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**SOLYFAST™ - Photo-latent metal catalyst
for rapid cure of 2K polyurethane coatings**

Ziniu Yu, Patrick Kelleher, and Avinash
Bhaskar

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Introduction



- Ziniu Yu, Ph.D.
 - ▶ Technical Specialist for Energy Curable Technologies
 - ▶ Ziniu.Yu@BASF.com
 - ▶ (248) 304-5238

Overview

- Why use a photo-latent catalyst?
- Non-Sn photo-latent metal catalyst for 2K-PUR coatings
 - ▶ Concept
 - ▶ Curing and cure rate
 - ▶ NCO conversion
 - ▶ Hardness and field trial
- Summary and conclusions

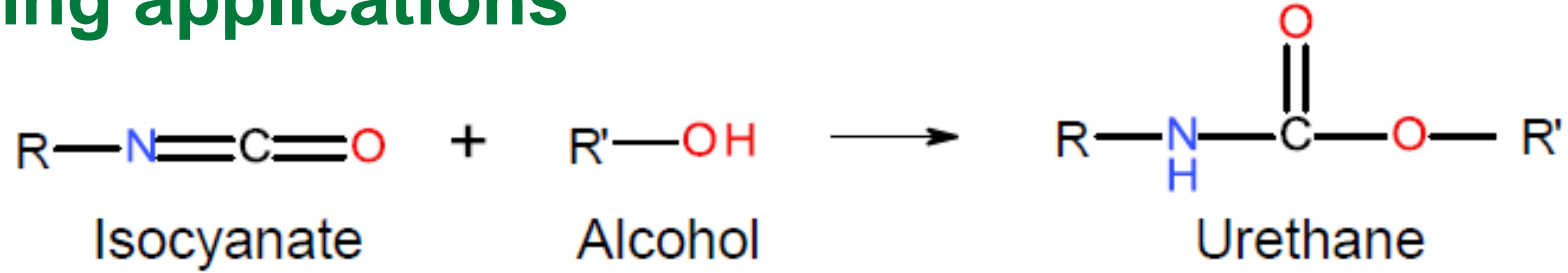
Why use a photo-latent metal catalyst?

- Accelerated curing of applied 2K-PUR
 - ▶ Reduced energy consumption
 - Room temperature vs. 60 – 80 °C
 - Addresses issue of heating large objects, heat-sensitive parts, or heavy metal structures
 - ▶ Increased through-put
 - Short time to dust/tack-free
 - Short time to handling/moving of coated objects
- Long pot-life
 - ▶ Reduced paint waste
 - ▶ Flexible processing time – cure-on-demand
- Organotin free compound – safer working conditions

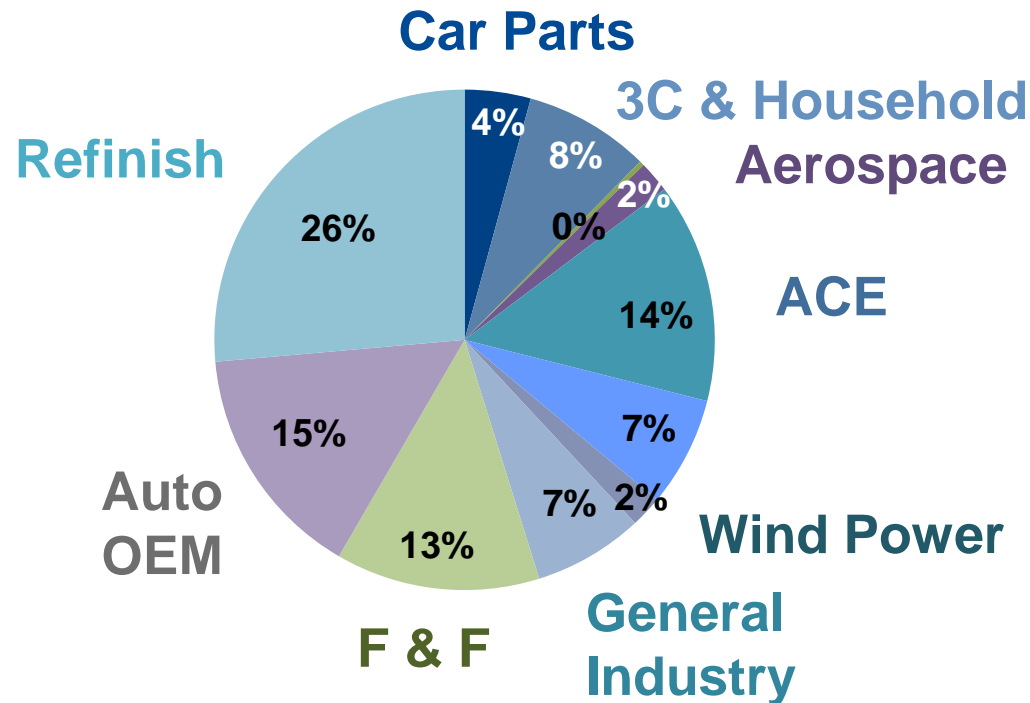


▶ Solution = non-Sn metal catalyst activated by UV-light at room temperature and when desired (“cure-on-demand”)

