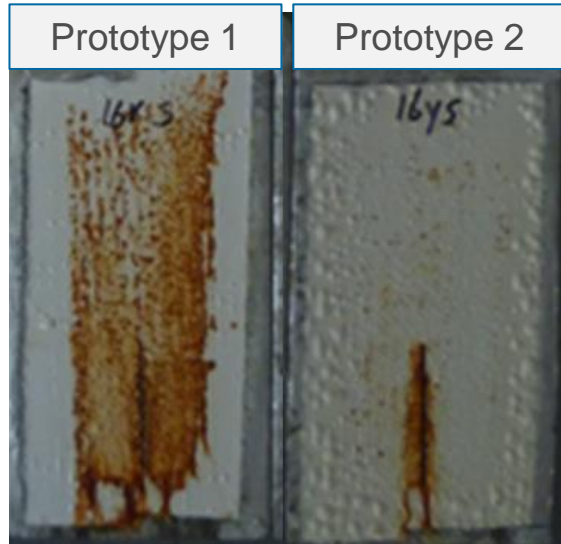


Formulation consideration: coalescent selection

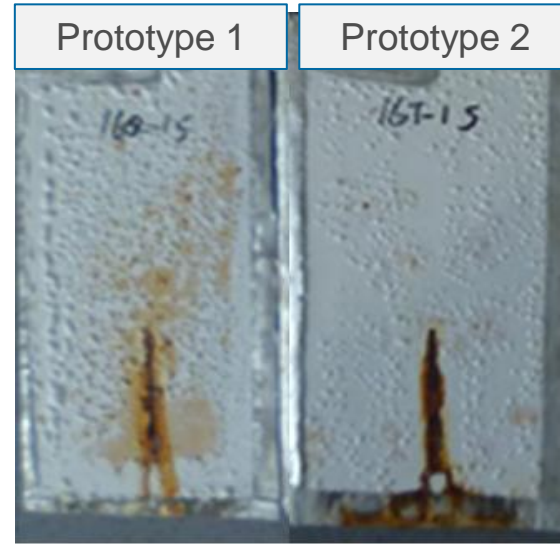
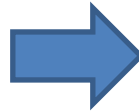


- Wide range of effective coalescent
- Short time hardness is critical

Formulation consideration: dispersing agent



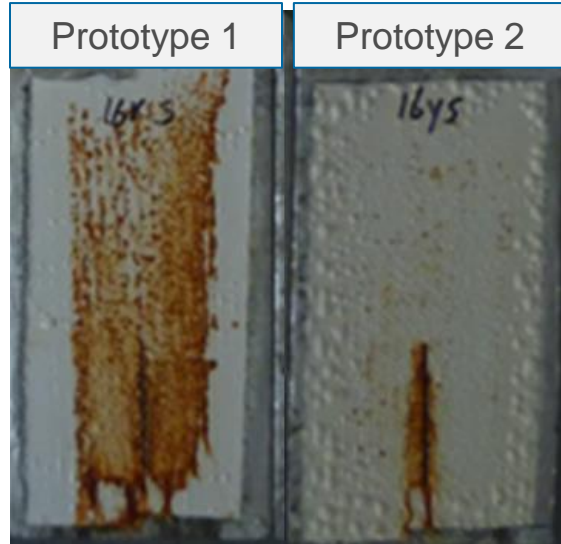
Hydrophilic dispersing agent
No anticorrosive additive



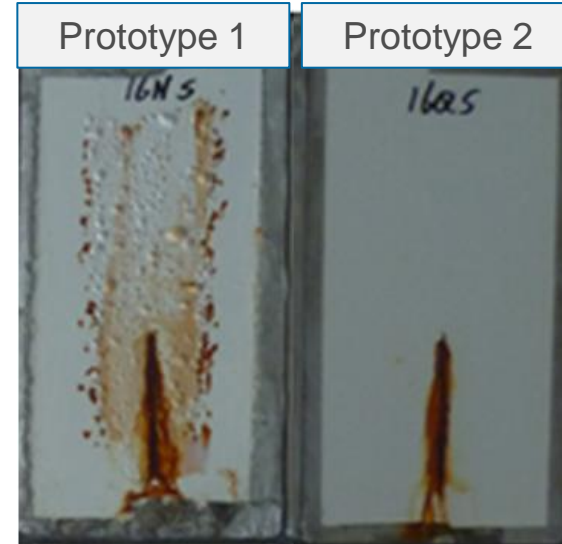
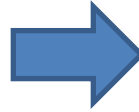
Hydrophobic dispersing agent
No anticorrosive additive

