ENGINEERED POLYMER SOLUTIONS

Science Simplified

ADH-Free Water Based Binder for Lasure Coatings - EU Ecolabel Compliant

Massimo Longoni

European Coating Show 2017 Conference

03rd /04th April 2017 Nuremberg - Germany

AGENDA

- **EU Ecolabel, background and facts**
- Why adipic acid dihydrazide (ADH)?
- New development → 1-to-1 substitution
- Comparative study → lasure formulations
- Summary

EU Ecolabel scheme
Voluntary award

- Introduced in 1982 (Regulation (EC) 1980/2000) - Implemented in 2009 (Regulation (EC) 66/2010)
- > 44000 products & services involved (Sep. 2015)
- Paints & varnishes category - Commission Decision 2014/312/EU - counts 10% ca. of total number of awards (Sep. 2015)
- Key points: Voluntary
  Focus on environmental impact (hazardous content) and life cycle (durability)
  Visual label for consumers

AGENDA

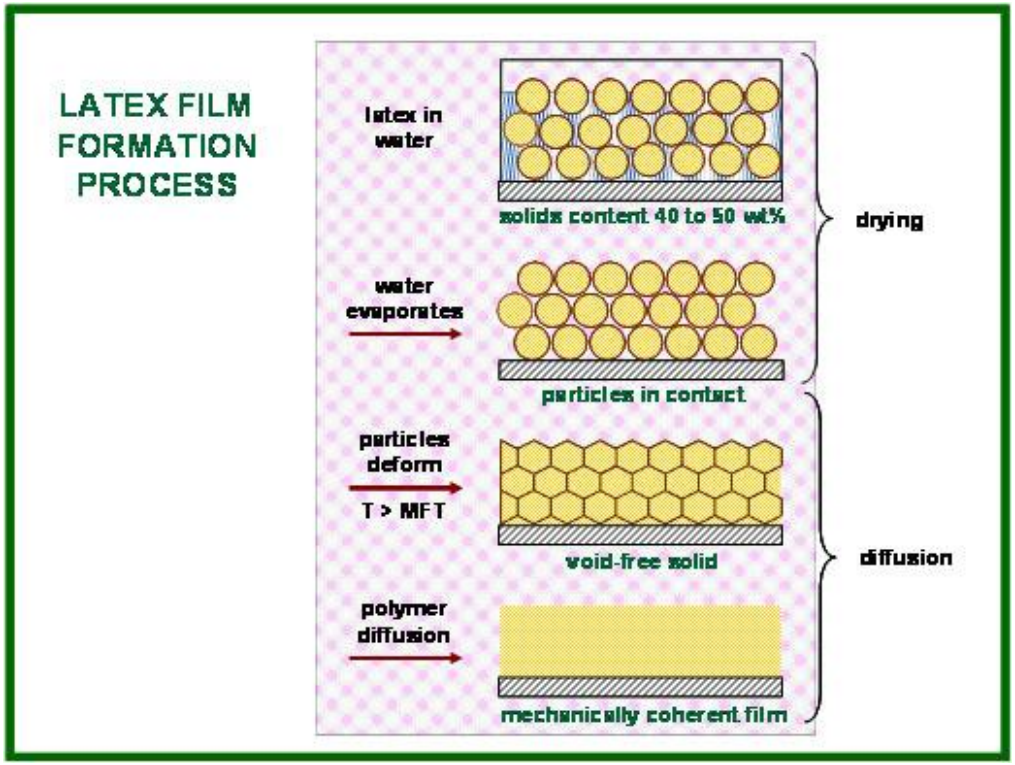
ENGINEERED POLYMER SOLUTIONS

Science Simplified

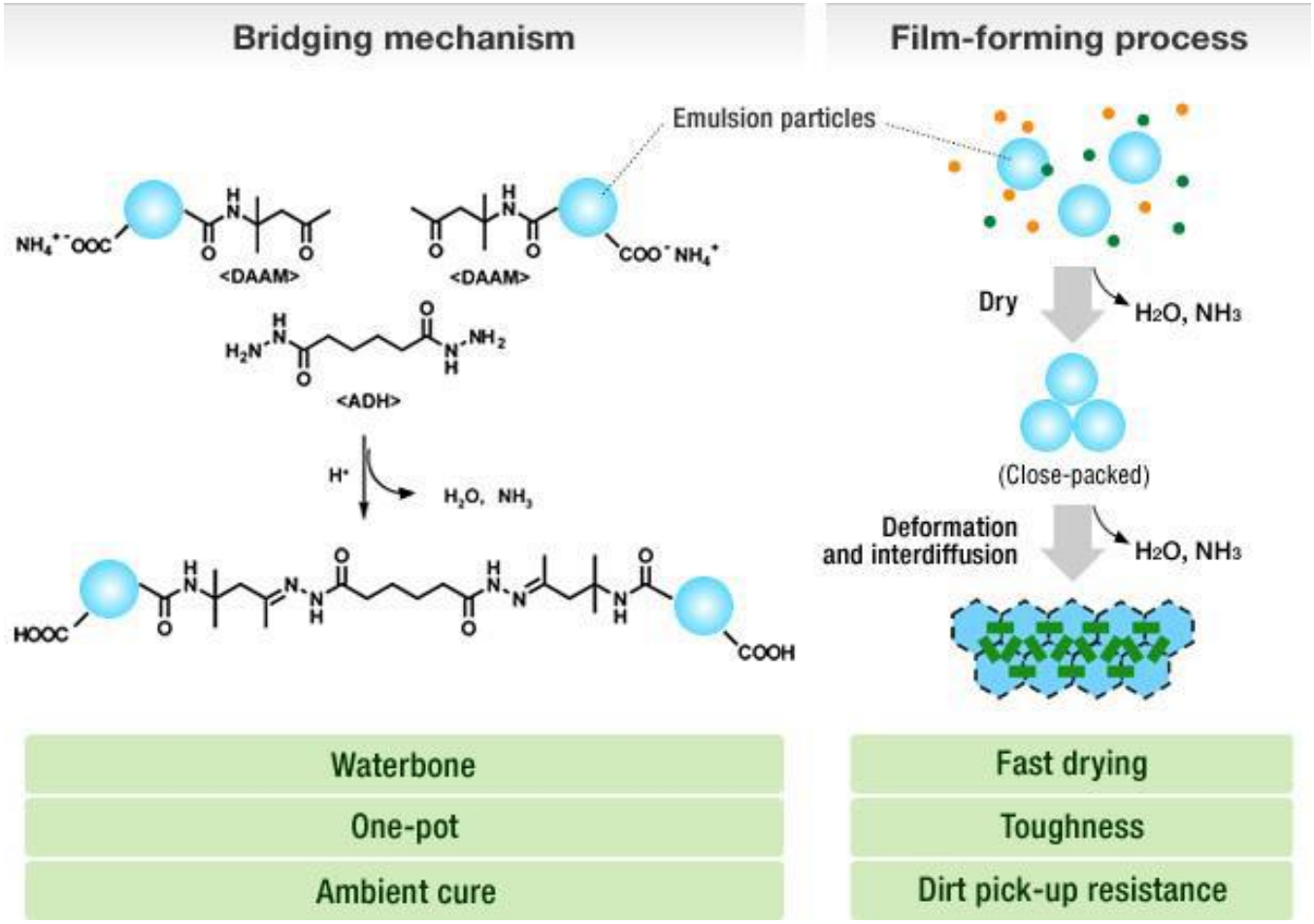
- EU Ecolabel, background and facts
- **Why adipic acid dihydrazide (ADH)?**
- New development → 1-to-1 substitution
- Comparative study → lasure formulations
- Summary

Why is ADH used in water based binders?
Room temperature curing

- Polymers designed with Tg = 0-20 °C
  - Good film formation but,
  - Leads to blocking
  - Low water resistance
- Solution: Post cure films
  - Preferably with 1K system



