

# ALLNEX NEW APPLICATIONS FOR FAST CURE TECHNOLOGY VERSATILITY TO THE MAX



FRANCESCA FALLANI; BEREND MULDER; GOTTFRIED FÜRPAß



# OUR SPEAKERS



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**Elwin de Wolf**  
Application Manager  
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# AGENDA ALLNEX NEW APPLICATIONS FOR FAST CURE TECHNOLOGY

PART ONE : FAST CURE CHEMISTRY AND KINETICS

PART TWO : SETALUX® FC PRODUCT RANGE AND ITS USE

PART THREE : NEW DUROFTAL® FC PRODUCT RANGE AND ITS USE

CONCLUSIONS

Q&A



# PART 1- ALLNEX FAST CURE TECHNOLOGY : CHEMISTRY AND KINETICS

VERSATILITY TO THE MAX



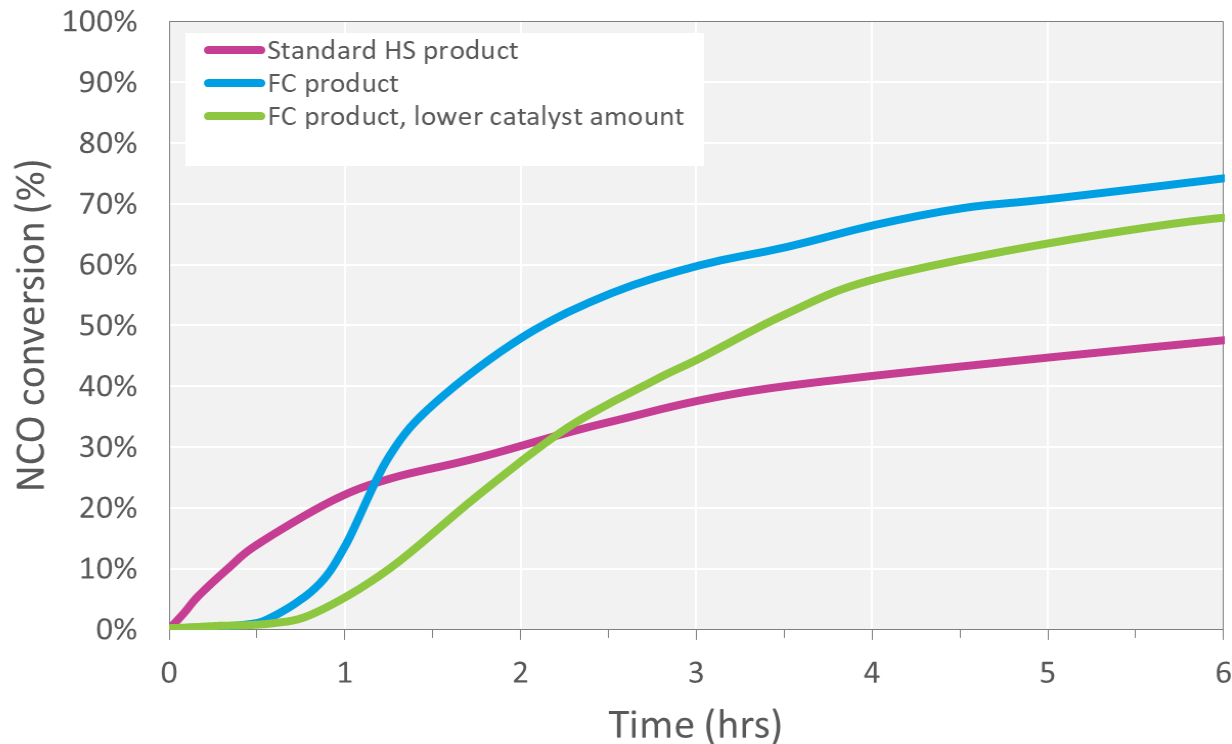
[www.allnex.com](http://www.allnex.com)

**allnex**  
The Coating Resins Company

# ALLNEX FAST CURE TECHNOLOGY: FINE-TUNING OF ISOCYANATE CONVERSION

- Obtaining an improved balance between drying time and pot life is an ever-ongoing challenge in 2K isocyanate coatings.
- With allnex Fast Cure technology 2K isocyanate curing has been taken to the next level, shortening the drying time down to 1 hour at room temperature while still keeping a long pot life.
- With allnex Fast Cure technology the isocyanate reaction kinetics can be fine-tuned to achieve the desired conversion.

## Isocyanate conversion by FT-IR:



In standard products, NCO conversion begins immediately after mixing of the two components and proceeds gradually until end value

In Fast Cure products NCO conversion is delayed (open time)

At a given point NCO curing begins and proceeds quickly to higher level

The NCO reaction kinetics can be fine-tuned by the choice of optimal concentrations of tin catalyst and other formulation components

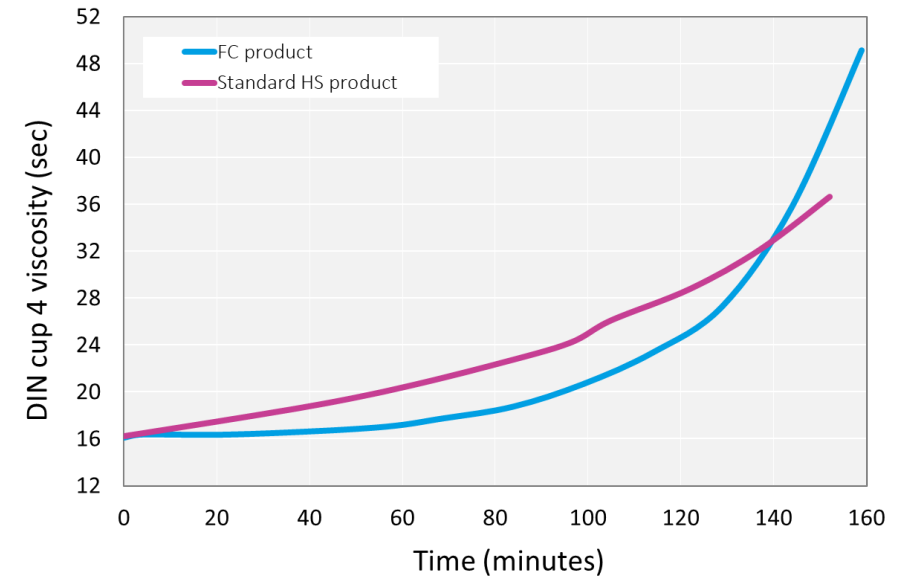
# ALLNEX FAST CURE TECHNOLOGY: PROPERTIES BUILD-UP

## Fine-tuned kinetics

- Longer open time
- Longer pot-life
- Longer workability time (+2 - 4 seconds DIN cup 4 spray viscosity)
- Better levelling → improved appearance

## Higher conversion shortly after curing

- Faster drying → improved drying / pot-life balance
- Early properties build-up: Tg, XLD
- Improved early hardness
- Improved application performances: better early handleability, polishability, sandability
- Improved early chemical resistance
- Very good outdoor durability



DMTA results	Fast Cure Technology		Standard 2K product	
	1 day RT	7 days RT	1 day RT	7 days RT
Tg (max tan-δ, °C)	46	47	38	43
Crosslinking density (mmoles/cm <sup>3</sup> )	0.91	0.91	0.66	0.78

# ALLNEX FAST CURE TECHNOLOGY: FINE-TUNING OF ISOCYANATE CONVERSION AND PROPERTIES BUILD-UP

The NCO reaction kinetics can be fine-tuned to achieve the desired conversion by optimizing the concentrations of formulation components

Tin catalysts: higher levels can be added

- Speed up drying while still keeping a long pot-life → Improved drying / pot-life balance

(Slow) solvents: optimized concentration

- Find optimal balance between, drying, appearance, hardness development

Bases (amines)

- Speed up drying, but also shorten pot-life and lower end hardness

Acids

- Prolong pot-life, but also drying, lower early hardness

Acidic or basic properties of formulation components should be taken into account!

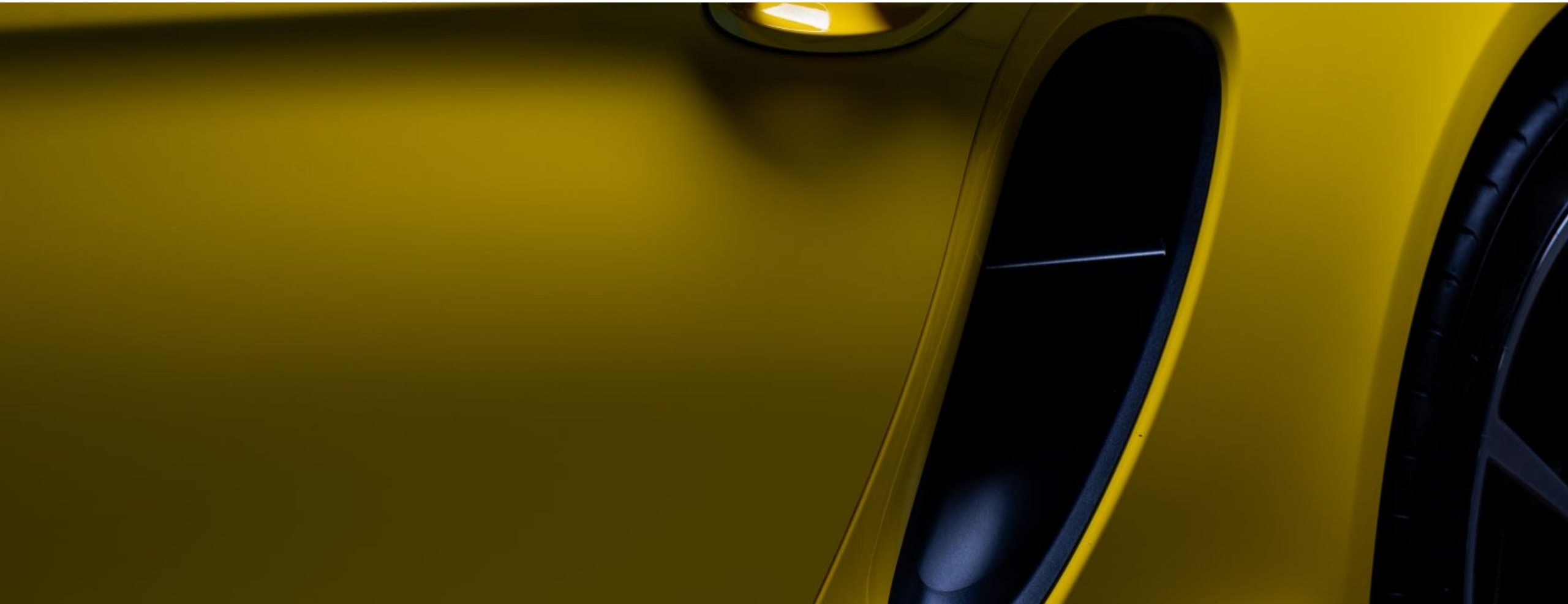
The right balance between all formulation components should be searched