2K-PUR coating applications

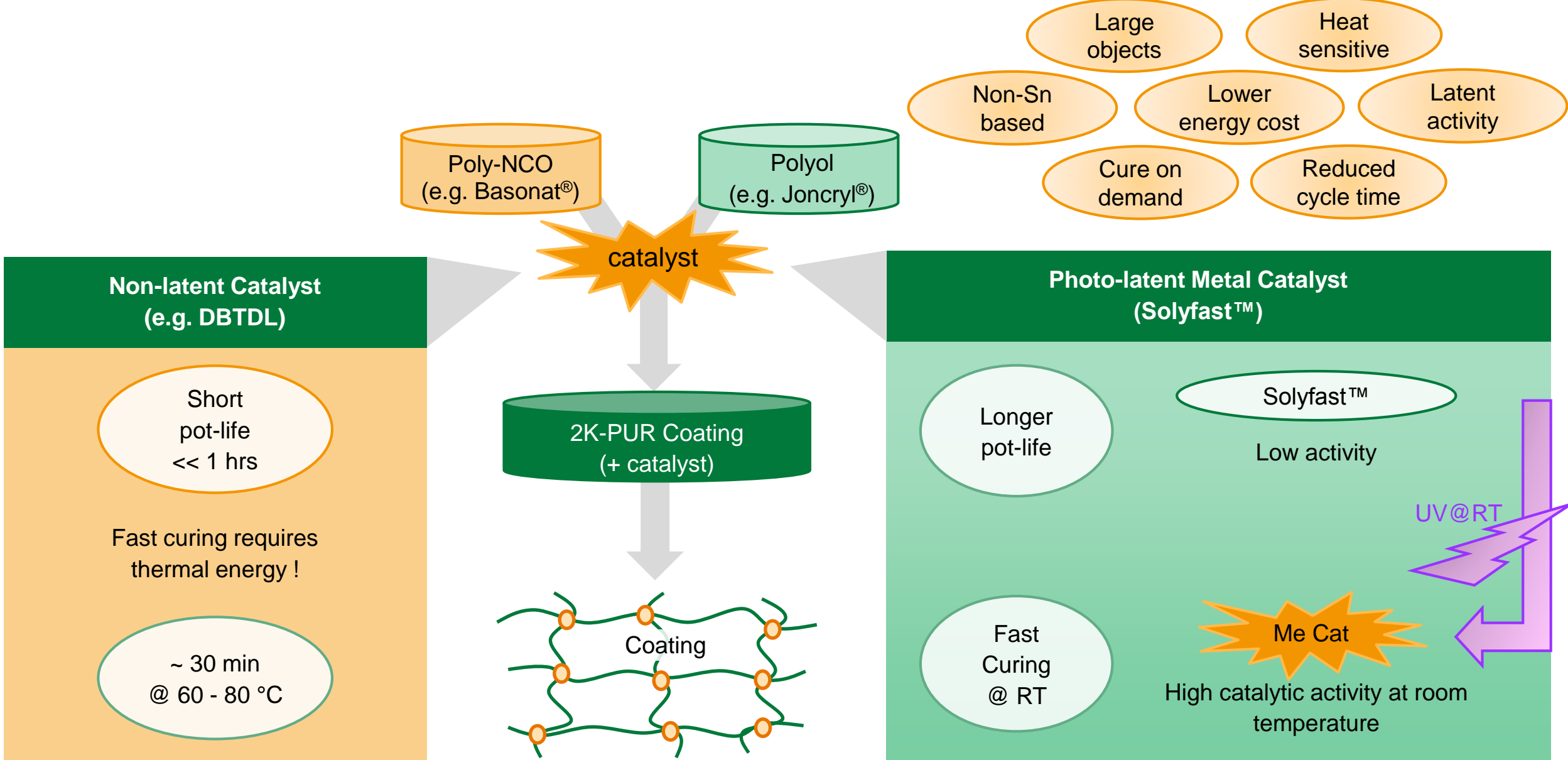


Global Coatings Market for 2K-PUR ~17,000 kT

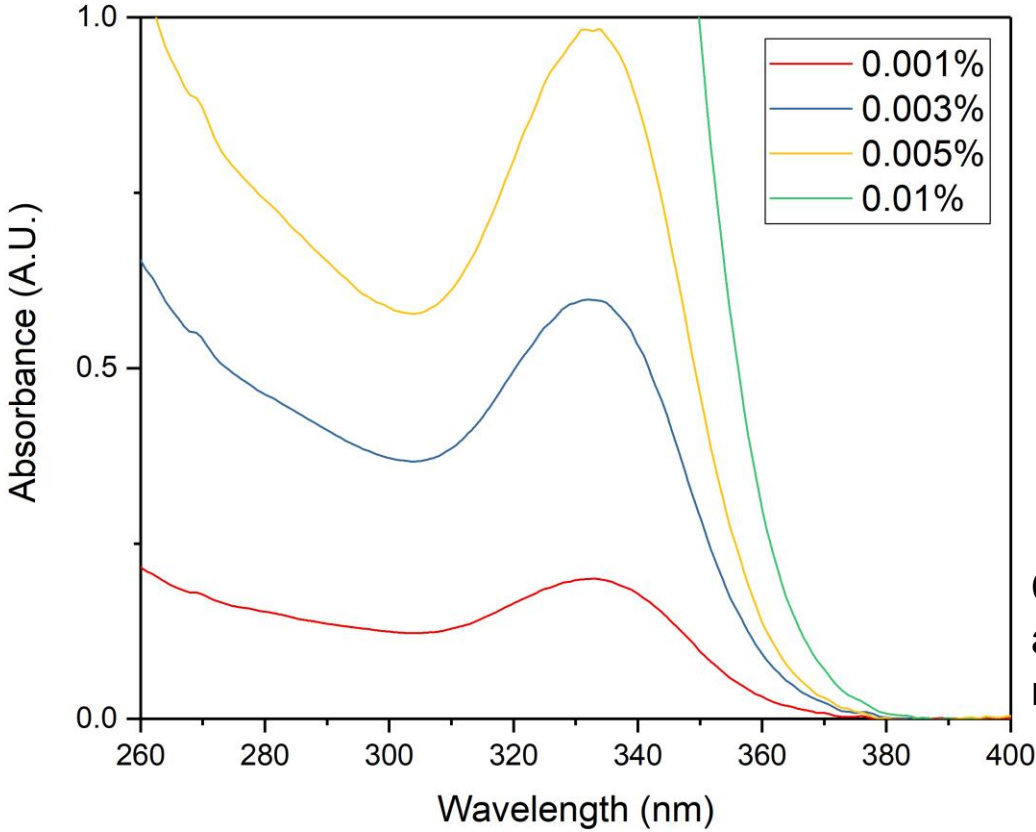


- Good UV resistance with HDI
- Good gloss retention
- Good color stability