Crosslinking mechanism
Room temperature curing



Reference: http://www.khneochem.co.jp/en/rd/technology/daam/

ADH is hazardous to the environment
New crosslink solutions are needed

ENGINEERED POLYMER SOLUTIONS
eps Science Simplified

- Chronic category 2 – hazard statement H411
- Ecolabel threatened
- On March 16, 2016 the commission has derogated ADH since no alternative is feasible
- Up to 1% ADH can be used

AGENDA

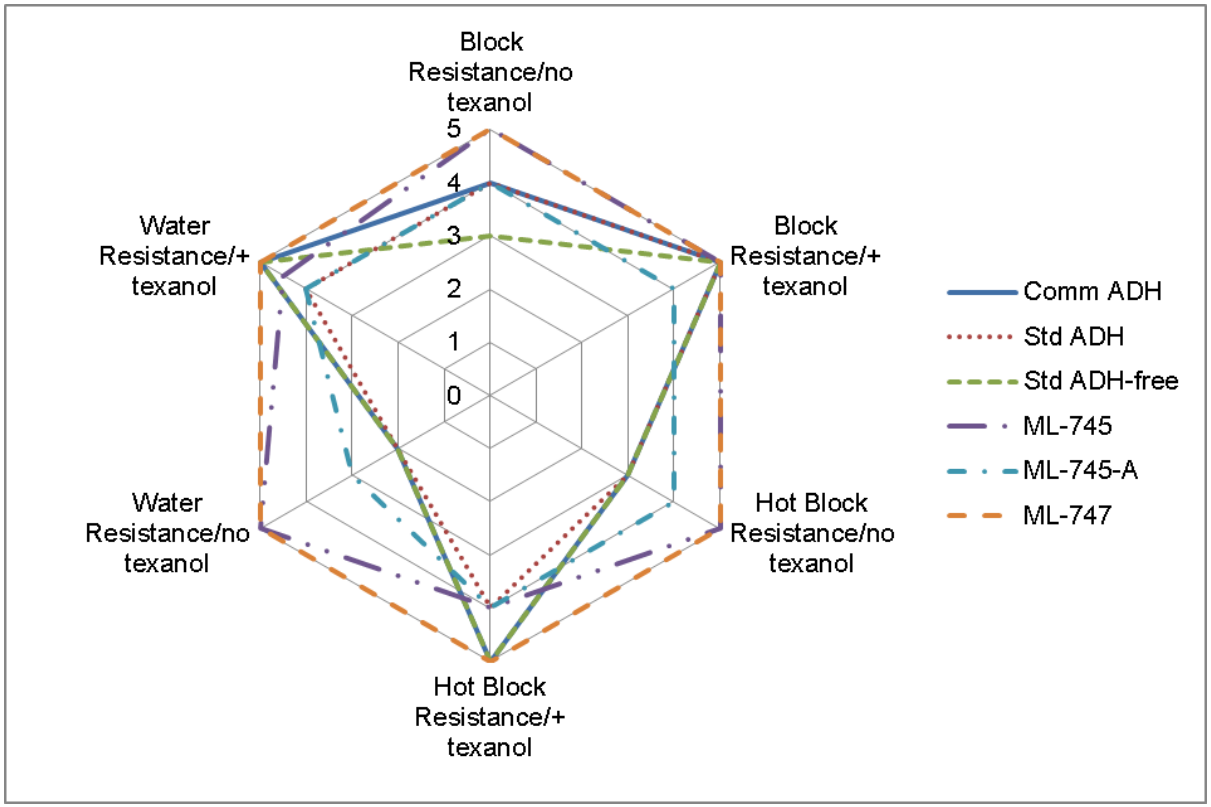
- EU Ecolabel, background and facts
- Why adipic acid dihydrazide (ADH)?
- **New development → 1-to-1 substitution**
- Comparative study → lasure formulations
- Summary

Development aim
1-to-1 substitution of ADH containing binder

- 1K crosslinkable binder
- Two phase polymer, optimized monomer composition
- Comparable properties to ADH in respect to:
  - Block resistance
  - Water resistance
- 0 VOC – improve vs standard

