

WATERBORNE PUDS FOR WOOD

Customer Summit 2021



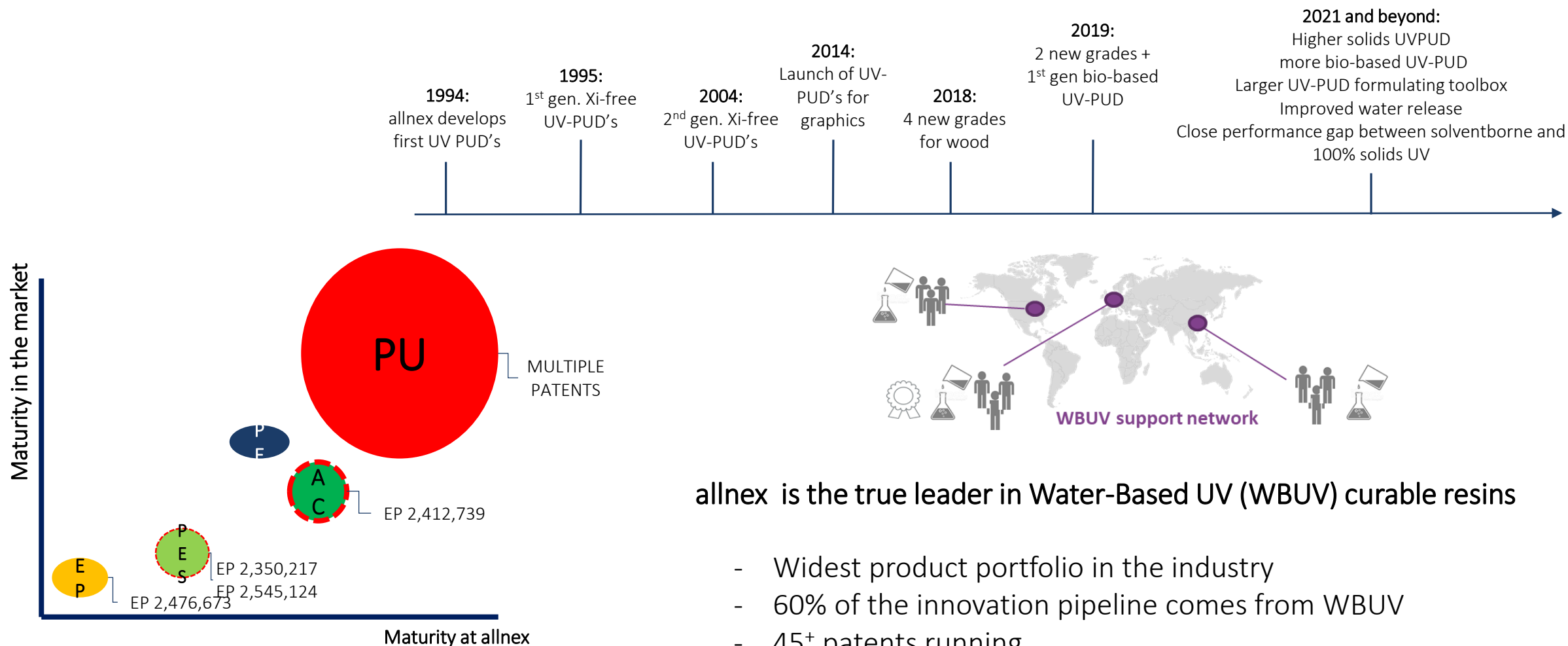
Marcus Hutchins and Kurt Willard



www.allnex.com

allnex
The Coating Resins Company

allnex, committed to the waterborne UV technology



allnex is the true leader in Water-Based UV (WBUV) curable resins

- Widest product portfolio in the industry
- 60% of the innovation pipeline comes from WBUV
- 45+ patents running
- Leader with 30% market share

[Figure] Positioning of the WBUV polymer backbones as a function of estimated market size and technology maturity (PU = polyurethane; PE = polyether; AC = acrylic; EP = epoxy; PES = polyester & alkyd)

Why product usage is growing globally?

WBUV combines:

Environmental & VOC benefits over solvent-based systems

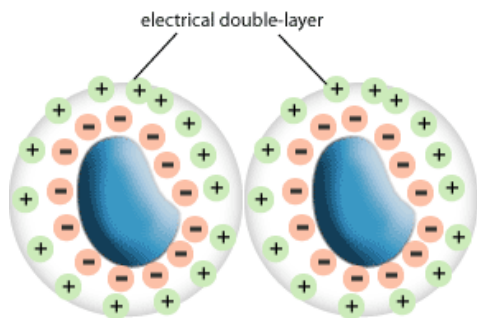
Productivity & performance benefits over water-based systems

Complementary attributes & features over 100% UV systems

[Idealized chemical structure of telechelic UV-PUD's]