Curing of 2K-PUR with non-latent and UV-light triggered catalysts



UV absorption of SOLYFAST™ photo-latent metal catalyst



Catalyst dissolved in butyl acetate for absorption measurement

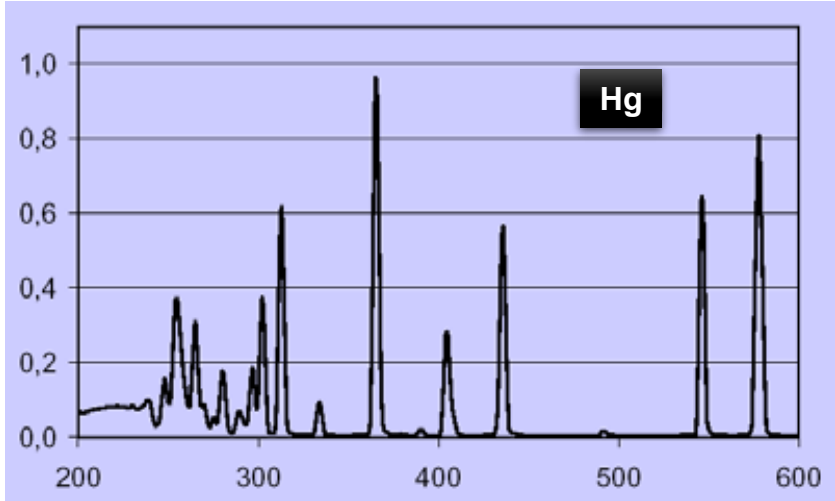
$$E = \frac{hc}{\lambda}$$



UV-F450 "Flood Lamp" (Panacol-elosol)