Allnex SPF and support to benefit in an optimal way of Fast Cure products

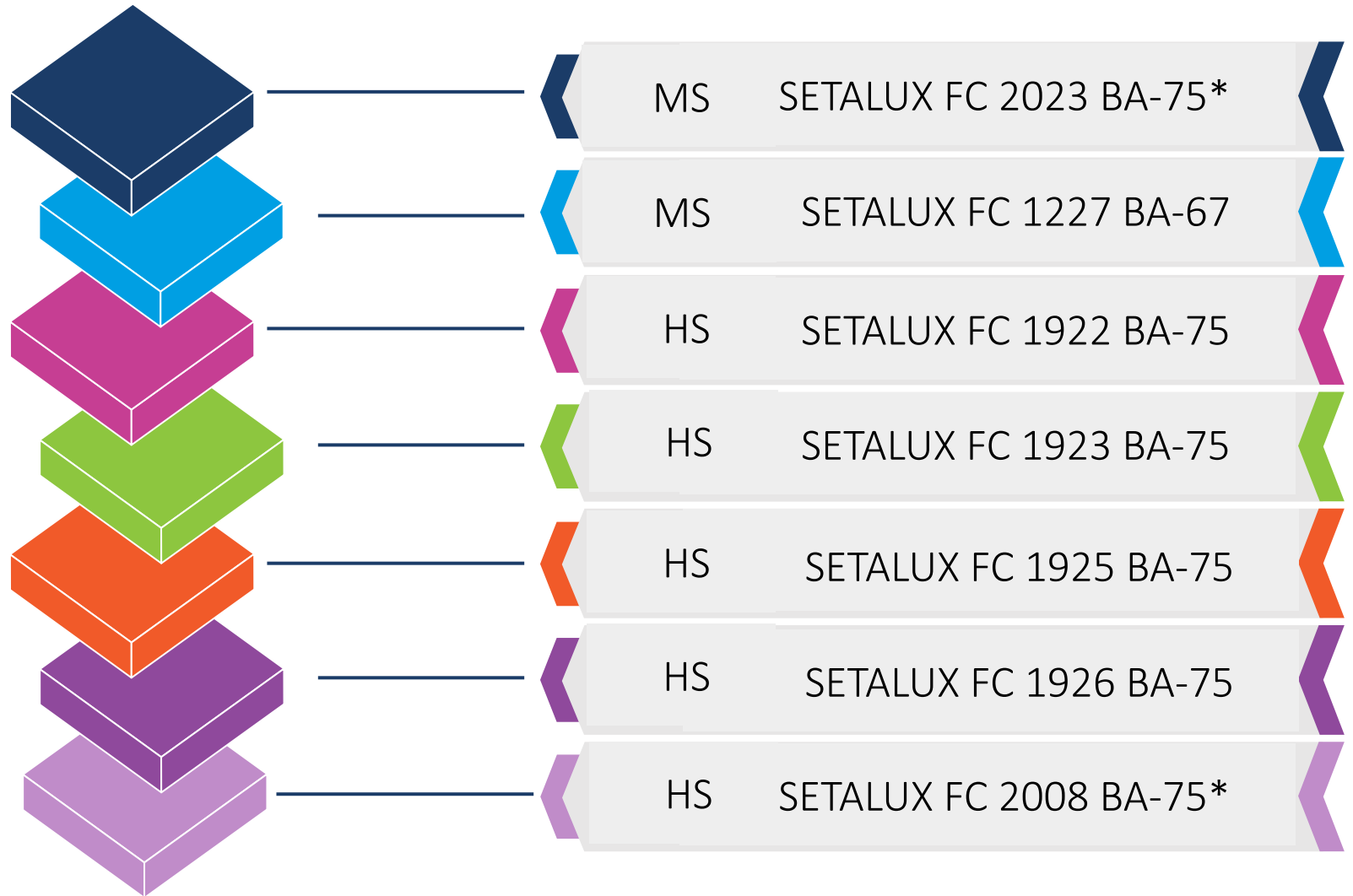


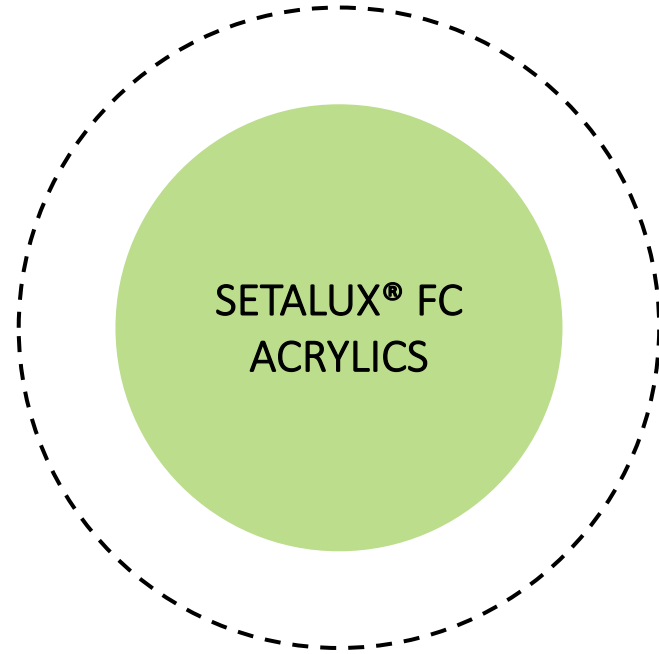
# PART 2 - SETALUX® FC ACRYLICS

VERSATILITY TO THE MAX

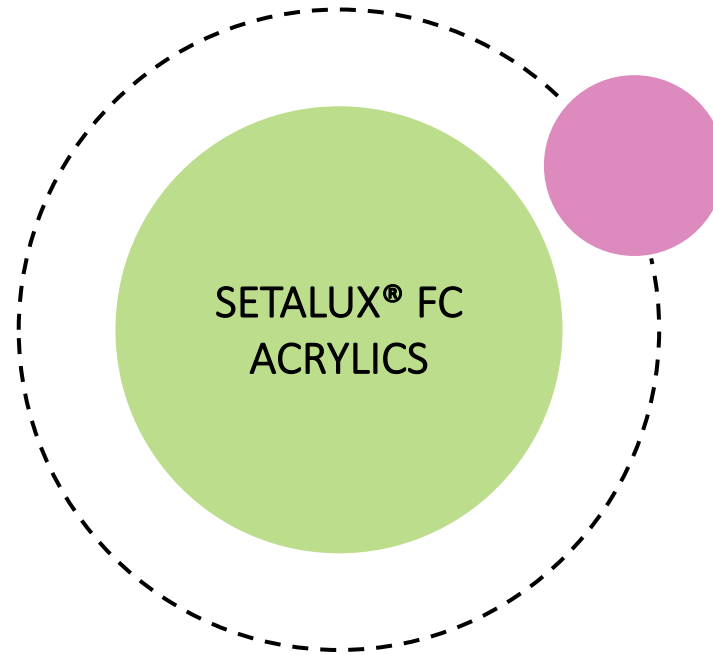


# SETALUX<sup>®</sup> FC ACRYLICS PRODUCT RANGE





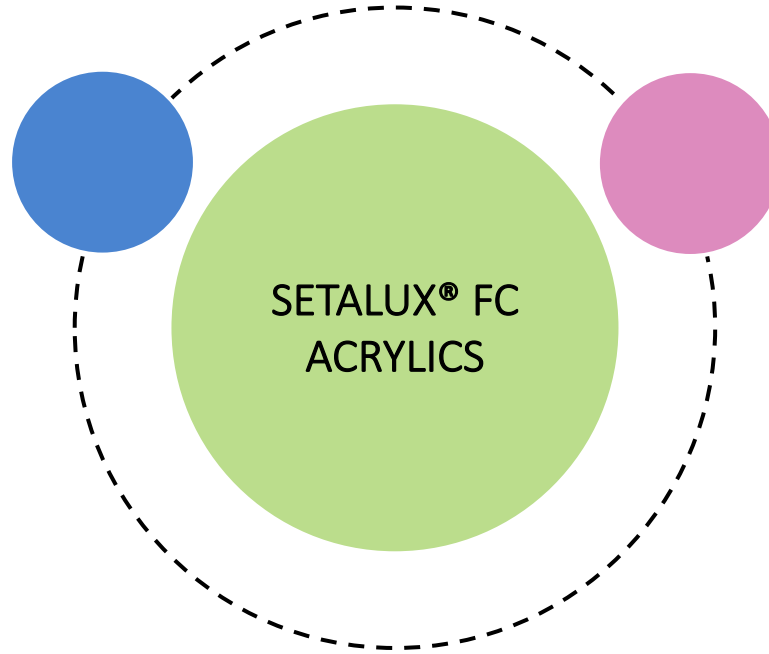
# SETALUX® FC VERSATILE IN USE



FAST DRYING AT RT (VR, WOOD)

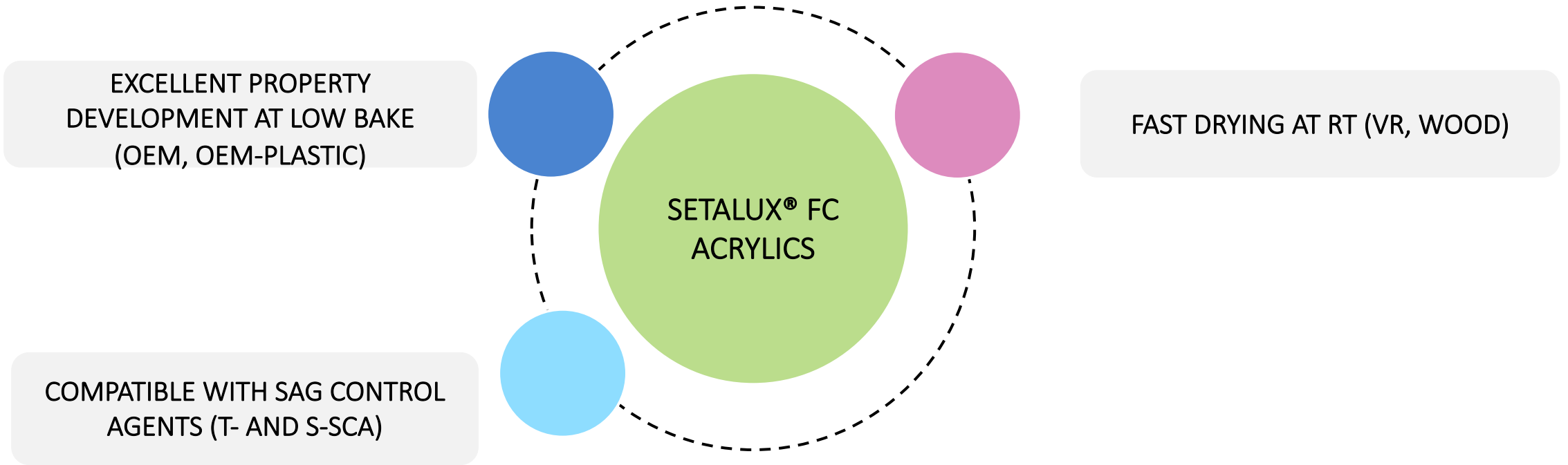
# SETALUX® FC VERSATILE IN USE

EXCELLENT PROPERTY  
DEVELOPMENT AT LOW BAKE  
(OEM, OEM-PLASTIC)

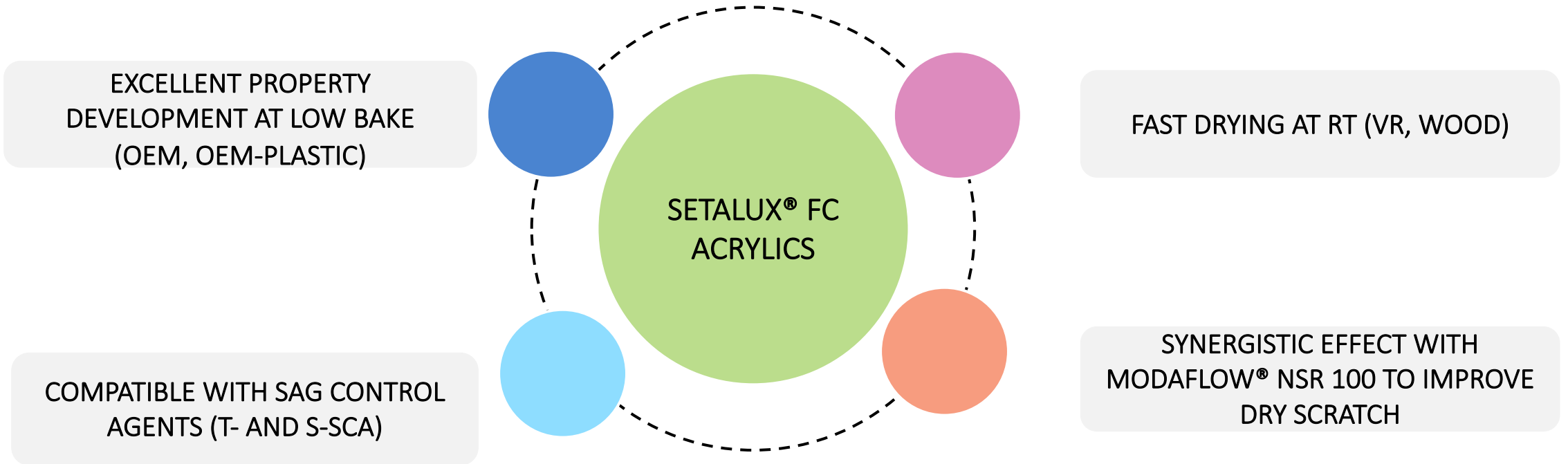


FAST DRYING AT RT (VR, WOOD)