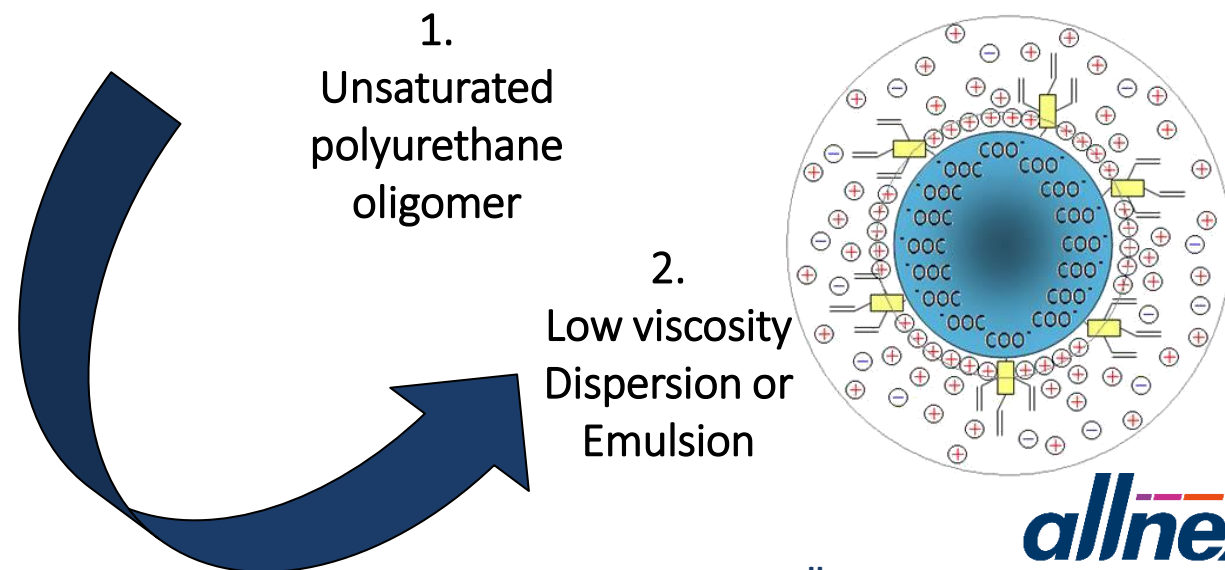
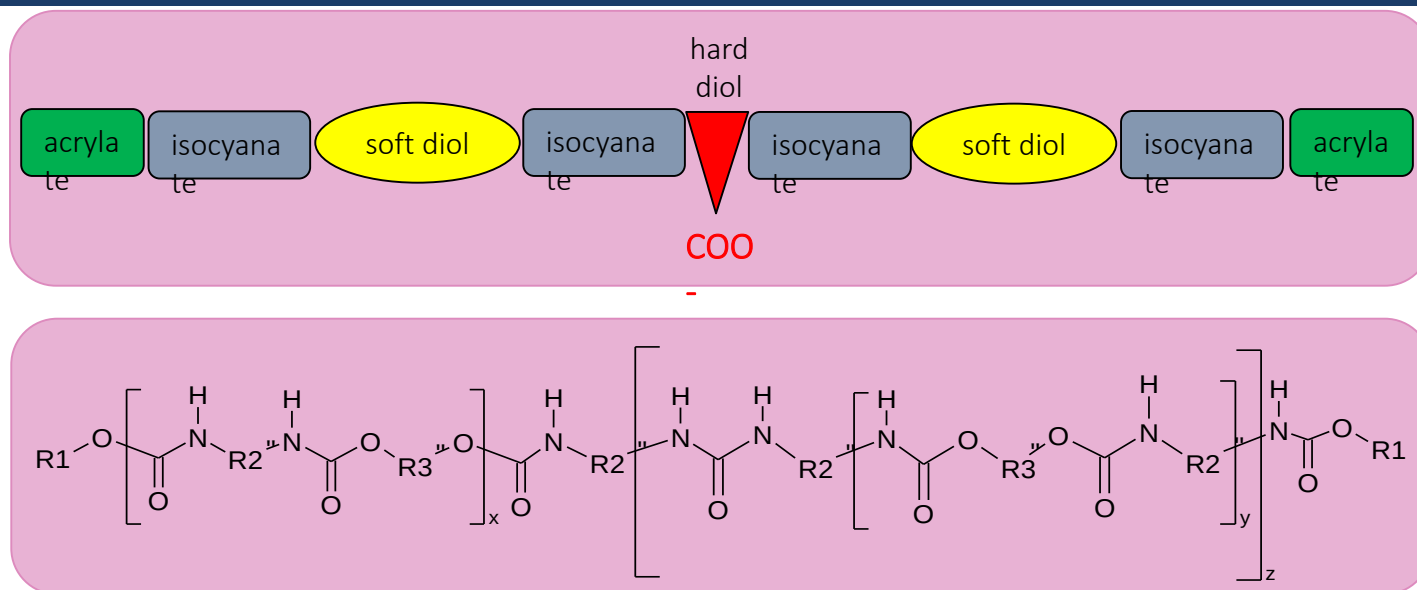
- **Thermodynamically unstable : $\Delta G_f^0 > 0$**

- ✓ Creation of new interfaces makes the dispersion less stable



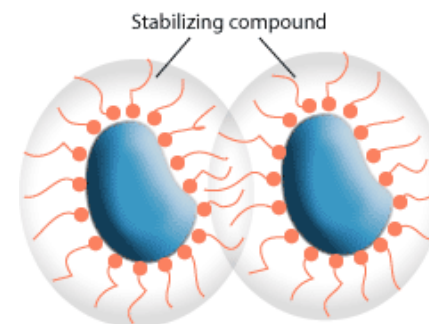
- **Kinetically stable : $E_{act} \gg kT$**

- ✓ Energy barrier from ionic or steric repulsion between particles
- ✓ Avoids particle irreversible aggregation from Brownian energy
- ✓ Resists thermal, mechanical & chemical stresses



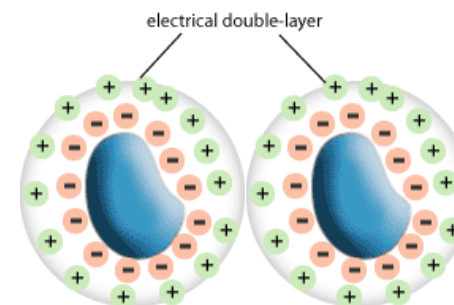
[Fundamentals of polymer colloid stabilization in water]

LOW MOLECULAR WEIGHT EMULSION	TYPE	Internal	External	Mixed
	Anionic		X	
	Nonionic		X	
	Cationic			



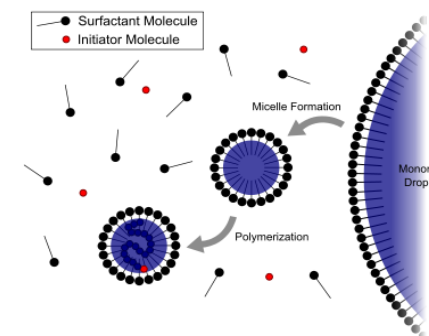
[EMULSION]

HIGH MOLECULAR WEIGHT DISPERSION	TYPE	Internal	External	Mixed
	Anionic	X		
	Nonionic	X		
	Cationic			



[DISPERSION]

(MINI) EMULSION POLYMERIZATION	TYPE	Internal	External	Mixed
	Anionic			X
	Nonionic			X
	Cationic			