HB-404 (Philips)



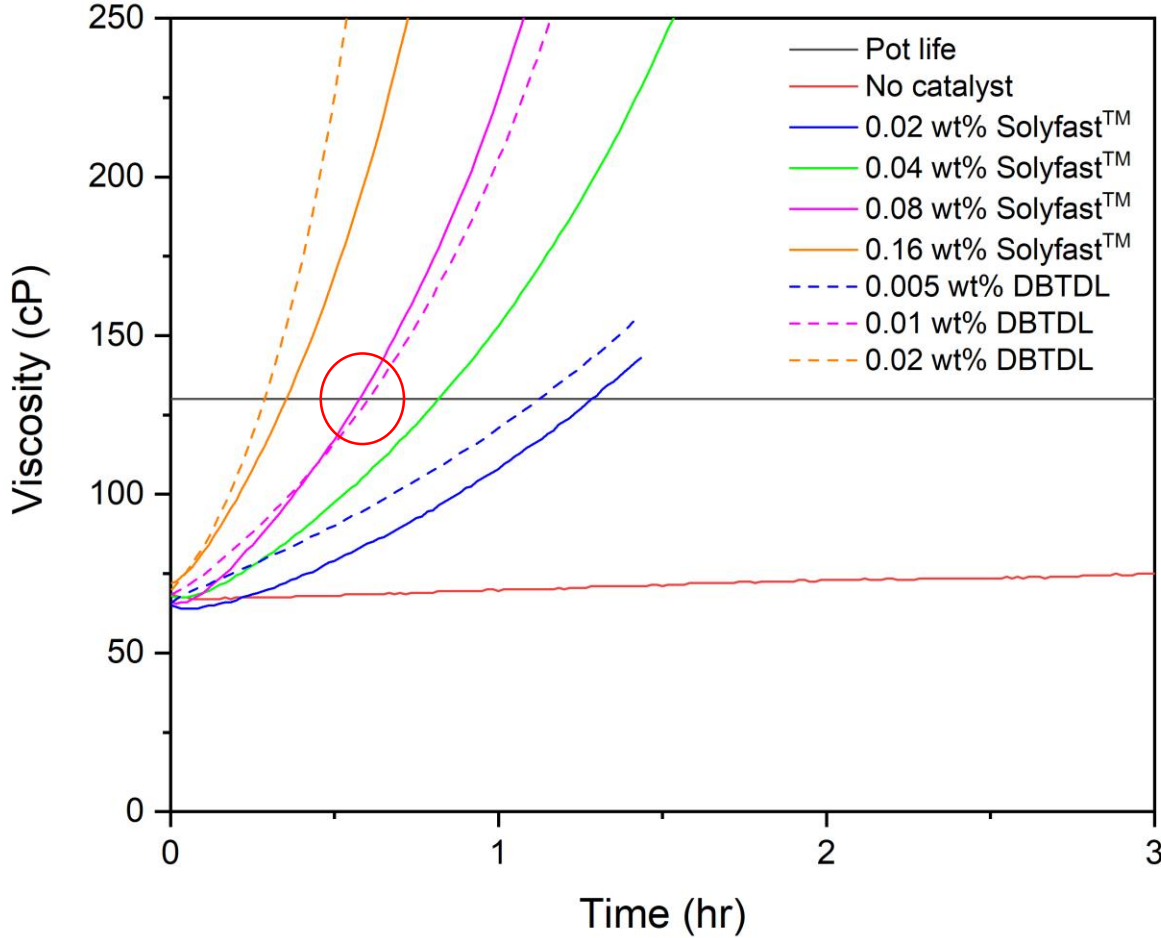
- Solyfast™ has strong absorption up to 380 nm
- Solyfast™ can be triggered by inexpensive UV lights, high intensity metal doped lamps, or even LED

Formulation

Component A	wt%
Polyol (JONCRYL [®] 507)	52.72
Leveling additive (EFKA [®] 3030)	0.60
Butyl-acetate	25.95
Component B	
Isocyanate (BASONAT [®] HI 2000)	10.07
Isocyanate (BASONAT [®] HA 1000)	10.57
Catalyst	
SOLYFAST 0010 or DBTDL	0.005 - 0.08