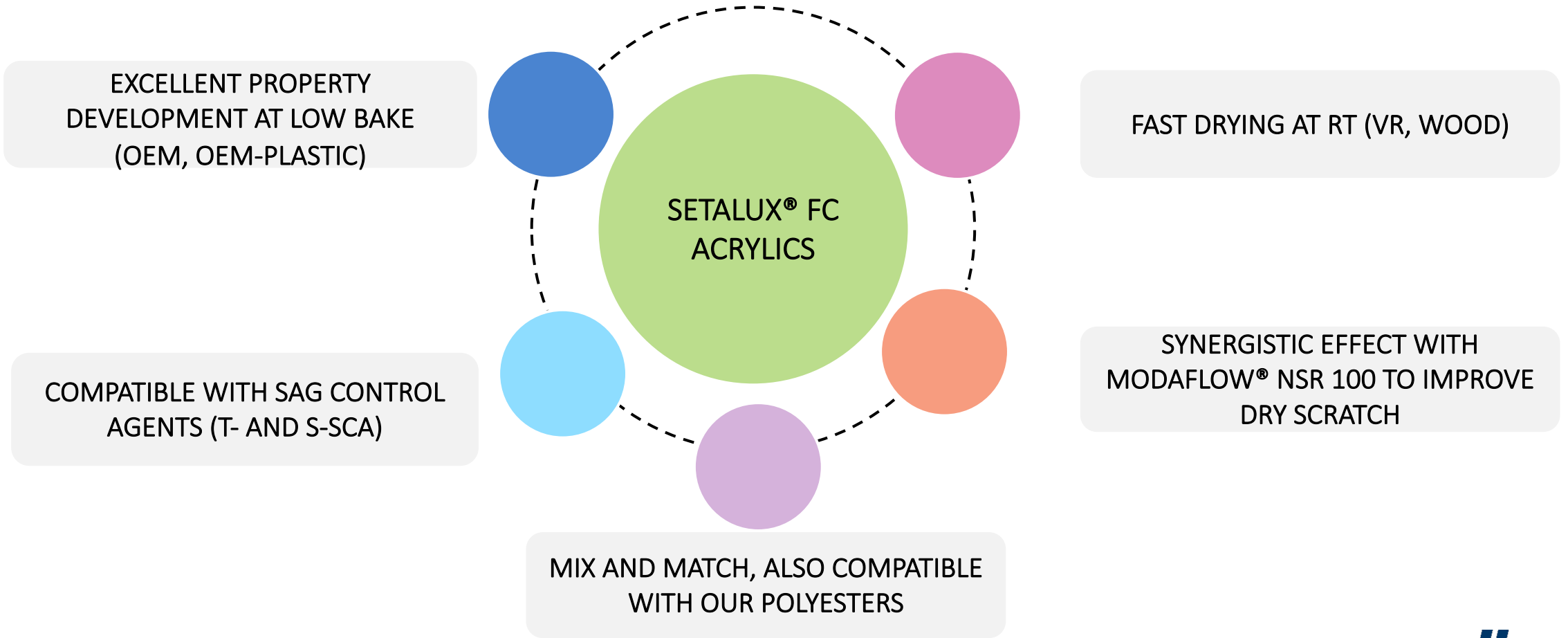
# SETALUX® FC VERSATILE IN USE



# SETALUX® FC VERSATILE IN USE



# SETALUX® FC VERSATILE IN USE





# SETALUX<sup>®</sup> FC ACRYLICS TESTED IN VEHICLE REFINISH AT ROOM TEMPERATURE

## MEDIUM SOLIDS

SETALUX FC  
1227 BA-67

- 3.6% OH
- Ultra Fast

Sprayed at 500 g/l  
Tolonate<sup>™</sup> HDT-90  
Crosslink: 110%  
DBTL: 0.2\*

## HIGH SOLIDS

SETALUX FC  
1922 BA-75

- 4.1% OH
- Best in class

DBTL: 0.2\*

SETALUX FC  
1923 BA-75

- 3.6% OH
- Economy –  
lower NCO  
demand

DBTL: 0.15%\*

SETALUX FC  
1925 BA-75

- 4.1% OH
- High  
performance  
Economy

DBTL: 0.2%\*

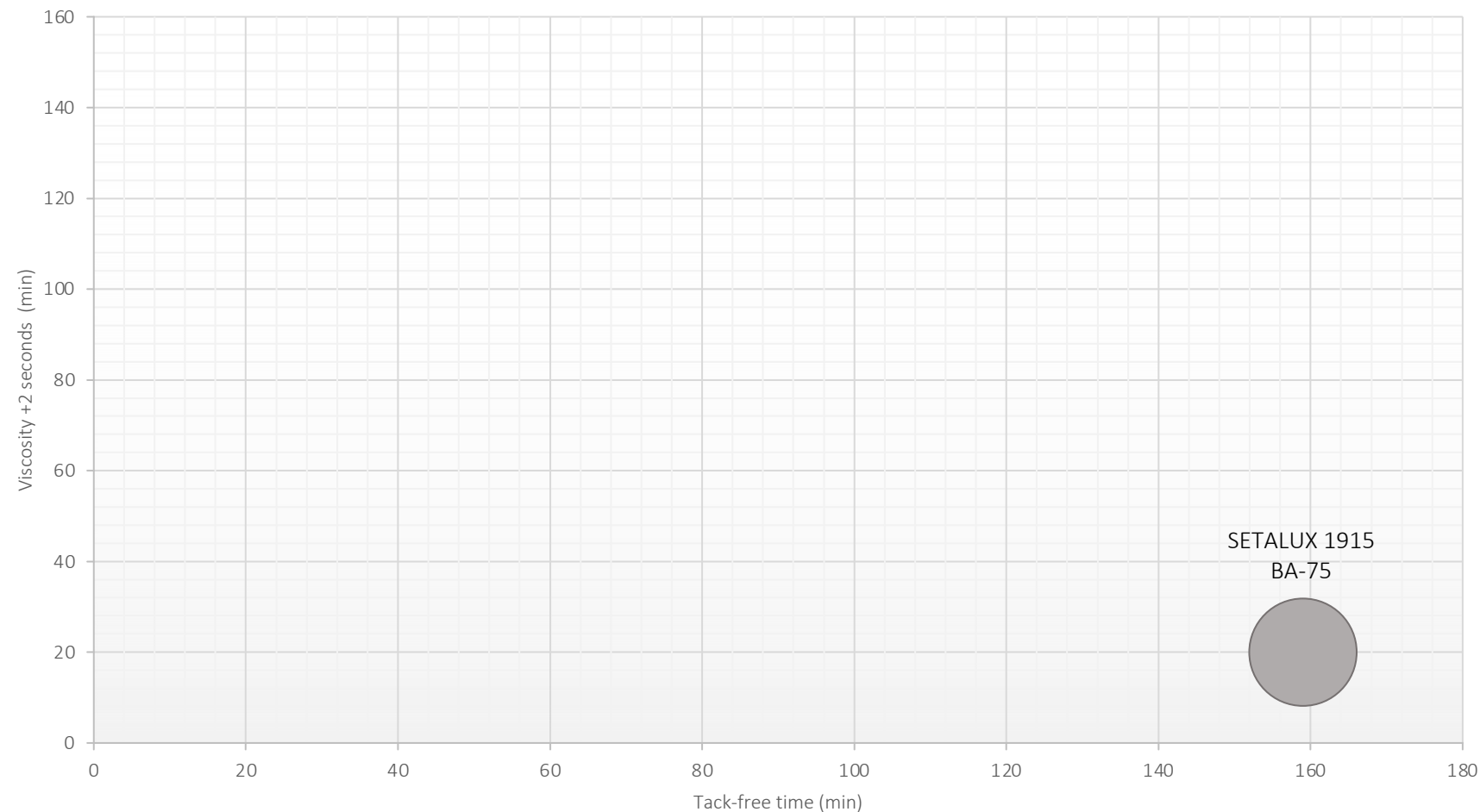
SETALUX FC  
1926 BA-75

- 4.1% OH
- High  
performance  
Economy

DBTL: 0.15%\*

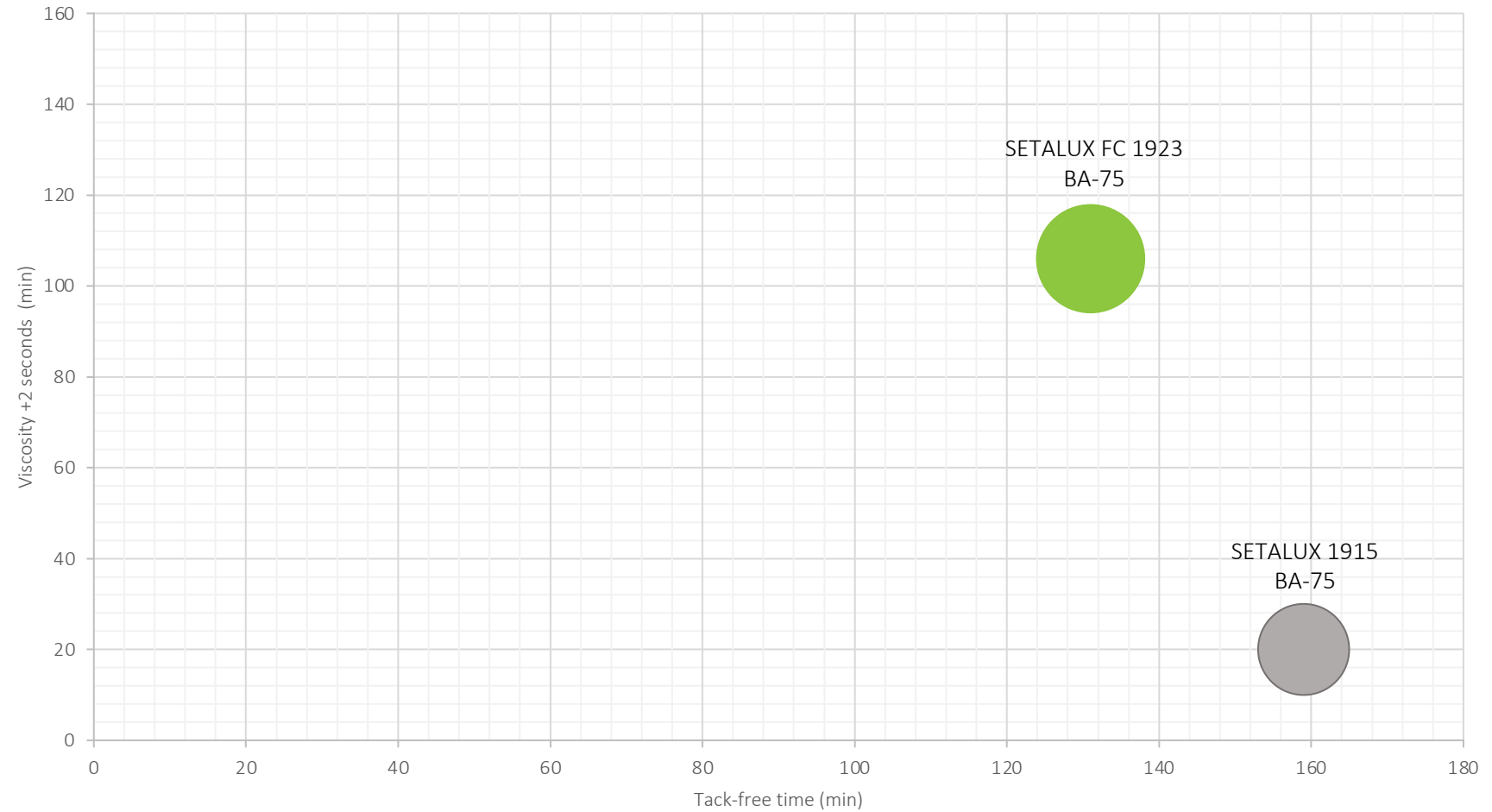
\* b.o.r.s. = total of resin and hardener solids

# POT LIFE / DRYING OF SETALUX<sup>®</sup> FC ACRYLICS AT ROOM TEMPERATURE



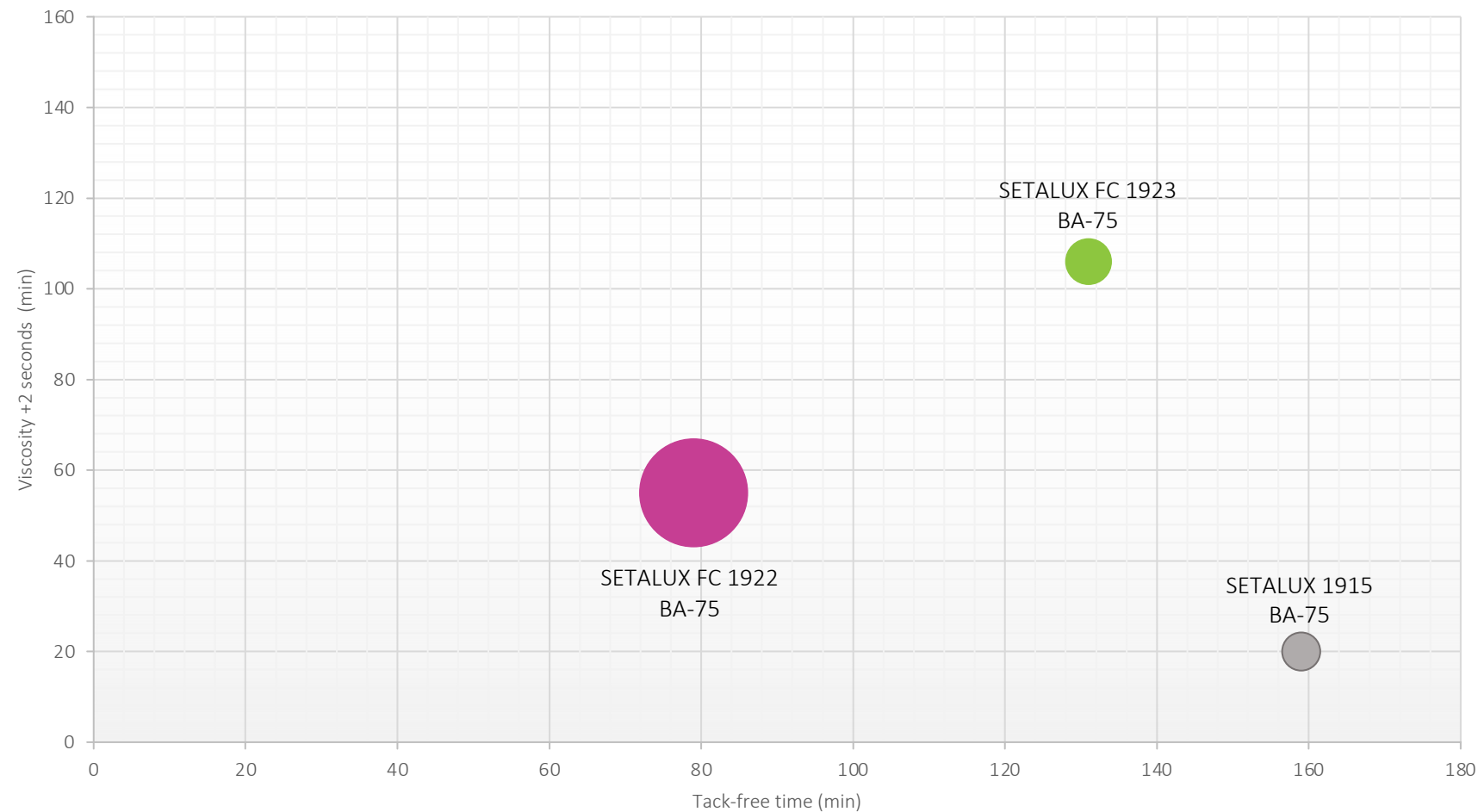
The size of the circles correlates with the early hardness measured by Persoz, 1h after the clearcoat is tack-free at Room Temperature.