[EMULPOL]

Forming a Film

- [The importance of complete drying for best coating performance]

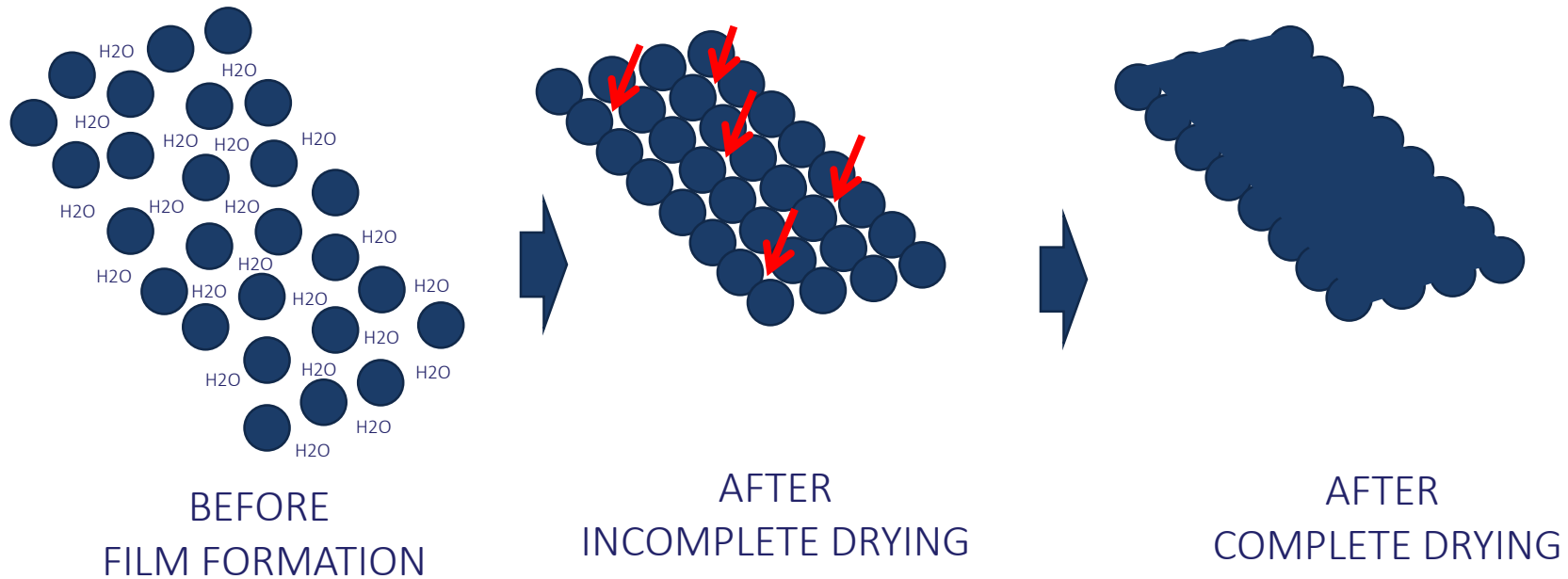


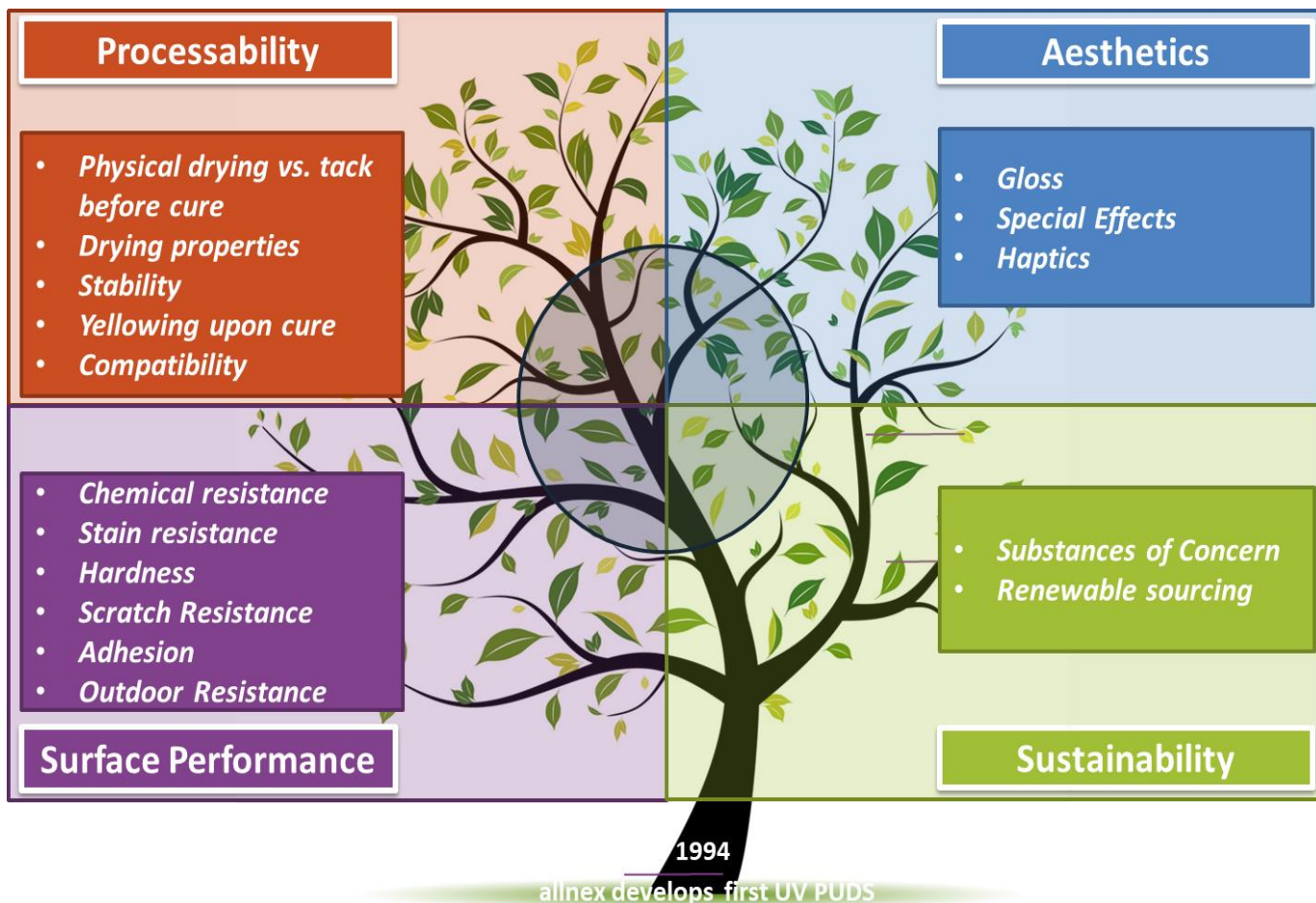
Figure: the film formation of a polymer dispersion happens in 4 distinct steps; the incomplete coalescence of the particles leaves micro-cavities and micro-channels that allow water to penetrate and affect coating clarity & adhesion especially after hot water immersion