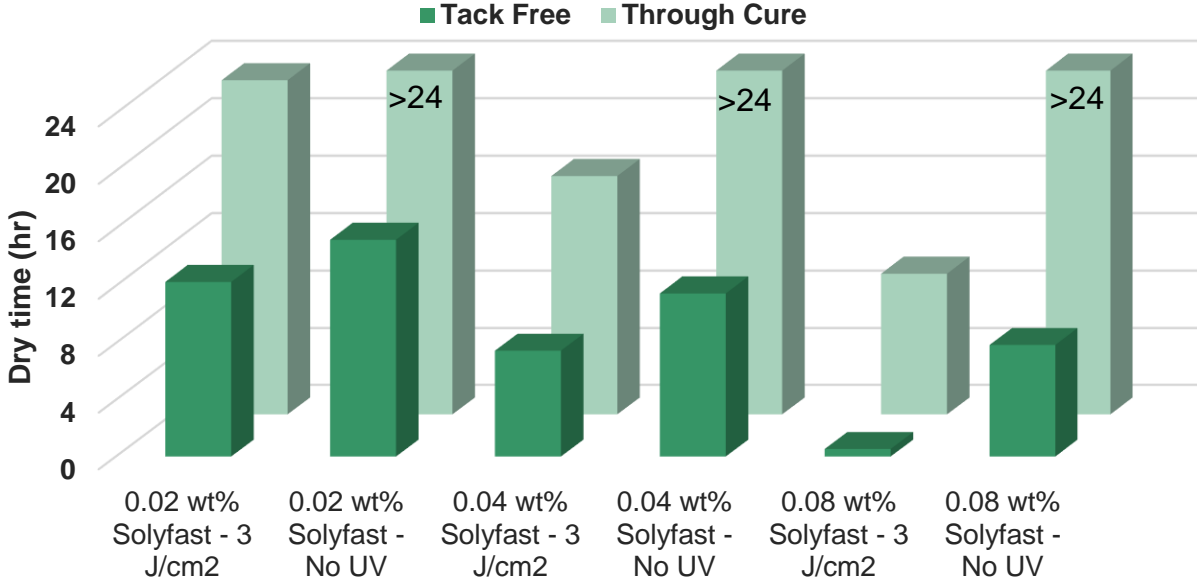
- Formulation characteristics
 - ▶ 63% Solids
 - ▶ Initial Viscosity ~65 cP
 - ▶ NCO:OH 1.05:1

SOLYFAST and DBTDL Pot Life

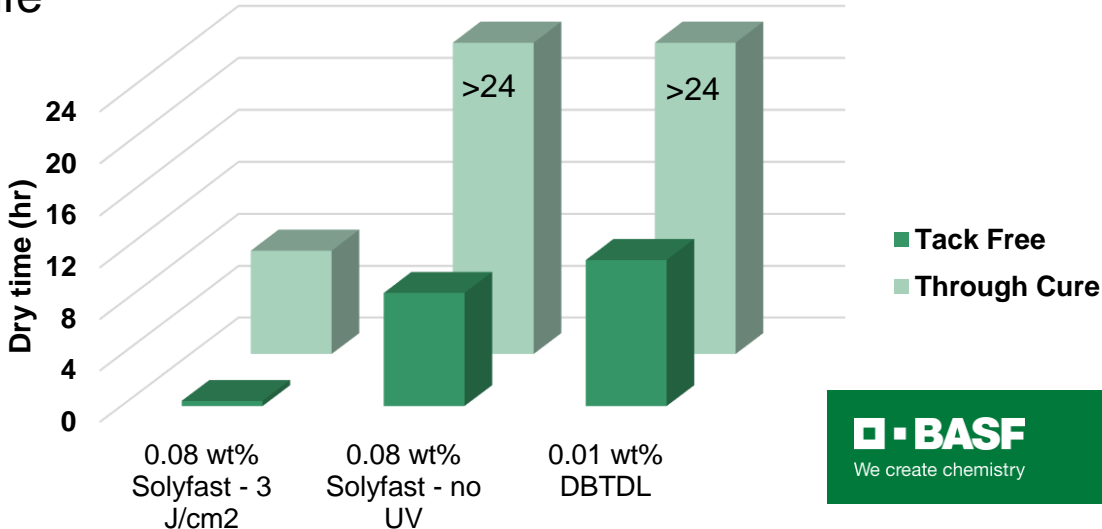
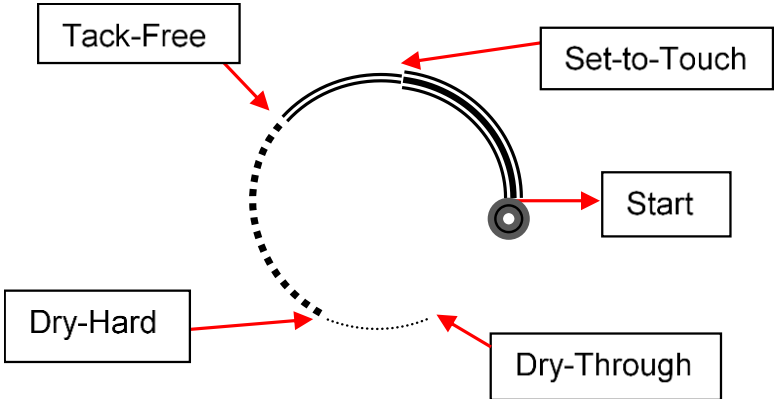