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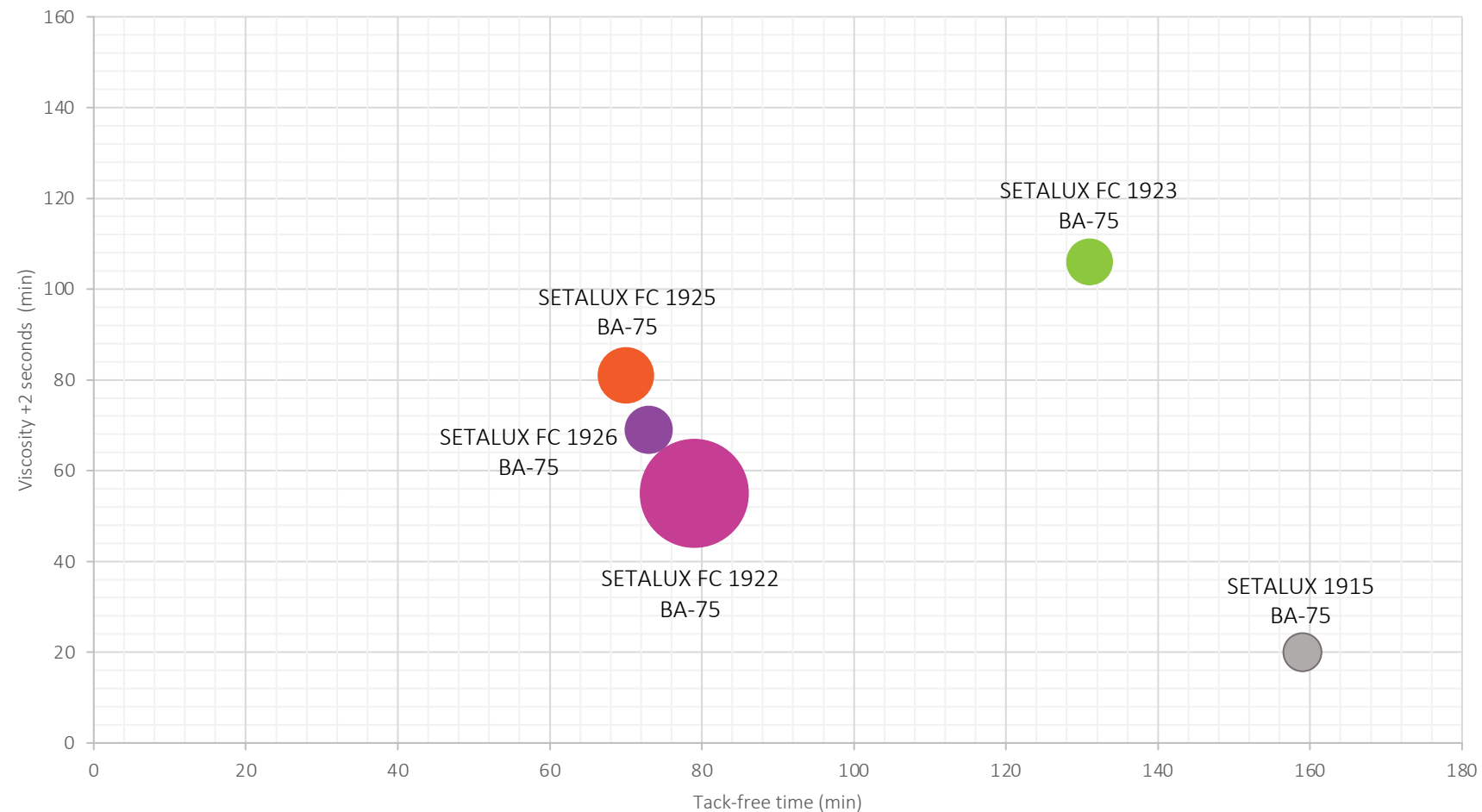
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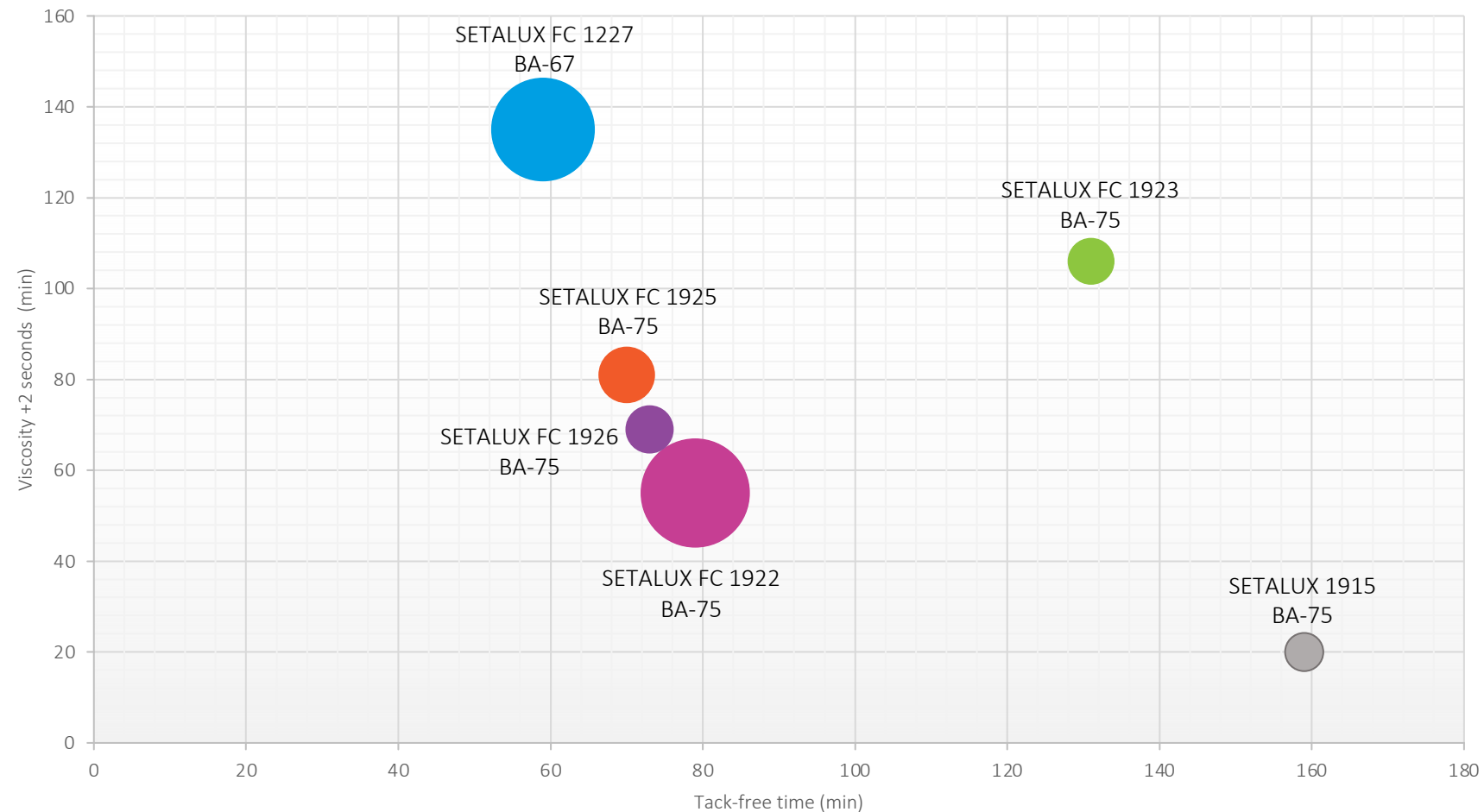
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# POT LIFE / DRYING OF SETALUX® FC ACRYLICS AT ROOM TEMPERATURE



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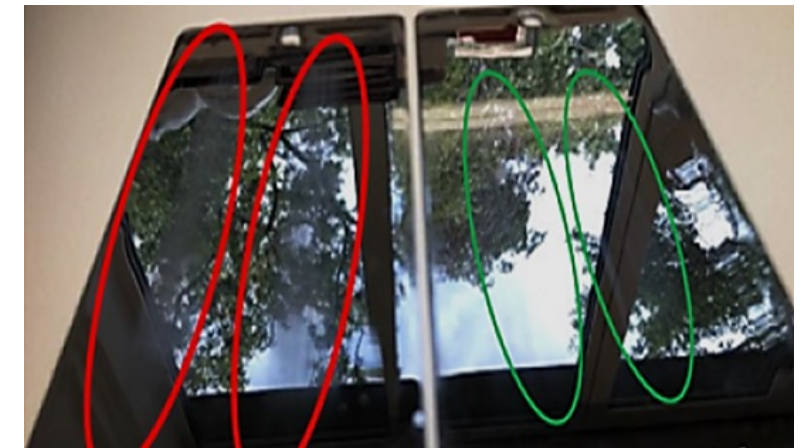
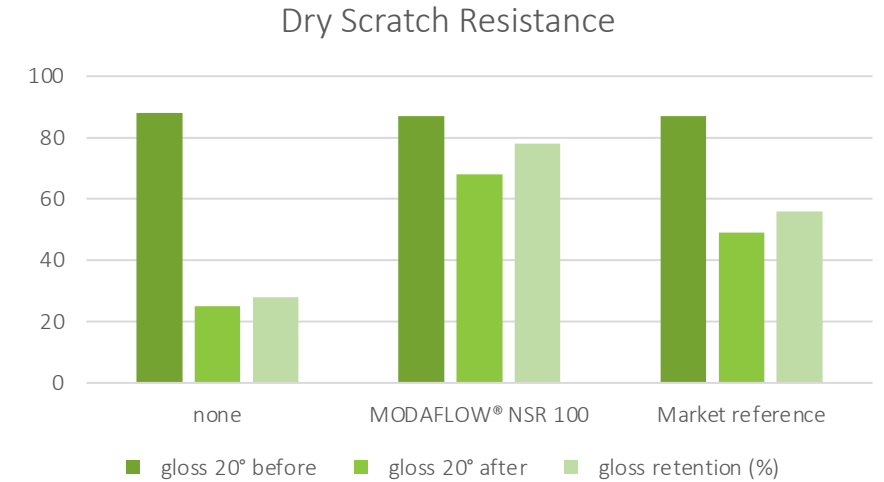
# SETALUX® FC IN COMBINATION WITH MODAFLOW® NSR 100 – BOOST DRY SCRATCH



- Formulation based on:

- SETALUX FC 1922 BA-75
- MODAFLOW NSR 100
- TOLONATE® HDT-LV
- MODAFLOW LAMBDA

- Dosage of 1.2 % solid MODAFLOW NSR 100 on solid resin
- Crosslink ratio of 120%
- Dilution to 18 s DC 4 using butyl acetate
- On commercial black WBBC
- Drying at room temperature (or short time at 60 °C also possible).



No Nano Silica  
additive

MODAFLOW NSR 100

# SETALUX® FC IN OEM LOW BAKE CLEARCOAT – EXCELLENT PROPERTY DEVELOPMENT



- Formulation based on:
  - SETALUX FC 1925 BA-75
  - SETAL® X 12327 (new HS Polyester)
  - SETALUX 61230 BA-60 (SCA)
  - MODAFLOW® 9200
  - ADDITOL® XL 123 N
  - TOLONATE® HDT LV
- Crosslink ratio of 110%
- Dilution to 100 mPa.s at 1000 s-1
- On commercial black WBBC
- Drying for 30 minutes at 80 °C
- Compared to high bake reference cured for 30 minutes at 140 °C

	HS Fast Cure	High Bake ref
VOC (g/l)	395	450
Shortwave / Longwave	17.6 / 10.1	21.4 / 8.1
Gloss (20°)	86	84
DOI	94	92
Early chemical resistance*		
IPA	1 / 1	1 / 1
Ethanol	1 / 3	1 / 2
Chemical resistance after 1wk		
Pancreatine	72	50
Tree resin	41	46
NaOH	> 75	65
H <sub>2</sub> SO <sub>4</sub>	50	52
Results after 1 week ageing		
Tg (max tan delta) – DMTA	51	64
XLD (mmol / cm <sup>3</sup> ) – DMTA	0.98	1.80
Erichsen elasticity (mm)	10	8.1
Impact resistance – direct / indirect	>105 / >105	75 / 50

\* 5 min exposure, 2h after curing  
softening / lifting ; rating: 1=OK, 5=NOK



## PART 3 - DUROFTAL® FC POLYESTER RESINS

VERSATILITY TO THE MAX



## DUROFTAL FC 9511/80BAC

### Topcoats with outstanding early hardness at ambient cure

- Long potlife even at high catalyst levels
- Outstanding drying and early hardness at ambient conditions
- Low paint VOC
- Excellent mechanical properties
- Excellent weathering resistance
- 4,5% OH; 80% solids