<http://www.formulaction.com/en/microrheology/coatings-drying>

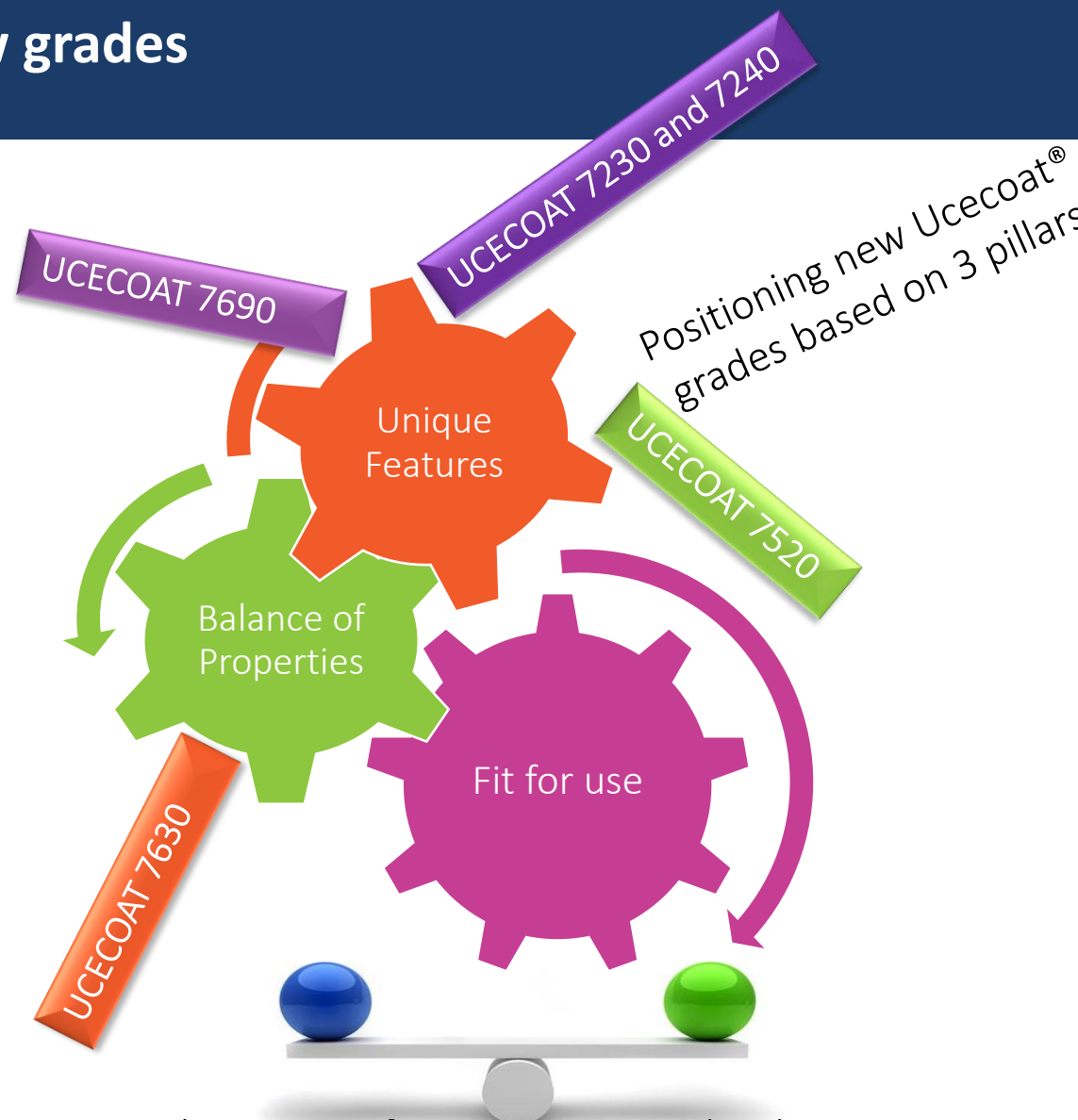
Blending Rules for UV PUD

- KEEP pH > 7 but <8.5
- DO NOT ADD ACIDS
- DO NOT ADD CATIONIC DISPERSIONS / ADDITIVES
- DO NOT ADD SALTS

allnex' innovation in WBUV and positioning of new grades



4 key dimensions that drove allnex' WBUV expansion



Balancing performance across the dimensions

AND... Cost Effective!
www.allnex.com

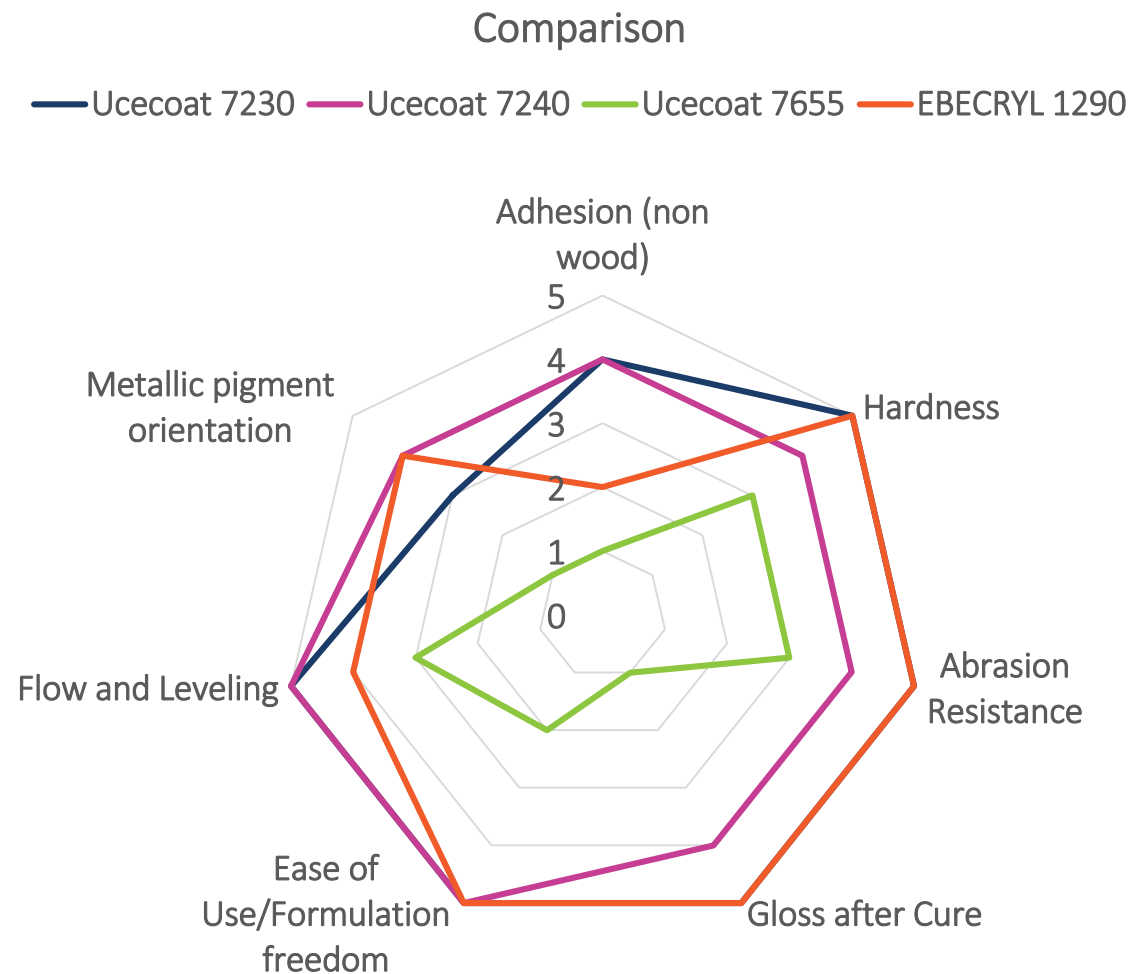
allnex
The Coating Resins Company

UCECOAT® 7230 (TSCA) and 7240 (not on TSCA or DSL): Hardcoats

- UCECOAT 7230 and 7240 are aliphatic polyurethane dispersion based on the concept of swollen particles resulting in stable and easy to use product with high performance after cure
- Specifically designed to bridge the performance gap between 100% solids and solventborne UV curable hardcoats
- Offers hardness, abrasion resistance, high gloss, and DOI after cure that is comparable to 100% and solventborne hexaacrylates
- UCECOAT 7230 and 7240 has good compatibility with conventional WB resins for boosting other performance properties such as adhesion to variety of substrates metal and glass



UCECOATS 7230 and 7240 offer high gloss and DOI, excellent hardness, abrasion resistance, and excellent compatibility with conventional acrylics without the brittleness of highly functional acrylates



UCECOAT® 7230 (TSCA) and 7240 (not on TSCA or DSL): Performance