All screening tests done on binder with and without solvent

New Acrylic Polymer
Multiple options



	Cross-linker
Comm ADH	√ (ADH)
Std ADH	√ (ADH)
Std ADH-free	×
ML-745	√
ML-745-A	√
ML-747	√

New AC → no coalescing agent required

AGENDA

- EU Ecolabel, background and facts
- Why adipic acid dihydrazide (ADH)?
- New development → 1-to-1 substitution
- **Comparative study → lasure formulations**
- Summary

Comparative study
Lasure formulation

	ML-19-E	ML-39-D
ML-745	50	
ML-747		50
Defoamer	0.40	0.40
Deareator	0.50	0.50
Substrate wetting agent	0.20	0.20
Neutralising agent	0.10	0.10
Texanol	1.00	1.00
UV absorber	1.00	1.00
Water	45.40	45.40
Slip agent	0.20	0.20
In-can preservative	0.10	0.10
Pseudoplastic HEUR thickener	0.40	0.40
Newtonia HEUR thickener	0.70	0.70
	100	100

- Low VOC (possible to formulate 0 VOC)
- Low solids (23%)
- Test vs commercial lasures: Ref. A, Ref. B (glossy, low solids – 23/24%)
- Compare: block resistance, adhesion, weathering resistance and gloss retention in accelerated test and natural exposure

Block Resistance
Room and high temperature

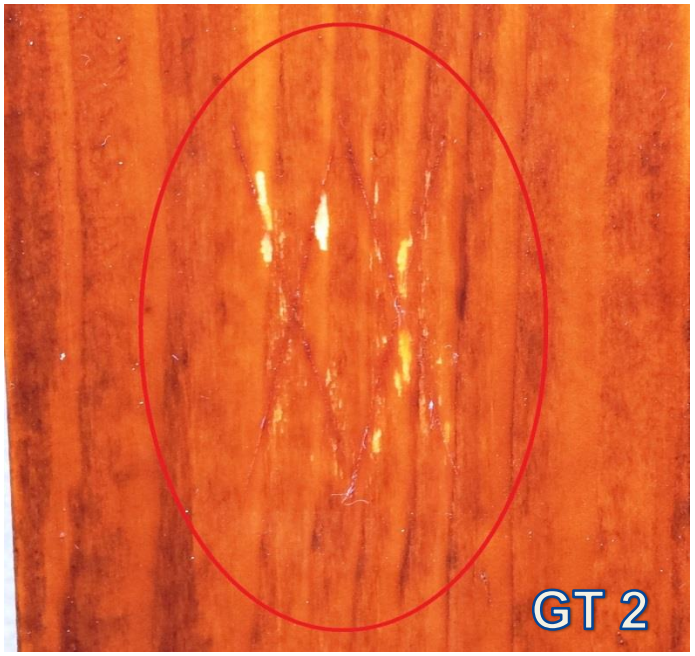
ML-19-E

Ref. A

1 hour @ 50°C	Ref. A	Ref. B	ML-19-E	ML-39-D
Block pressure - (1kg * 1 cm2)	5A	5B	5A	5A
24 hours @ RT	Ref. A	Ref. B	ML-19-E	ML-39-D
Block pressure - (1kg * 1 cm2)	5A	5A	5A	5A