# DUROFTAL® FC POLYESTER PRODUCT RANGE

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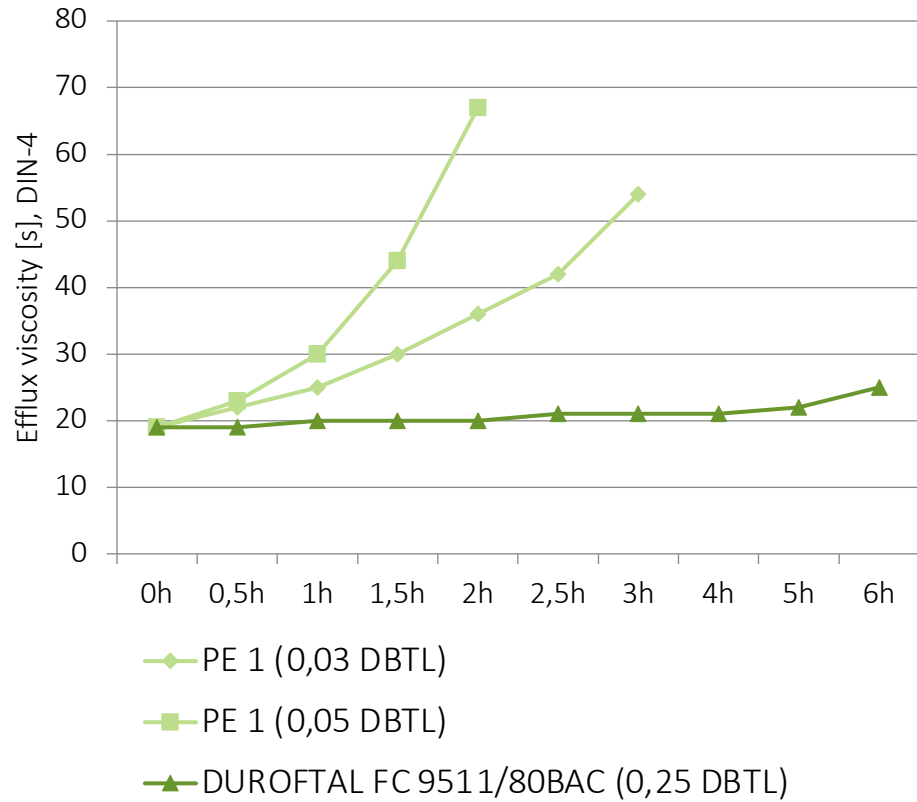
## DUROFTAL FC 2828/75BAC

### Direct to Metal (DTM) monocoats Highly chemical and solvent resistant topcoats

- Long potlife even at high catalyst levels
- Superior early hardness upon forced cure Low paint VOC
- Lowest paint VOC
- High chemical and solvent resistance
- Excellent UV and corrosion resistance
- 6,5% OH; 75% solids

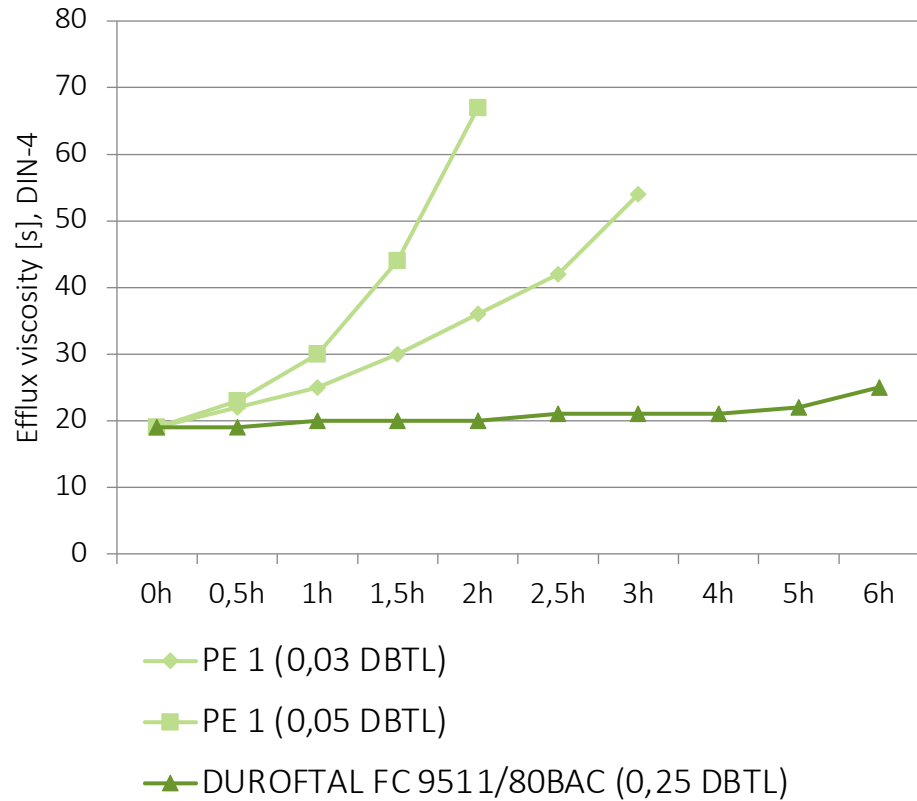
# THE FAST CURE CONCEPT: DECOUPLING OF POTLIFE AND REACTIVITY

Potlife (closed cup, 23°C)

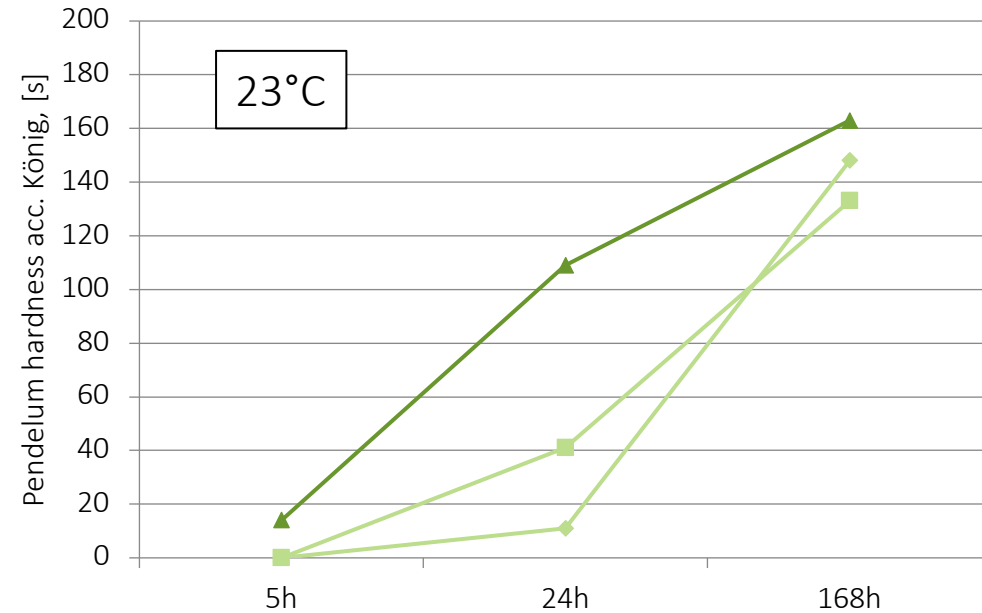


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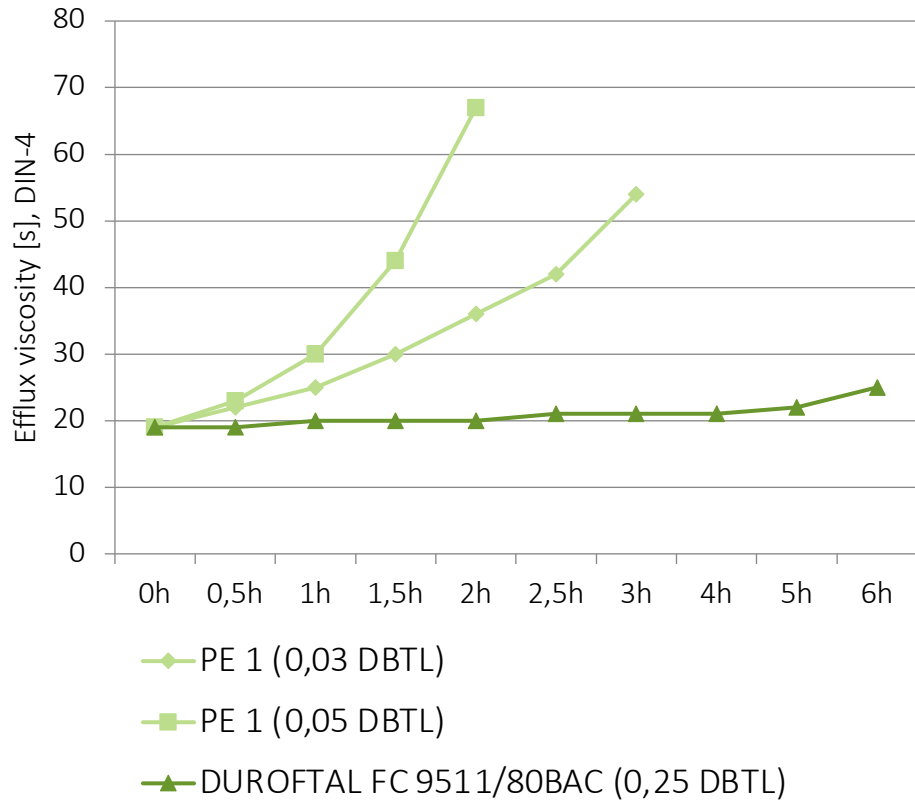


Hardness development

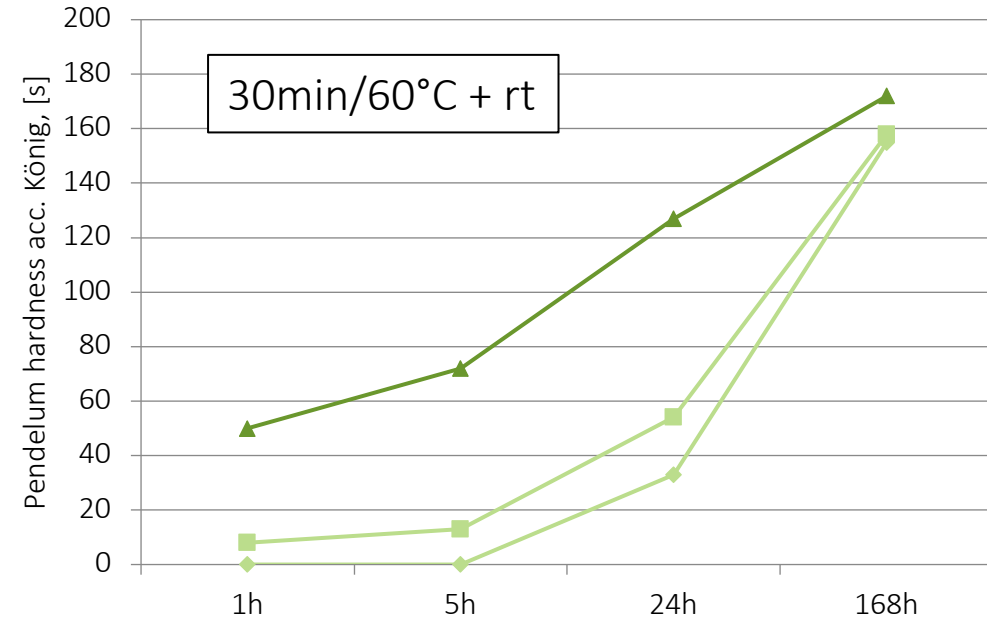


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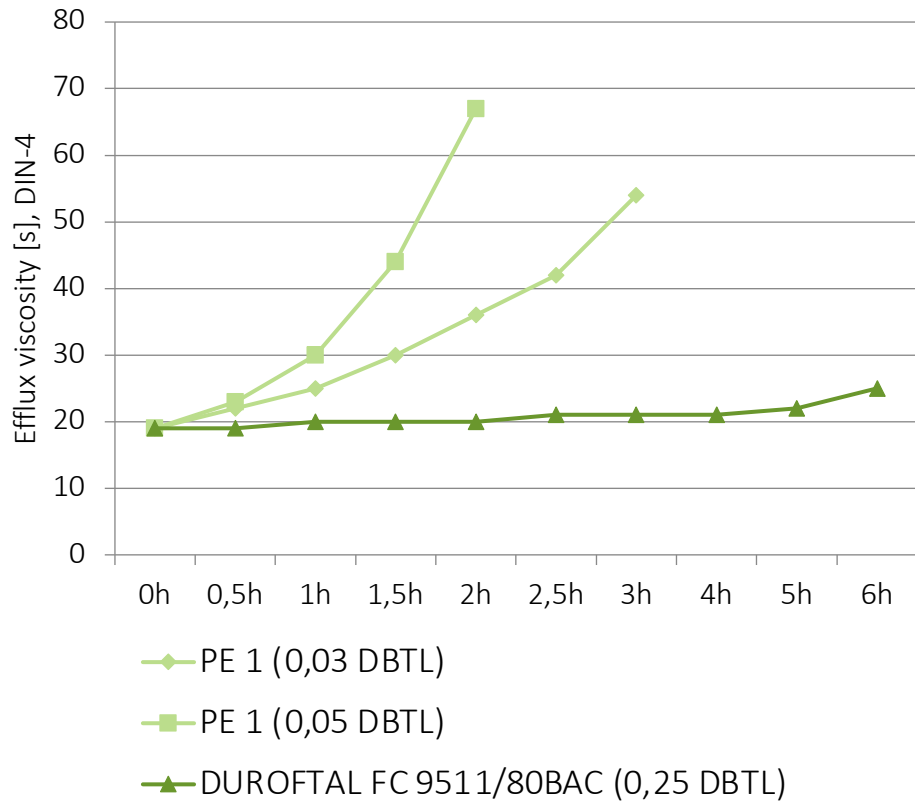