NSST, ASTM B 117. DFT: 100 micron. Curing cond.: 1 day RT + 3 days 50°C

Formulation consideration: dispersing agent



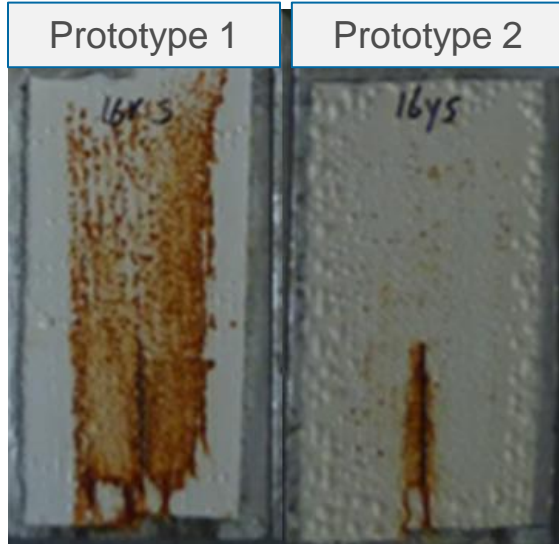
Hydrophilic dispersing agent
No additive



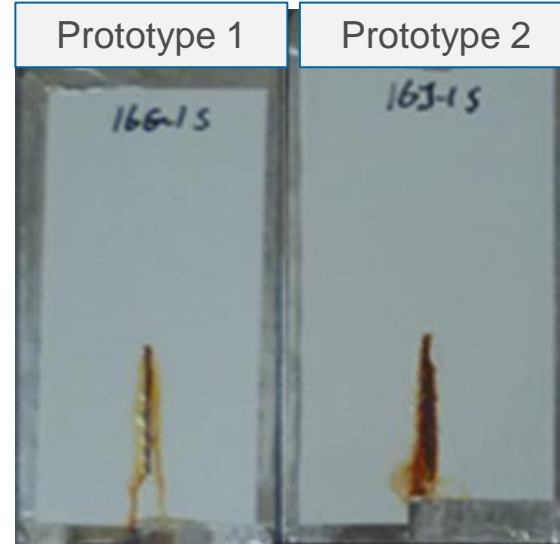
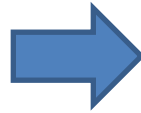
Hydrophilic dispersing agent
Anticorrosive additive

NSST, ASTM B 117. DFT: 100 micron. Curing cond.: 1 day RT + 3 days 50°C

Successful coating formulation



Hydrophilic dispersing agent
No anticorrosive additive



Hydrophobic dispersing agent
Anticorrosive additive

NSST, ASTM B 117. DFT: 100 micron. Curing cond.: 1 day RT + 3 days 50°C

Optimized formulation

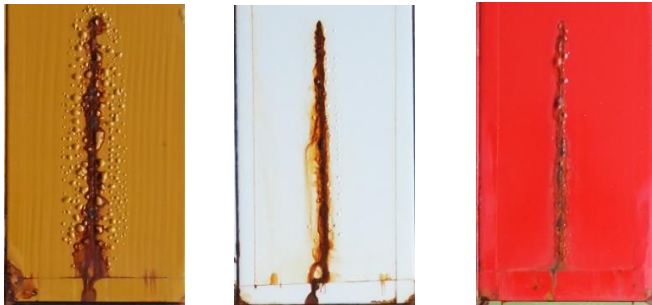
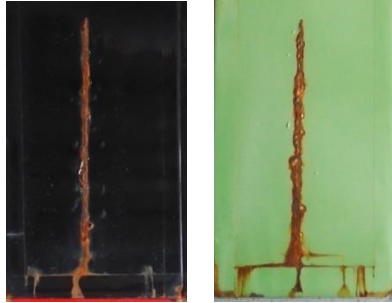
Raw Material		% weight
Water	-	2.70
PC Mull® GR 100	EPS	3.08
AMP 90	Eastman	0.20
Tegofamex 810	Evonik	0.10
Kronos 2190		18.50
TAFIGEL PUR 85	Munzig	0.35
deionized water	-	0.20
EPS® 595	EPS	62.00
Butyl Glycol	-	3.80
TAFIGEL PUR 85	Munzig	0.40
TAFIGEL PUR 64	Munzig	0.35
Tegofamex 800	Evonik	0.30
Asconium 143	Ascotec	2.40
Ascotran H10	Ascotec	0.30
Water	-	5.32
TAFIGEL PUR 85	Munzig	0.00
TAFIGEL PUR 64	Munzig	0.00
Total:		100.00