- WBUV resins can be limited for plastics applications due to the challenging performance requirements on plastics and their adhesion.
- **UCECOAT 7230 and 7240** offers excellent adhesion to wood and variety of plastics such as PC, PC/ABS and ABS, and achieves outstanding performance on humidity resistance, scratch resistance and compatibility of different pigments.



		UCECOAT 7240	UCECOAT 7230	EBECRYL 1290
Hardness – Scratch/Abrasion	Persoz Hardness (seconds)	280	310	330
	Taber Haze 100 cycles (%)	6	4	5.7
	300 cycles (%)	11	5	10.2
	500 cycles (%)	15	7	13.3
	Steel wool 10 Double rubs (0=BAD; 5=GOOD)	3	5	5
Stain Resistance Testing	Water (24h)	5	5	5
	Coffee (16 h)	5	5	5
	Eosine 2% in H ² O (16h)	4	5	5
	Iso-betadine (16h)	4	4	5
	EtOH (50%) (16h)	5	5	5
	Mustard D&L (16 h)	2	5	5
	Mustard USA (6 h)	1	5	5
	Ketchup Heinz (16 h)	5	5	5
	Marker Artline 70N black (5 min)	5	5	5

UCECOAT 7520 (PMN Filed, DSL listed): Fit-for-use UV PUD for Industrial Wood Applications

- UCECOAT 7520 is a **Tin-free** fit-for-use UV PUD with an overall balance of properties.
- Ideal for applications requiring color accuracy and short drying times, UCECOAT 7520 combines an excellent water release with low yellowing upon cure for simplified color matching.
- Product highlights:

Low Yellowing on Cure

- Simplified quality control and lower rejects rates and color related complaints for the coater