Hardness development

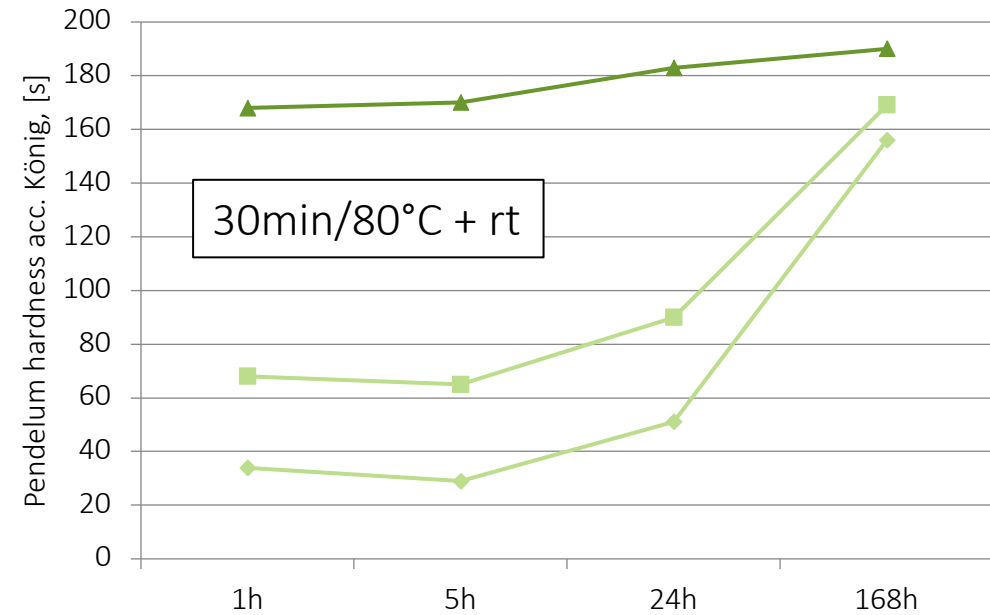


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Potlife (closed cup, 23°C)



Hardness development



# PERFORMANCE OF FAST CURE VS STANDARD TECHNOLOGY

	DUROFTAL®FC 9511/80BAC	PE 1	DUROFTAL FC 2828/75BAC	PE 2	SETALUX®FC 1923	APO 1
OH-% on solid resin	4,5	4,5	6,5	5,4	3,6	3,6
Form of delivery (in BuAc)	80%	80%	75%	76%	75%	75%

White pigmented topcoat formulations (crosslinked with HDI Trimer; NCO/OH=1; pigment/binder=0,8)

DBTL (%) <i>on solid polyol</i>	0,32	0,05	0,35	0,05	0,21	0,05
Exp. Paint solids (%) <i>at 30s (DIN-4)</i>	74,3	74,9	77,7	74,3	71,4	71,8
Exp. VOC (g/l) <i>at 30s (DIN-4)</i>	339	330	296	340	368	359



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Potlife (h) <i>doubling of viscosity</i>	4,2	0,9	2,9	2,0	3,5	1,5
Tack-free time (h) <i>152µm wet</i>	3,3	> 6	3,5	> 6	2,5	4,5

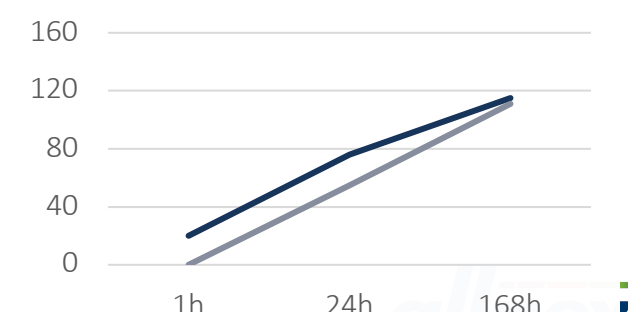
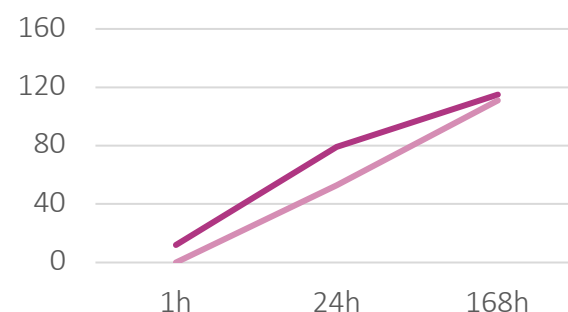
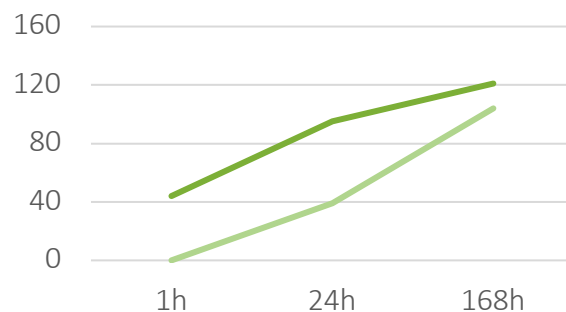
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Tack-free time (h) <i>152µm wet</i>	3,3	> 6	3,5	> 6	2,5	4,5

König hardness (s)  
30min/50°C + rt



# TOPCOAT PERFORMANCE

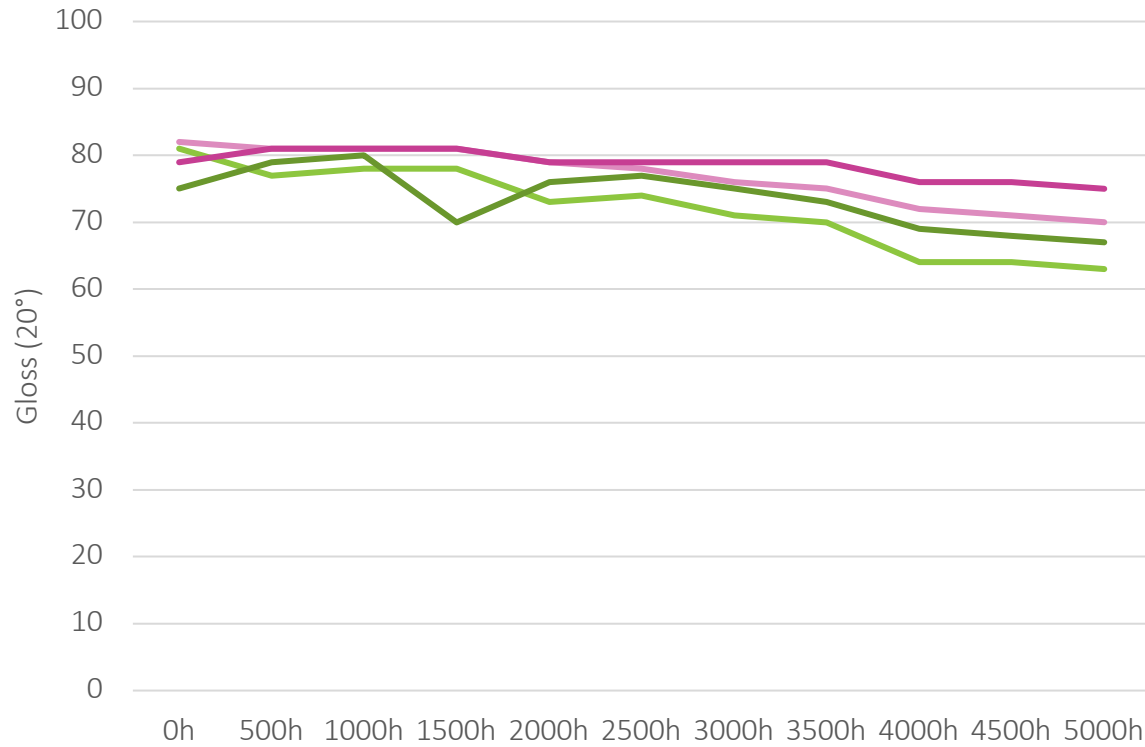


	DUROFTAL® FC 9511/80BAC		DUROFTAL FC 2828/75BAC	
Cure temperature	23°C	30min/80°C	23°C	30min/80°C
Gloss (20°/60°)	81/87gu	81/87gu	81/87gu	81/88gu
Crosscut adhesion	Gt 0	Gt 0	Gt 0	Gt 0
Erichsen cupping	> 10mm	> 10mm	> 10mm	> 10mm
Impact (front/back)	80/80iP	80/80iP	80/80iP	80/80iP
Fuel resistance	10min	10min	10min	10min
Xylene resistance	4min	9min	10min	10min
MEK double-rubs	122	159	> 200	> 200

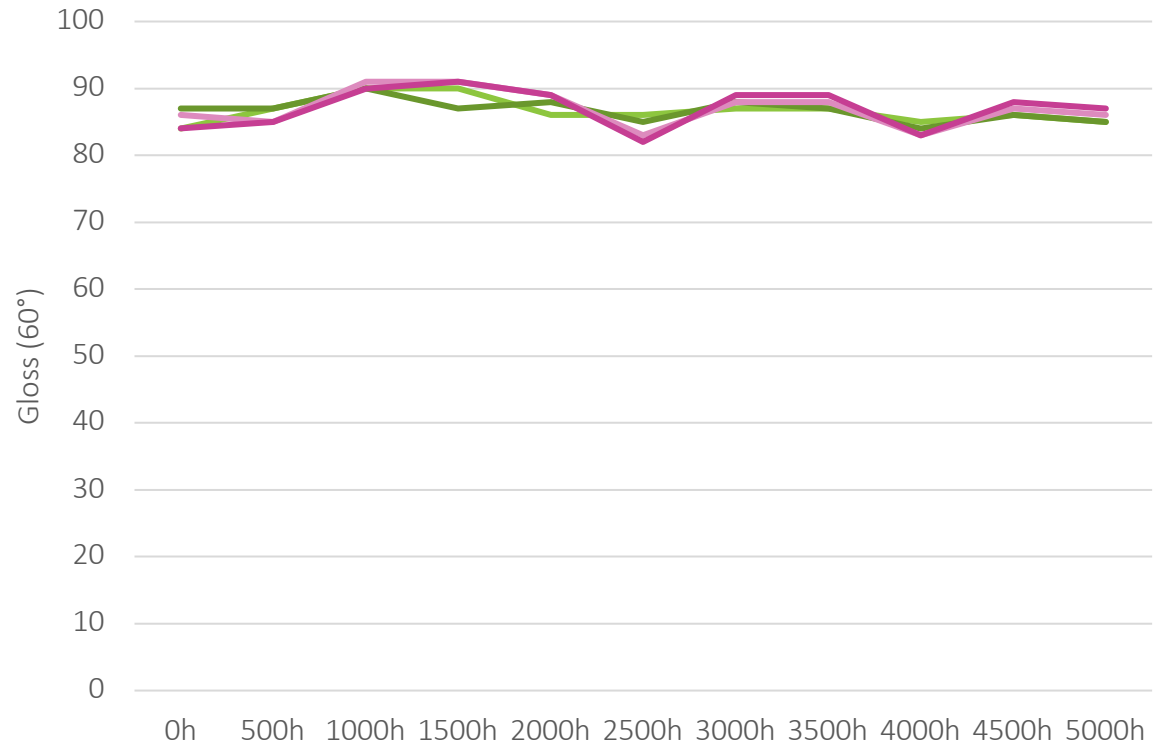
Topcoat properties on Gardobond 26S 6800 OC (80-90µm dft)

# TOPCOAT PERFORMANCE

Xenon-WOM: Gloss (20°) retention



Xenon-WOM: Gloss (60°) retention



5000h Xenon-WOM	Gloss retention (20°/60°)	Delta E
FC 9511_RT	78% / 100%	0,29
FC 9511_30min/80°C	89% / 100%	0,38
FC 2828_RT	85% / 100%	0,31
FC 2828_30min/80°C	95% / 100%	0,22

# TOPCOAT PERFORMANCE: DUROFTAL® FC 9511 OVER SB EPOXY PRIMERS

1440h salt spray chamber (NSST)



Excellent compatibility with solventborne 2K epoxy primers

# DUROFTAL® FC 2828/75BAC: DTM PERFORMANCE

## Dry adhesion

Substrate	7d/23°C	30min/80°C + 7d/23°C
Zn-Mn-phosphated steel, degreased	Gt 0	Gt 0
Fe-phosphated steel, degreased	Gt 0	Gt 0
Untreated smooth steel, degreased	Gt 0	Gt 0
Electro-galvanized steel, degreased	Gt 0	Gt 0
Hot-dip-galvanized steel, degreased	Gt 0	Gt 0
AlMg1 alloy, degreased	Gt 0	Gt 0
AlMn1Cu alloy, Cr-III conversion	Gt 0	Gt 0
AlMn1Cu alloy, untreated	Gt 5	Gt 5
inhouse automotive CED primer	Gt 0	Gt 0

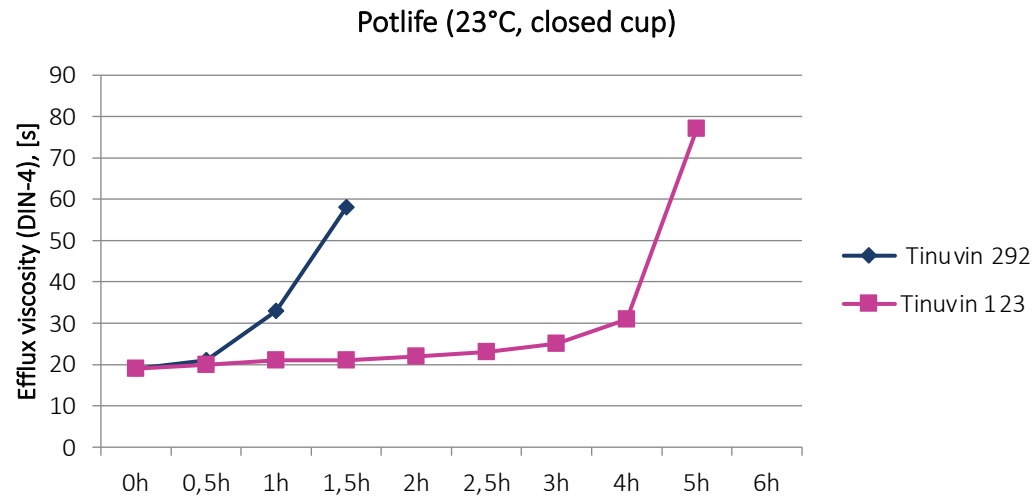
## 1000h salt spray chamber (NSST)