■ Higher SOLYFAST loading required to have an equivalent pot life to DBTDL

SOLYFAST- Coating Dry Time

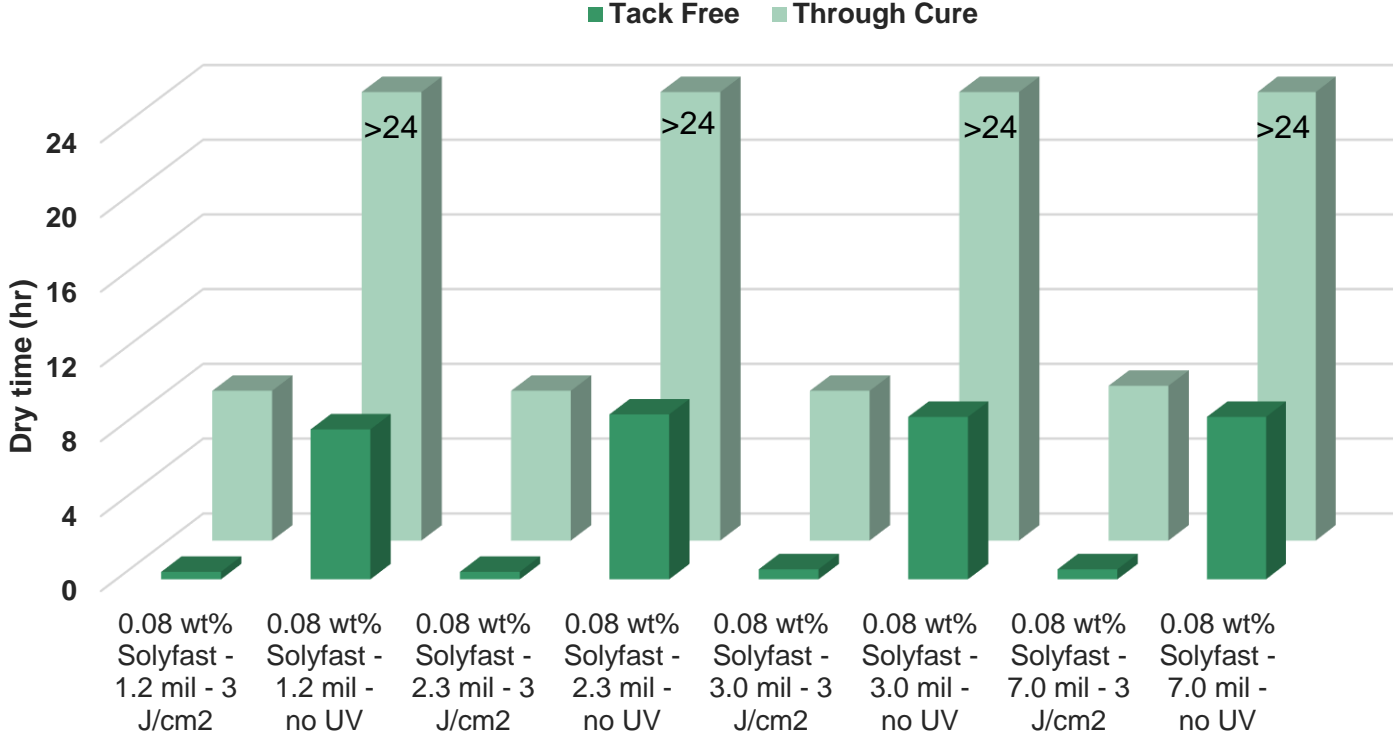
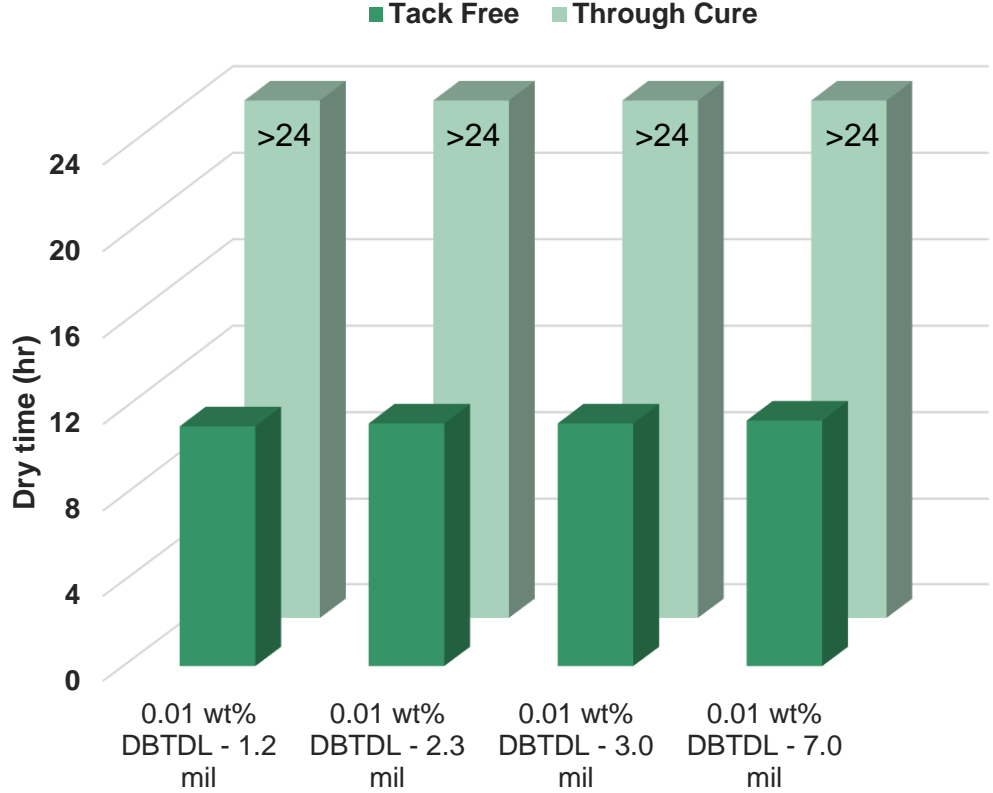