Optimal block and hot block resistance

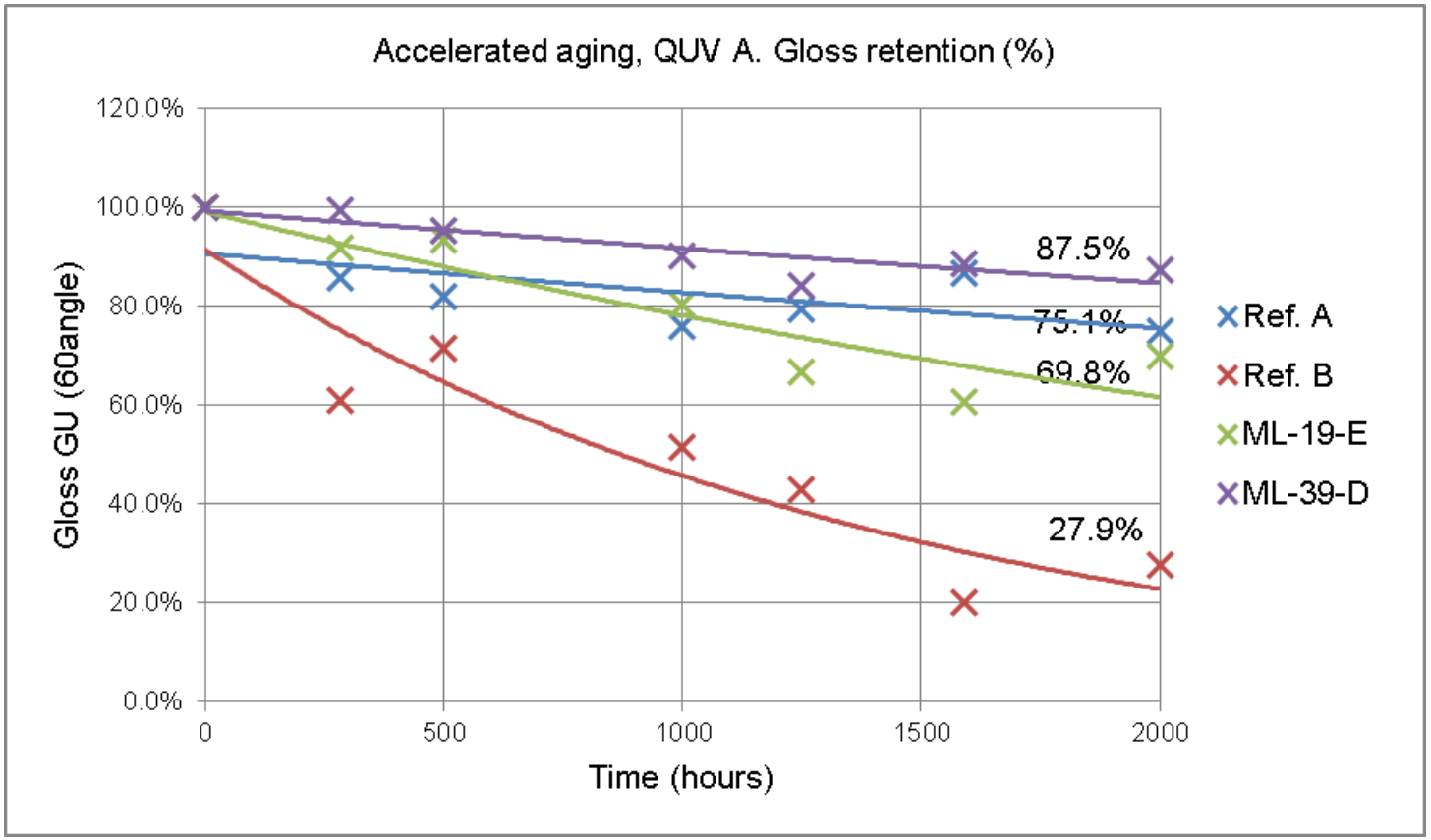
Adhesion
Dry and wet



	Dry Adhesion	Wet Adhesion
Ref. A	GT 0	GT 0
Ref. B	GT 0	GT 2
ML-19-E	GT 0	GT 0
ML-39-D	GT 0	GT 0

Perfect adhesion!