Gardobond OC dft: 97µm 30min/80°C + 7d rt	Gardobond WH 6800 OC dft: 116µm 30min/80°C + 7d rt	Sandblasted steel (Sa 2.5) dft: 121µm 30min/80°C + 7d rt

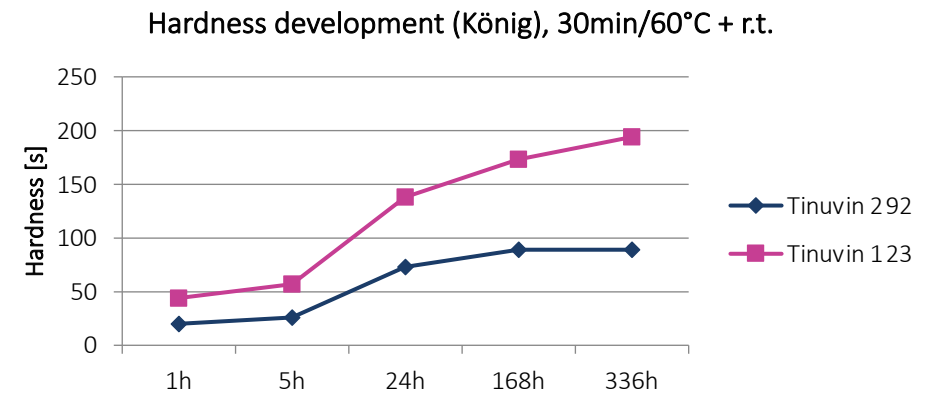
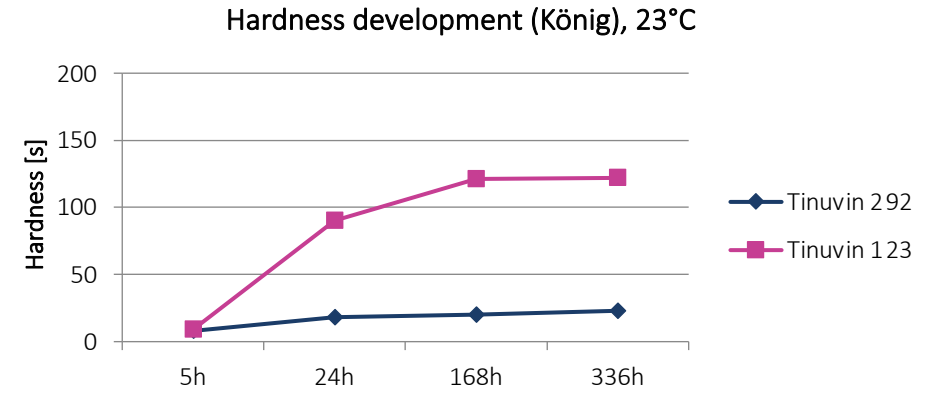
Curing conditions do not affect adhesion to different substrates

# TO BE CONSIDERED....

Clearcoat test formulations based on DUROFTAL® FC 2828 using different hindered amine light stabilizer (HALS):



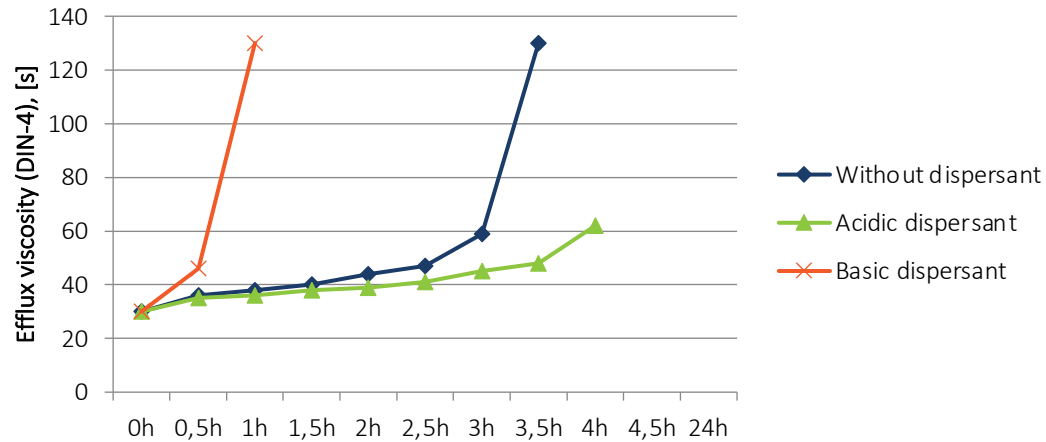
Basicity of light stabilizers to be considered in formulation development with FC technology!!



# TO BE CONSIDERED....

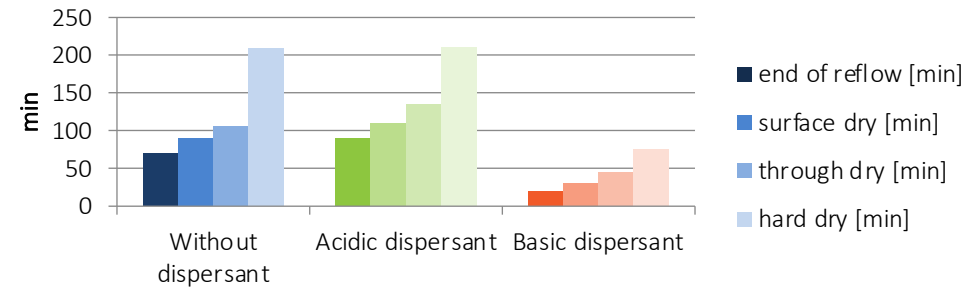
White pigmented test formulations based on DUROFTAL® FC 9511 with different dispersants:

Potlife (23°C)

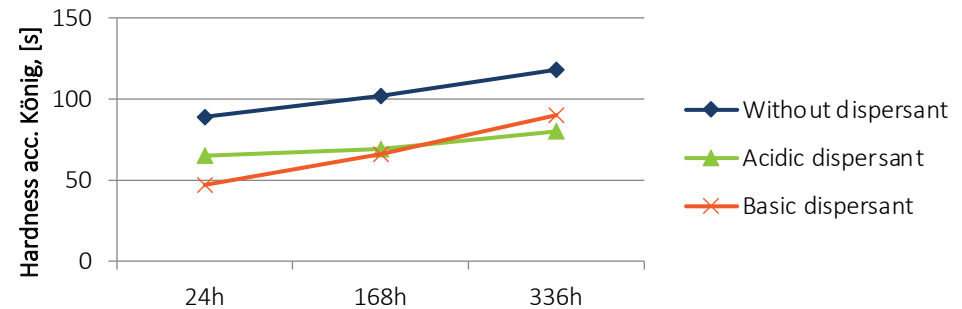


Basicity of dispersants to be considered in formulation development with FC technology!!

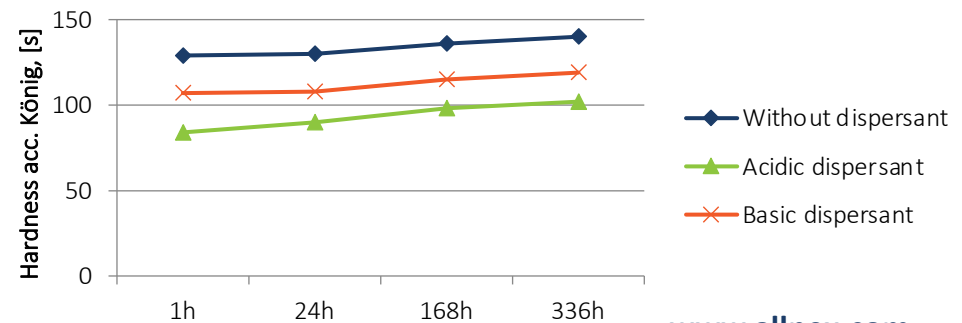
Drying Recorder (23°C)



Hardness development (23°C)



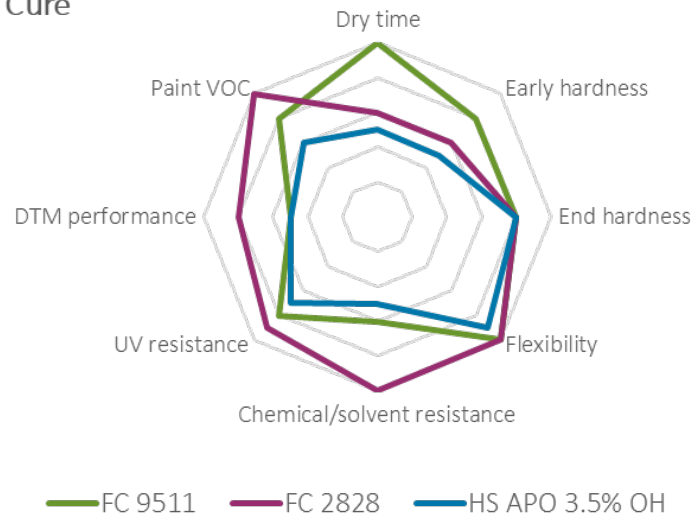
Hardness development (30min/80°C + r.t.)



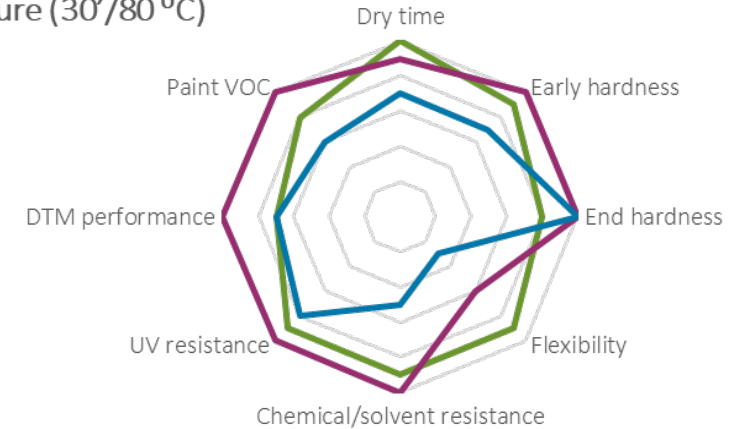


# CONCLUSION

## Ambient Cure



## Forced cure (30'/80 °C)



### DUROFTAL® FC 9511/80BAC

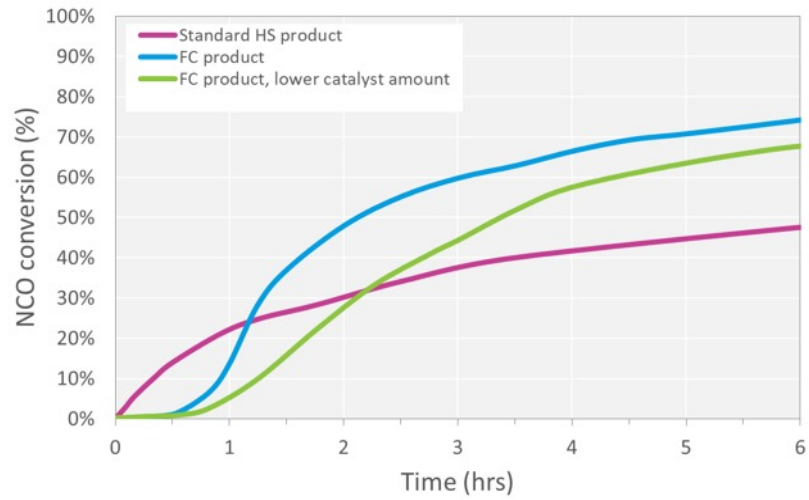
Preferred choice for **topcoat** applications where **early hardness** is a key requirement and especially suited for those cases where just ambient or slightly forced cure conditions (e.g. 40-60°C) are practicable.

### DUROFTAL FC 2828/75BAC

Best choice for topcoats with highest demands on **chemical and solvent resistance** combined with **lowest paint VOC**. It is also well suited for **direct-to-metal (DTM)** monocoats showing superior corrosion protection, e.g. on sandblasted steel, but also on more challenging substrates like untreated smooth steel.

Related to their polymer design both grades, when crosslinked with aliphatic polyisocyanate hardeners, provide **excellent outdoor durability**.