A good binder can perform poorly in a weak formulation.

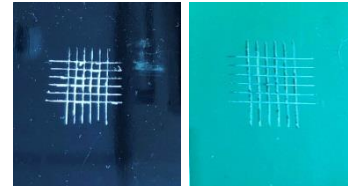
Broad metal protection

Robust formulation. Consistent wet-adhesion and barrier effect for good corrosion protection

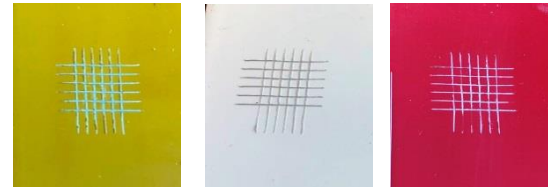
NSST
ASTM B 117



DFT: 100 micron. Curing cond.: 1 day RT + 3 days 50°C



Wet adhesion



DFT: 100 micron. Curing cond.: 7 days RT

Adhesion in different curing conditions

RM	Supplier	Formula		
		A	B	C
Demi-Water	-	10.20	9.70	8.70
Ammonia 18%	-	0.30	0.30	0.30
PC Mull® GR 100	EPS B.V.	4.70	4.70	4.70
Tego Foamex 810	Evonik Resourcance Efficiency GmbH	0.10	0.10	0.10
Kronos 2190	KRONOS Worldwide	10.80	10.80	10.80
Fintalc M15	Mondo Minerals	7.70	7.70	7.70
Durcal 2	Omya	6.00	6.00	6.00
TAFIGEL PUR 85	Munzig	0.30	0.30	0.30
Demi-Water	-	0.30	0.30	0.30
Ethyldiglycol	-	2.90	2.90	2.90
Tafigel Pur 48	Munzig	0.40	0.40	0.40
EPS® 595	EPS B.V.	50.50	50.50	50.50
Byk 345	BYK Chemie	0.30	0.30	0.30
Tego Foamex 800 (1:1 in water)	Evonik Resourcance Efficiency GmbH	0.60	0.60	0.60
Asconium 143	Ascotec	2.30	2.30	2.30
Ascotran H10	Ascotec	1.00	1.00	1.00
Texanol		1.50	2.00	3.00
Mergal 721 K3		0.10	0.10	0.10
		100.00	100.00	100.00