Outstanding Hardness

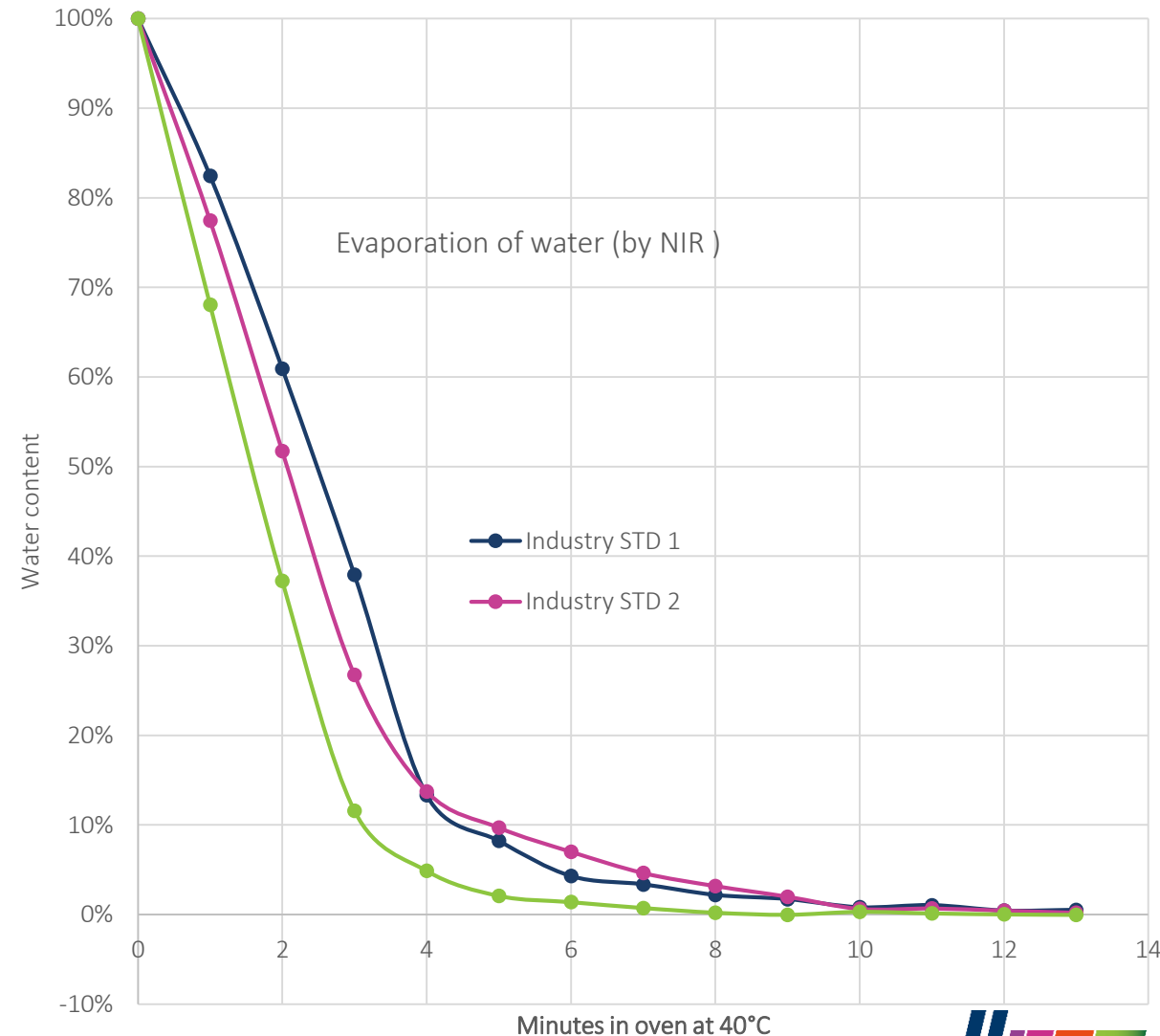
- Exceed cabinets and furniture manufacturing industry specifications

Good Water Release

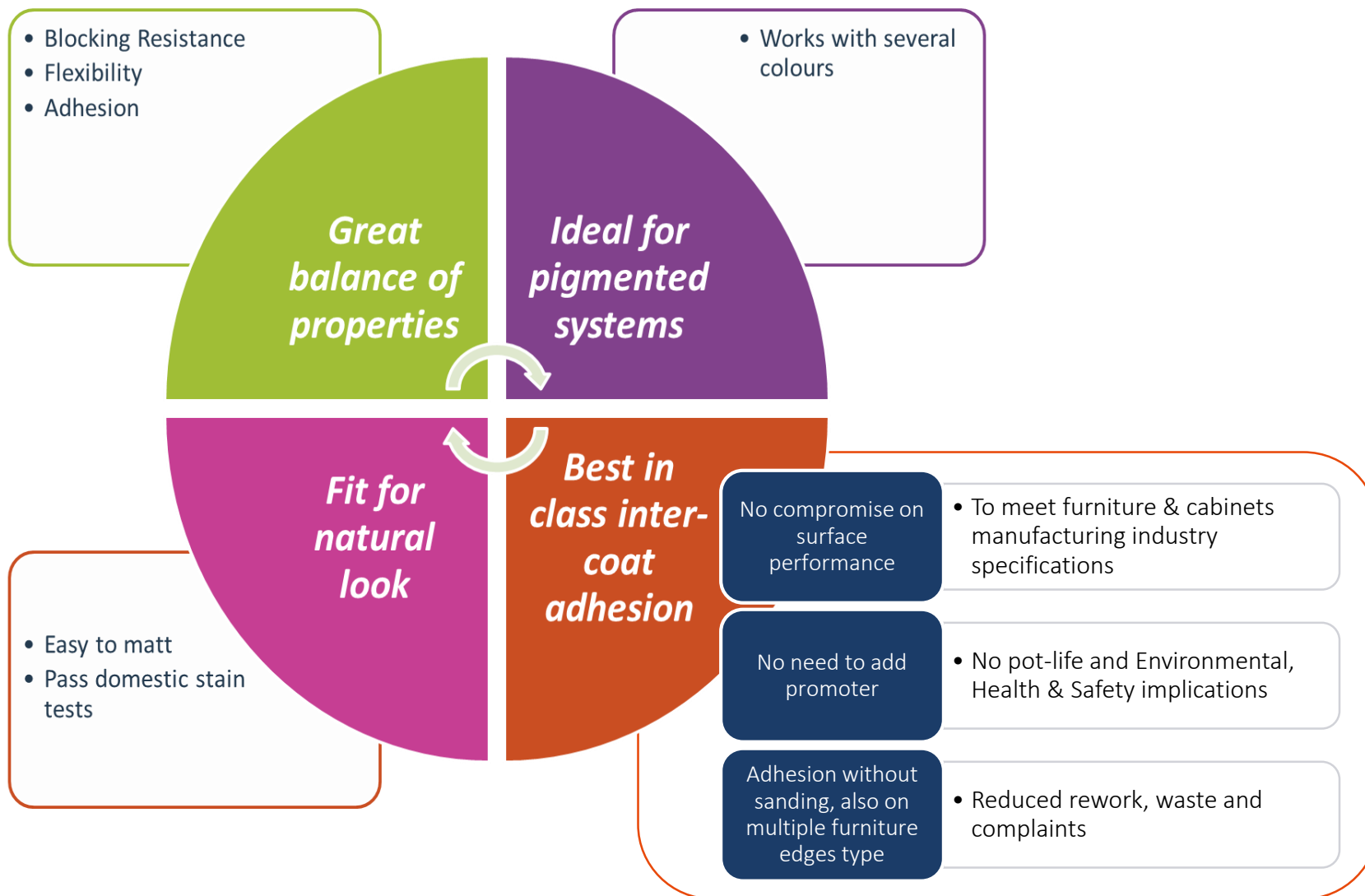
- Effective drying in the coating process with lower rejects rates for the coater