QUV A Gloss retention
Comparable performance to ADH/polymers



Top gloss retention

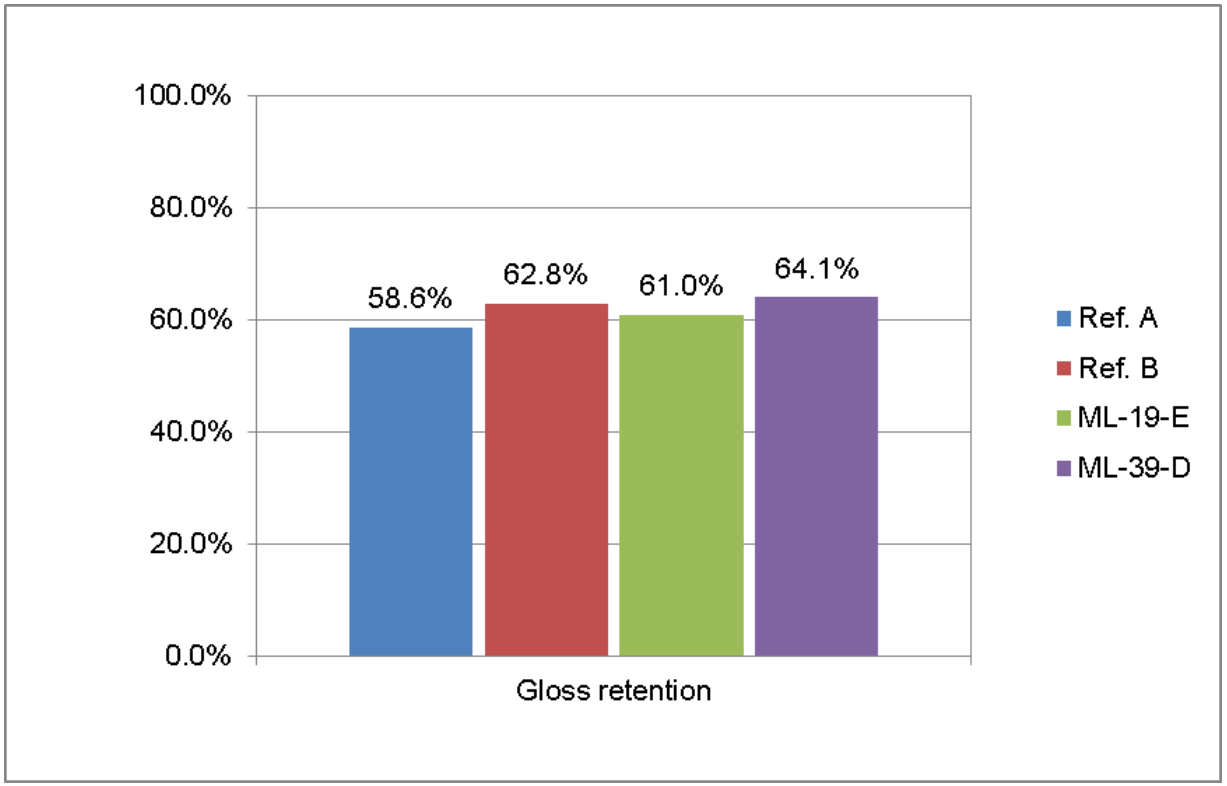
Natural exposure
Good shape after one year on a test fence

ML-19-E | ML-39-D | Ref. A | Ref. B

No failure, delamination, flanking or cracking!