- Cure rate can be tailored by changing the SOLYFAST concentration and UV exposure
- 0.08 wt% SOLYFAST ~ 0.01 wt% DBTDL → equivalent pot life



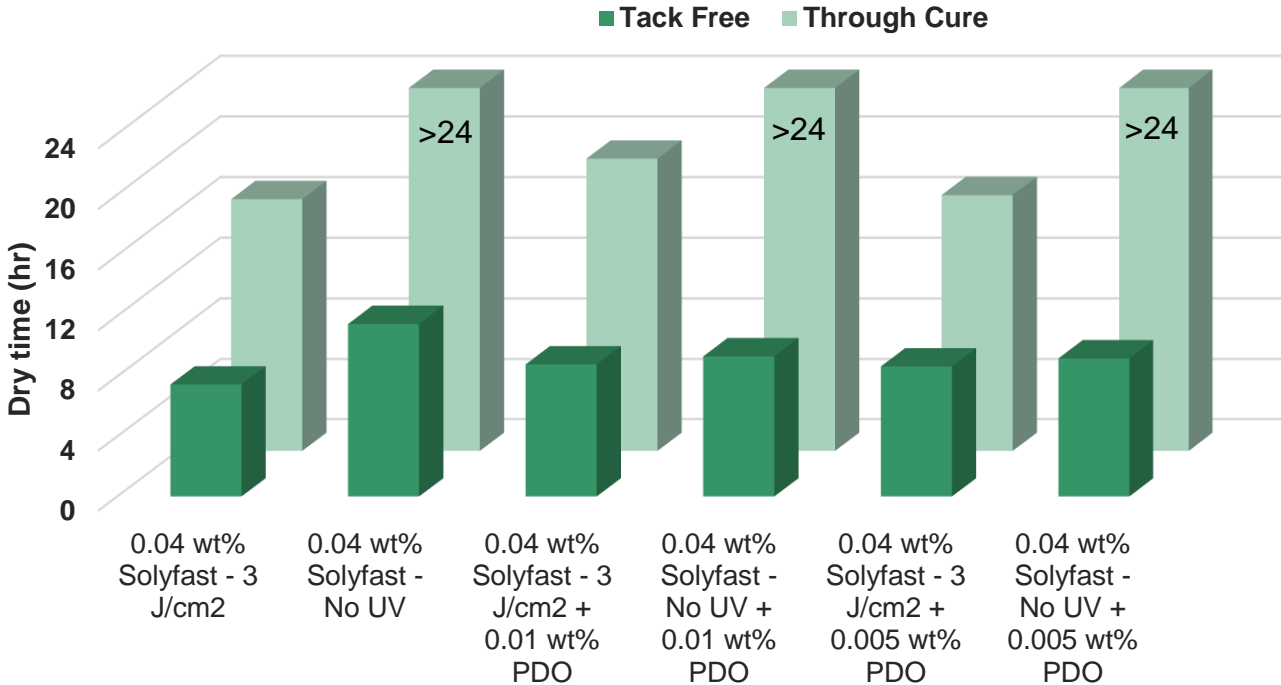