Excellent Cold Check Resistance

- In-use durability for greater consumer satisfaction



UCECOAT® 7630: Balance of Properties



- UCECOAT 7630 offers a good balance of properties such as hardness, scratch and stain resistance with exceptional intercoat adhesion
- UCECOAT 7630 unique blend of performance attributes allows for use beyond into such applications such as field applied, concrete and vinyl tile
- Tack-free after water evaporation
- UCECOAT 7630 provides an environmentally friendly solution that is tin-free and VOC-free.

UCECOAT 7630: Great Balance of Properties

		External reference	Internal reference	UCECOAT® 7630
ADHESION	Dry	5B	5B	5B
	Inter-coat	1B	1B	5B
Metal Marking		On all visible metal marking		
		worst ---	--	Better +
Stain Resistance 16 hours	2% eosine	1	3	4
	mustard	1	5	5
	coffee	2 **	4	5
	Iso-betadine	1 *	3	3.5
	NH ₃ 10%	5 *	5	5
	Ethanol 50%	3 ***	5	5
	Black marker N70, 5'	1	3	3.5
Average stain		2	4.0	4.4
Hamberger in N		11-12	<5	18
Erichsen pen in N		8	5	13-14

- Stain: 5= not visual, 4 = very light, 3= moderate, 2 = strong, 1= very strong stain, 0 = out of spec
- Swelling coat under stain: swell*-**-***strongs well
- Adhesion 5B-0B: 5B perfect- 0B no adhesion

UCECOAT 7630: Balance of Adhesion, Hardness, and Blocking

	Color master batches	Acetone	Adhesion			Persoz hardness	Blocking test at RT
		Solvent resistance	Dry	Wet	Inter-coat edge spray	In seconds	25Kg weight on 50 cm ²
Internal reference	15% Orange	4	0	5	4	281	Pass
UCECOAT® 7630	15% Orange	4	0	2	1	245	Pass
	10% yellow	5	0	2	1	182	Pass
		5	0	1-2	0	177	Pass
	3% Red	4	0	1	0	167	Pass
	5% Blue	4	0	1	0	177	Pass
	5% Green	5	0	4	0	154	Pass
	20% White	5	0	1-2	0	197	Pass
	5% brown	4	0	1-2	0	168	Pass

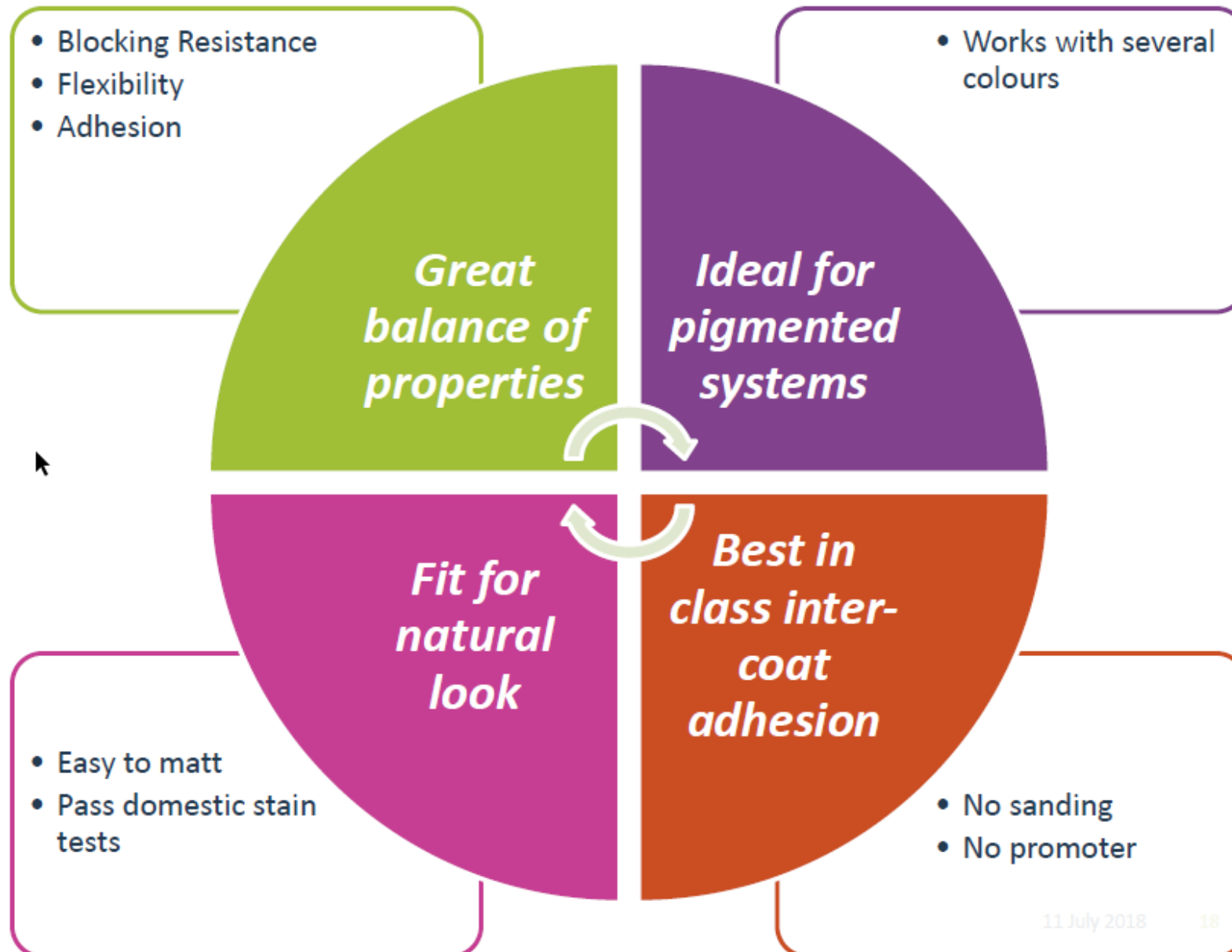
- Adhesion 0-5: 0 perfect- 5 no adhesion
- Acetone resistance: 5= perfect, 4 = slight surface dulling
- Pass blocking test: easy release without gloss variation