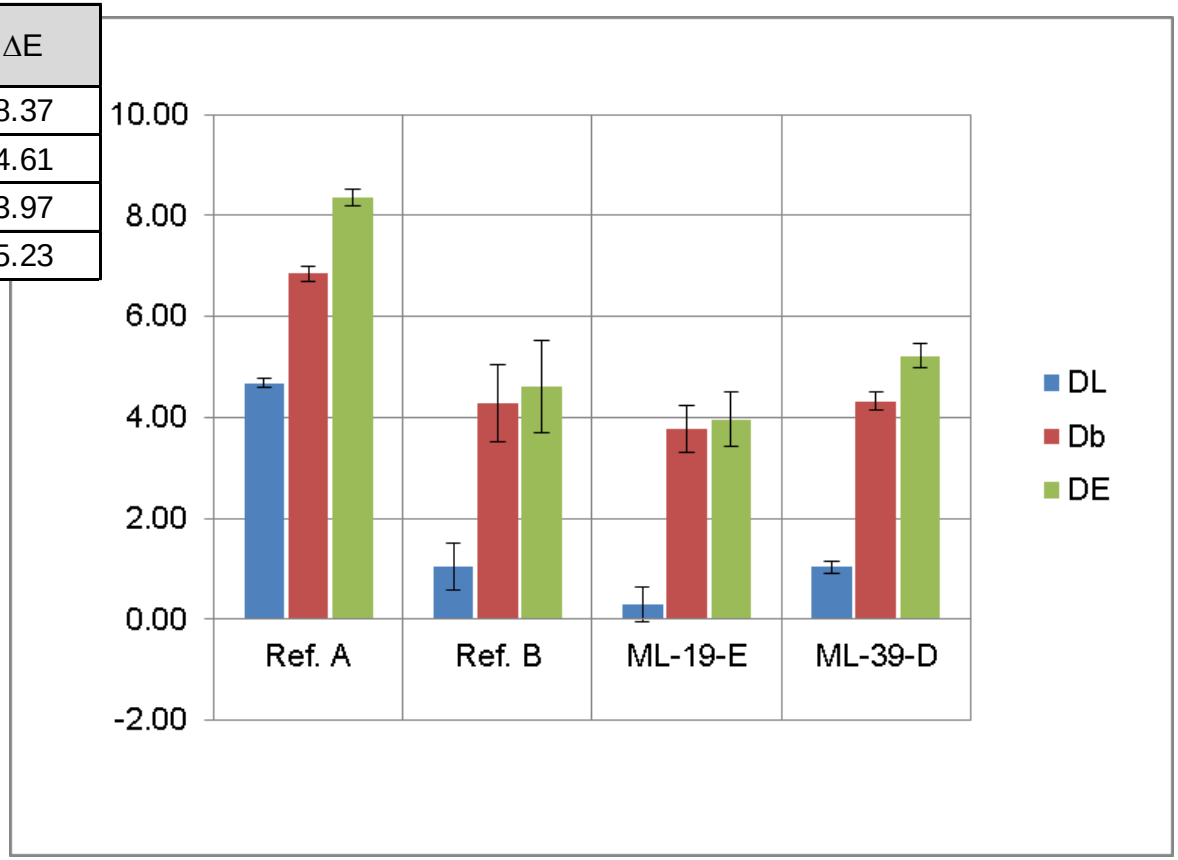
Natural exposure
One year gloss retention equal to std. lasures