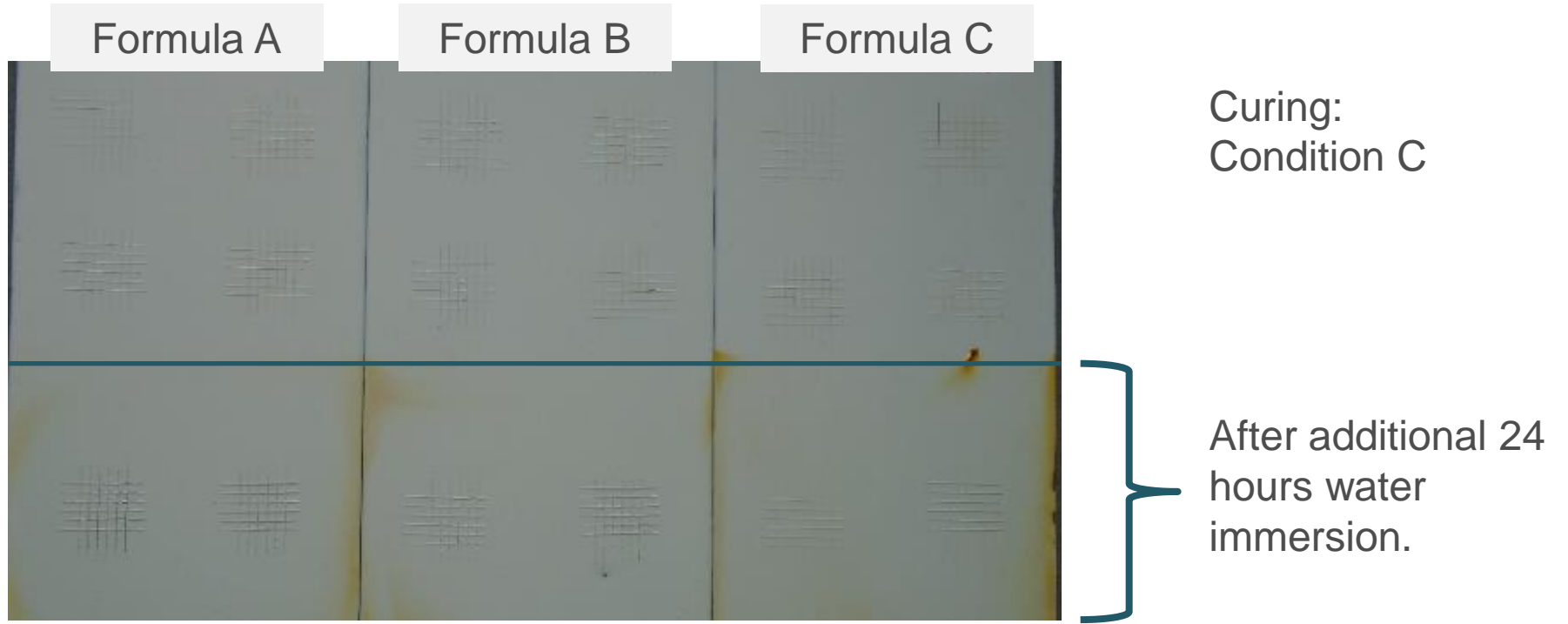
- Low PVC primer ~ 23.5%
- Solids w/w ~ 51%
- Solvent/binder solid ratio
 - a. Formula A ~ 17.4%
 - b. Formula B ~ 19.4%
 - c. Formula C ~ 23.3%

Adhesion in different curing conditions

Curing cycle	Flash off	Drying	Curing
Condition A	RT - 10 min	40°C - 45 min	RT - 6 hours
Condition B	RT - 10 min	RT - 1 day	50°C - 3 days
Condition C	RT - 10 min		15°C - 2 days

	Condition A		Condition B		Condition C	
	Dry	Wet	Dry	Wet	Dry	Wet
Formula A	0	0	0	0	0	0
Formula B	0	0	0	0	0	0
Formula C	0	0	0	0	0	0

Adhesion in different curing conditions




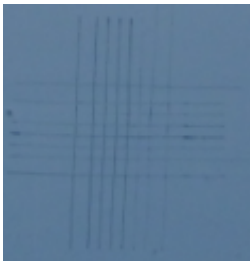
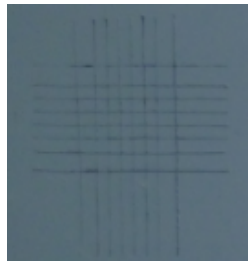



Curing:
Condition C

After additional 24
hours water
immersion.