UCECOAT 7630: Clear Matte Finish

		UCECOAT® 7788	UCECOAT® 7630
Gloss 60°angle		33/31	11/9
Fingernail / metal marking		Pass	Pass
16 hours stain tests	mustard	2	5
	2% eosine	3	4
	coffee	4	5
	Iso-betadine	2	4
	NH ₃ 10%	5	5
	Ethanol 50%	5	5
	Marker N70, 5'	1	4.5
	avg	3.1	4.6

	pbw
UCECOAT® 7630	100
Irg 500	1.5
Aquamatt 208	3
Acematt TS 100	2
ADDITOL VXW 6360 50%water	2





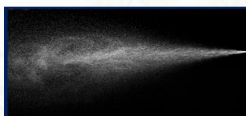
UCECOAT® 7690: Special Effect – Exterior Applications



Excellent weathering resistance for an extended outdoor durability



Superior water release and fast evaporation compared to industry standard



Low viscous and translucent: Ideal for spray applications



Sustainable chemistry: Label- Free, MIT Free, No VOC's, Sn-free and APEO Free



Good adhesion and flexibility: Versatile multi-substrate applications

Mechanical properties	Uc7690
Elongation (%)	15
Stress at Break (MPa)	36
Young Modulus (MPa)	1050
Tg by DMA (°C)	96



Graph: Xenon CI 4000 weathering
 Direct Coating: 60µm wet applied on ABS-PMMA plates
 Dried at 50-60°C till dry
 UV cure: 7 m/min 80W Ga + Hg lamp

UCECOAT® 7690: Performance

Clear Coating		
Water release	good	200μ grey PVC plate 6' @40°C - 5 m/m 80W Hg
Tackiness before UV	4-5	50μ Black Lenetta
Coating aspect on LENETTA sheet	ok good	5' @50°C - 5 m/min 80W Hg
Yellowing	Δb	5.7
	Yellow	8.24
Stain & chemicals resistance	Mustard	2 On Lenetta
	Eosin	4
	Coffee	5
	Isobetadine	2.5
	NH10%	5
	Ethanol 50%	5
	Marker	2
	Average	3.6
Acetone double rubs	>100	
Persoz Hardness	237	Avg of 3-4 measures 120μ on glass plate
Coating aspect on glass	ok	20' @40°C - 5 m/m 80W Hg

Coating formulations:

100p UC7690

1.5p BCPK [Photoinitiator]

2p UC8460 (50% sol in H₂O) [Thickener]

Elongation (%)	15
Stress at Break (MPa)	36
Young Modulus (MPa)	1050
Tg by DMA (°C)	96

UCECOAT® 7690: Performance in a Matte coating

Uc7690			
CLEAR COAT	Gloss	at 20°	65.9
		at 60°	88.7
	Coating aspect		no defect
MATT COAT	Gloss	at 20°	2.3
		at 60°	17.7
	Coating aspect		no defect
	Feeling of coating		normal feeling smooth surface

Coating formulations

100p UC7690

1.5p BCPK [*Photoinitiator*]

3p Aquamat 208*

2p OK520

2p UC8460 (50% sol in water) [*Thickener*]

*Aquamat® is a registered trademark from the company BYK

Product Summary

UCECOAT® 7230/7240

- Brilliant hardness, stain and abrasion resistance
- Performance comparable to 100% solids and solventborne UV curable hardcoats

UCECOAT® 7520

- Exceptional water release
- Low yellowing upon cure
- Balance of properties i.e. gloss, easy to matte, good hardness, etc

UCECOAT® 7630

- Balance of properties
- Offers natural wood look
- Excellent intercoat adhesion without sanding

UCECOAT® 7690

- Outstanding outdoor durability
- Good adhesion, scratch, blocking, and stain resistance
- Good to excellent water release

THANK YOU FOR YOUR ATTENTION!

Questions?



Marcus Hutchins

Marcus.hutchins@allnex.com

770-280-8391



www.allnex.com

allnex
The Coating Resins Company

LEGAL NOTICES

Disclaimer: allnex Group companies ('allnex') exclude all liability with respect to the use made by anyone of the information contained herein. The information contained herein represents allnex's best knowledge but does not constitute any express or implied guarantee or warranty as to the accuracy, the completeness or relevance of the data set out herein. Nothing contained herein shall be construed as conferring any license or right under any patent or other intellectual property rights of allnex or of any third party. The information relating to the products is given for information purposes only. No guarantee or warranty is provided that the product and/or information is suitable for any specific use, performance or result. Any unauthorized use of the product or information may infringe the intellectual property rights of allnex, including its patent rights. The user should perform his/her own tests to determine the suitability for a particular purpose. The final choice of use of a product and/or information as well as the investigation of any possible violation of intellectual property rights or misappropriation of trade secrets of allnex and/or third parties remain the sole responsibility of the user.

Notice: Trademarks indicated with ® , TM or * as well as the allnex name and logo are registered, unregistered or pending trademarks of Allnex Netherlands B.V. or its directly or indirectly affiliated allnex Group companies.

©2020 allnex Group. All Rights Reserved.



allnex

The Coating Resins Company