	Gloss retention
Ref. A	58.6%
Ref. B	62.8%
ML-19-E	61.0%
ML-39-D	64.1%



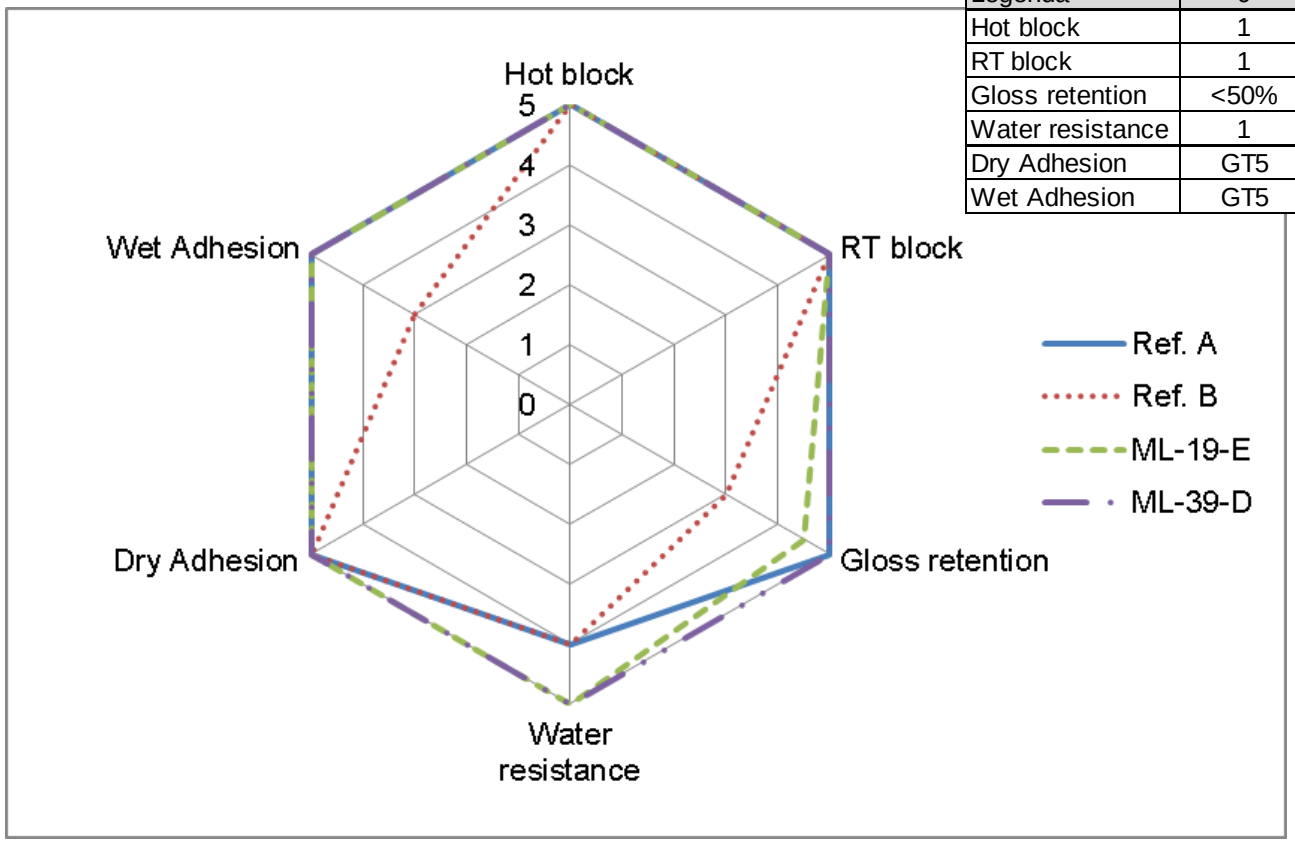
Natural exposure
Discoloration

	ΔL	Δb	ΔE
Ref. A	4.68	6.85	8.37
Ref. B	1.05	4.29	4.61
ML-19-E	0.30	3.78	3.97
ML-39-D	1.04	4.32	5.23



Full comparison
Complete picture

Legenda	0	→	5
Hot block	1	to	5
RT block	1	to	5
Gloss retention	<50%	to	>80%
Water resistance	1	to	5
Dry Adhesion	GT5	to	GT0
Wet Adhesion	GT5	to	GT0



ML-19-E and ML-39-D good as commercial lasures or, even, better

AGENDA

- EU Ecolabel, background and facts
- Why adipic acid dihydrazide (ADH)?
- New development → 1-to-1 substitution
- Comparative study → lasure formulations
- **Summary**

Summary

- Lasure formulations ML-19-E and ML-39-D equal or outperform commercial standards
- ML-745 and ML-747, both ADH-free, are suitable for Architectural exterior wood segment (varnish and lasure)
- Cross-linkable two-phase polymers ADH-free
- ML-745 and ML-747 are Ecolabel compliant binder without the hazard statement H411
- No trade-off between life span and environmental impact

Acknowledgements
R&D synthesis work

- ✓ Dr. Andrew Hearley[$] – EPS B.V. (Engineered Polymer Solutions)
- ✓ Emile Stevens – EPS B.V. (Engineered Polymer Solutions)
- ✓ Ibrahim Kemikkiran – EPS B.V. (Engineered Polymer Solutions)

$ - Dr. Hearley moved to The Valspar Corporation

Do you have questions? Contact me …

- ✓ Massimo Longoni – EPS B.V. (Engineered Polymer Solutions)

massimo.longoni@eps-materials.com

or Visit us at European Coating Show 2017 - Hall 7, Stand 356N