# SUMMARY



With *allnex* Fast Cure technology isocyanate reaction kinetics can be fine-tuned to achieve:

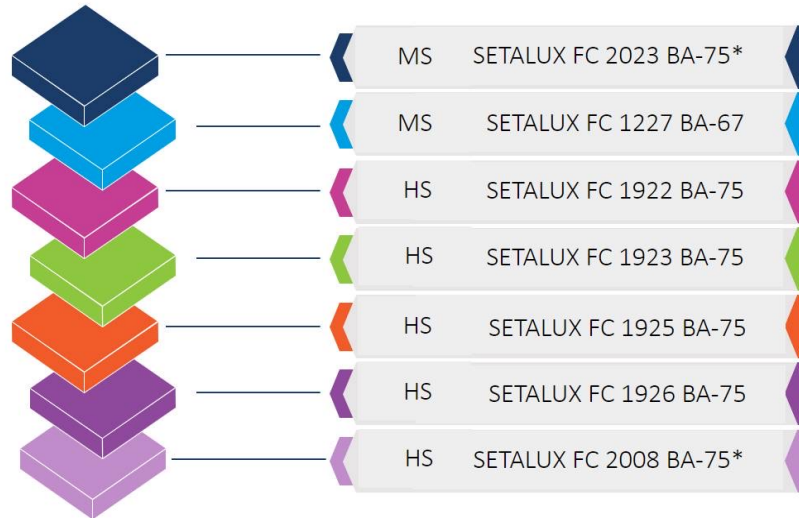
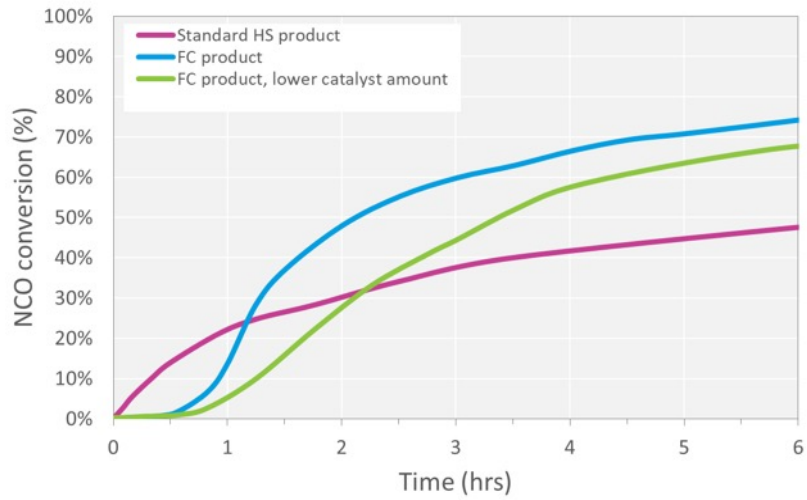
the desired conversion

resulting in longer open time

longer pot-life / workability time

faster drying and early properties build-up (T<sub>g</sub>, XLD, hardness, chemical resistance).

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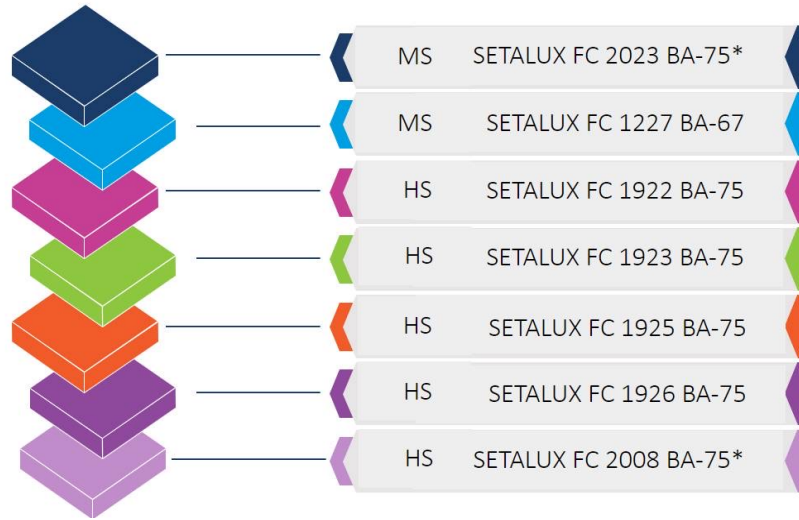
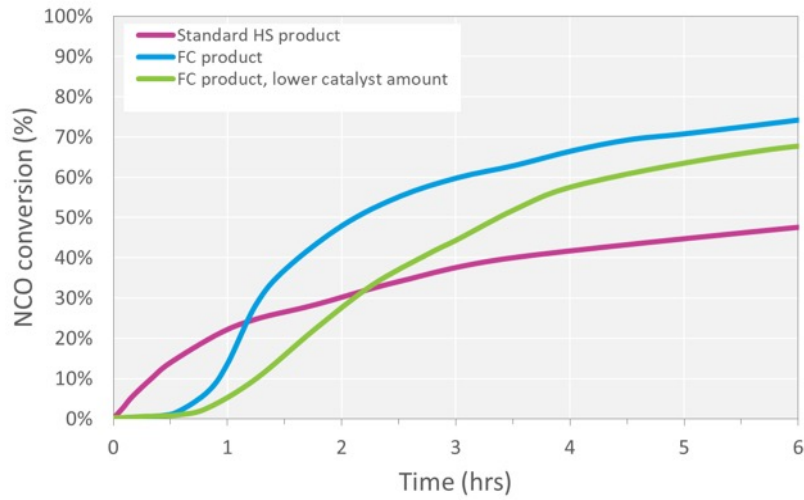
Our comprehensive Fast Cure Acrylics portfolio offers:

Global as well as regional grades to fit all needs

Freedom to Mix and Match in order to tune coating performance to your desire

A robust and versatile solution for a broad array of application areas

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A robust and versatile solution for a broad array of application areas

The FC product range has been extended to HS polyester polyols with:

**DUROFTAL FC 9511/80BAC**

The preferred choice for topcoats where early hardness development at ambient or slightly forced cure is a key requirement.

**DUROFTAL FC 2828/75BAC**

The best choice for highly chemical resistant topcoats and suitable for dtm (direct-to-metal) monocoats.

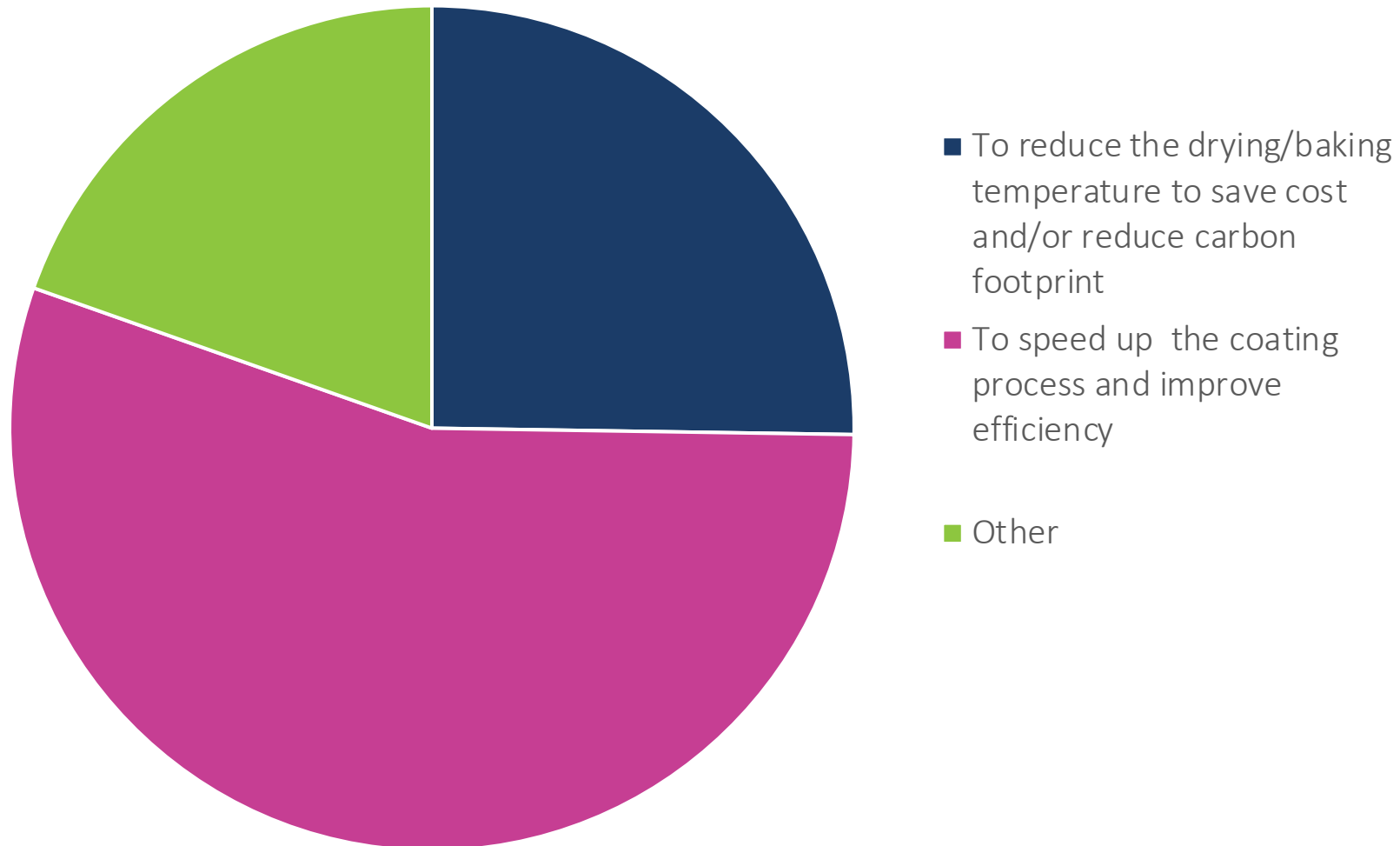
# ALLNEX NEW APPLICATIONS FOR FAST CURE TECHNOLOGY VERSATILITY TO THE MAX



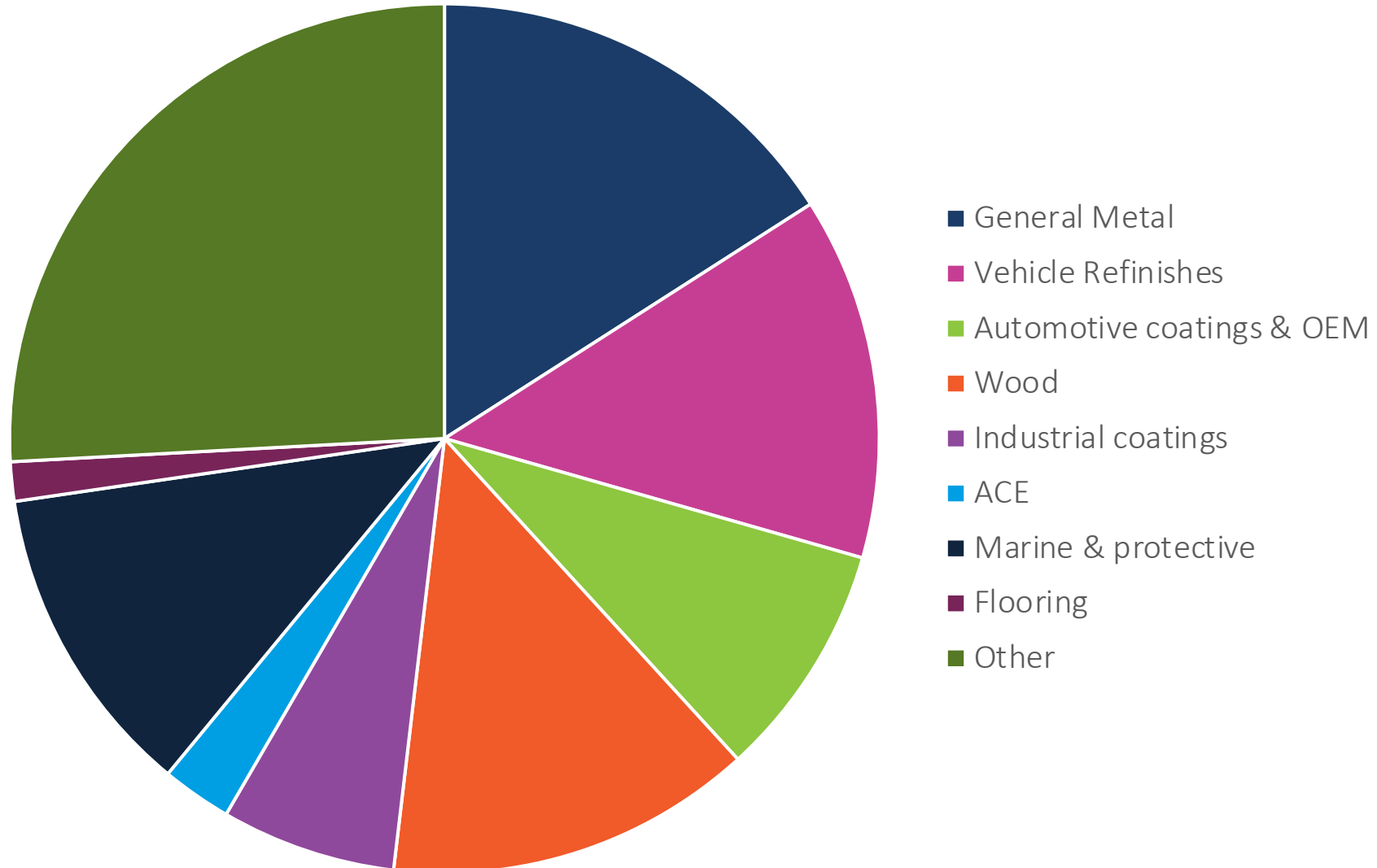
Q&A



# WHY ARE YOU INTERESTED IN THE ALLNEX FAST CURE TECHNOLOGY/PRODUCTS?



# IN WHAT COATING MARKET SEGMENT DO YOU INTEND TO USE THE FAST CURE TECHNOLOGY?







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