Benchmark vs standard modified acrylics for DTM

Wet adhesion

	Aluminum	Galvanized	Cold Rolled Steel (S)
Benchmark			
EPS® 595			

Unique dry and wet adhesion on multiple metal substrates

DFT: 100 micron. Curing cond.: 7 days RT

Benchmark vs standard modified acrylics for DTM

Wet adhesion

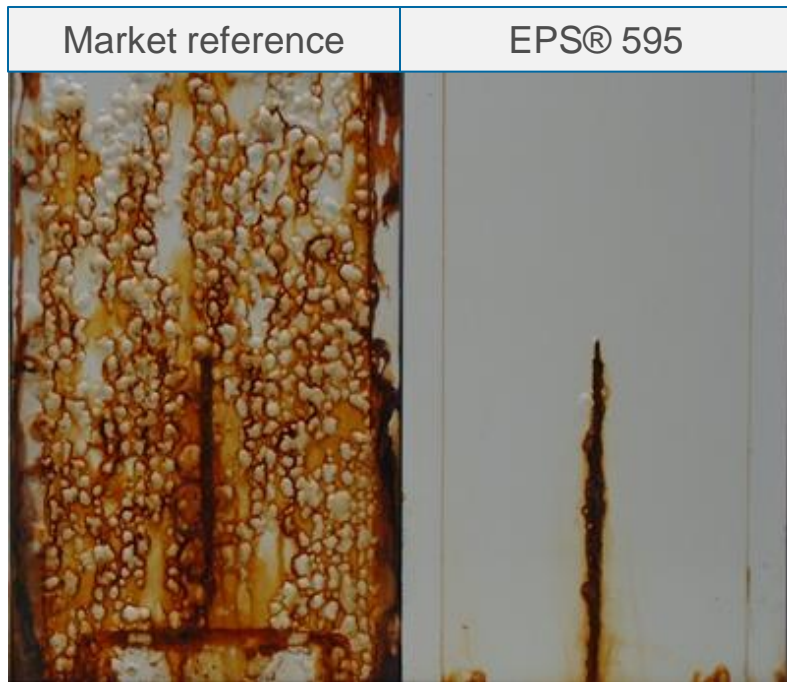
Consistent dry and wet adhesion.

	T-EPS 595		Best-competitor		Market -Average	
	Dry	Wet	Dry	Wet	Dry	Wet
CRS	0.5	0.5	0.5	0.5	1	1.5
Galv.	1	1	1	1.5	1	2
HDG	0.5	0.5	2	3	2	3
Aluminum	0.5	0.5	1	1	3	3

- Wet adhesion is in general problem.
- Most difficult substrates are galvanized and aluminum

Benchmark vs standard modified acrylics for DTM

Barrier properties



DFT: 100 micron

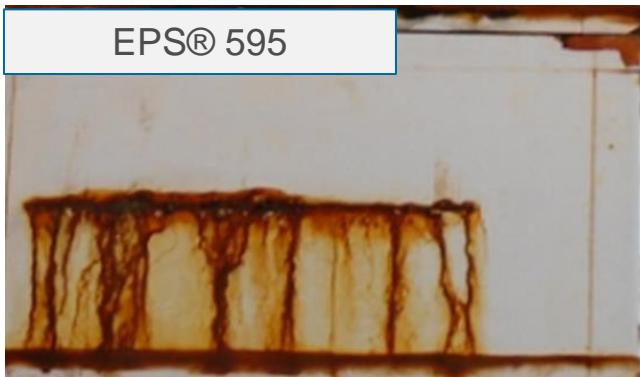
NSST ASTM B 117
1000 hours exposure

Curing cond.: 1 day RT +
3 days 50°C

NB: > 300 h Salt spray
ASTM B117, C3

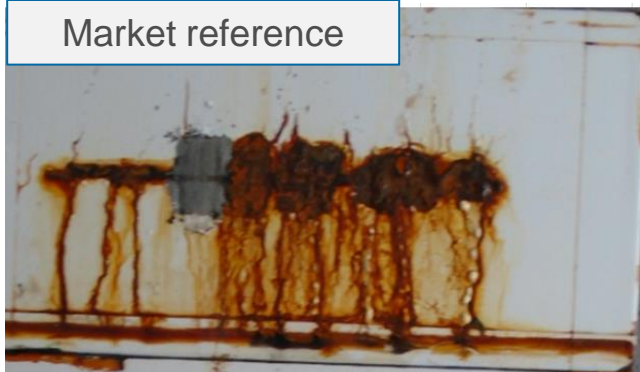
Benchmark vs standard modified acrylics for DTM Barrier properties

EPS® 595



Corrosion from scratch < 1
mm after 512 hr salt spray

Market reference



Corrosion from scratch > 1
mm after 216 hr salt spray

NSST, ASTM B 117. DFT: 100 micron. Curing cond.: 1 day RT + 3 days 50°C

Conclusions

EPS® 595 closes the gap between water-based acrylics and solventborne technologies in DTM segment.

- Outstanding wet adhesion on multiple metal substrates.
- Barrier effect.
- Long lasting corrosion protection (100 micron DFT required).
- Covers a wide range of curing conditions.

Conclusions

Samples?

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QUESTIONS?

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