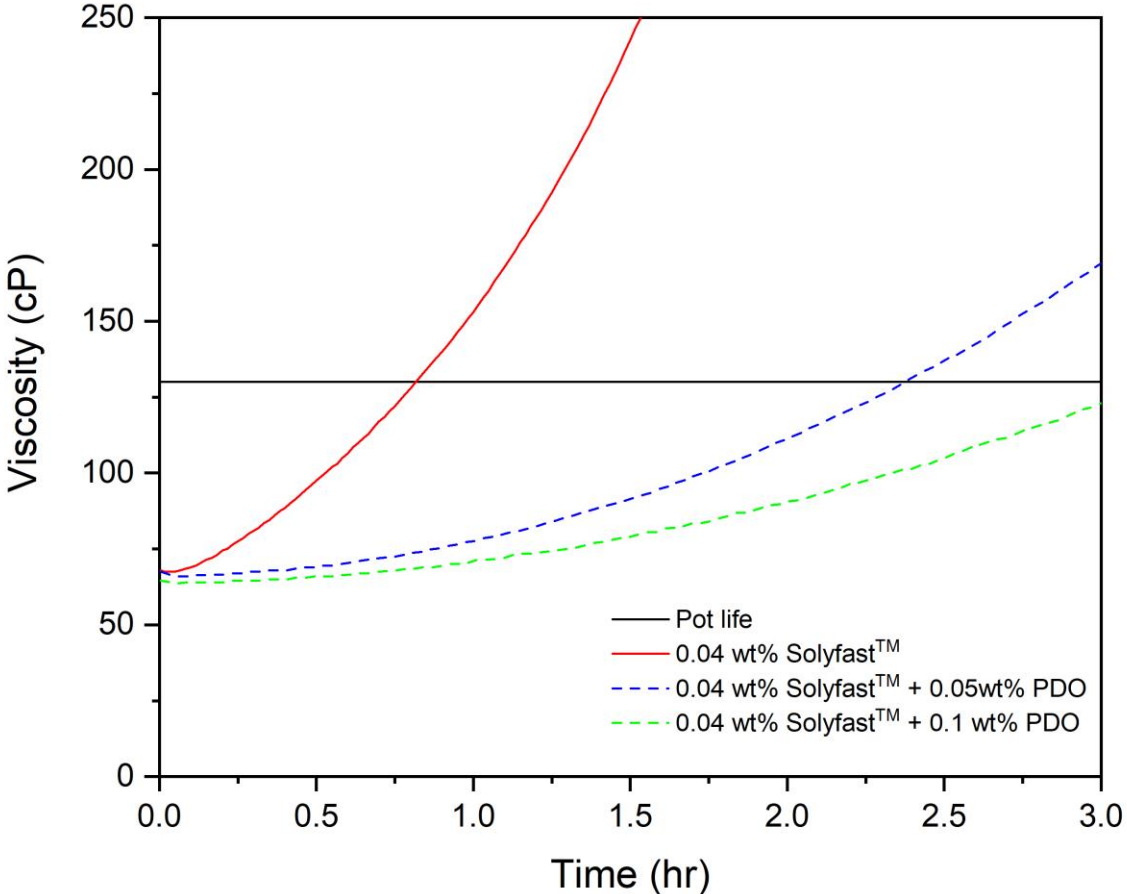
Dry time as a function of coating thickness

0.08 wt% SOLYFAST has an equivalent pot life to 0.01 wt% DBTDL



- Dry time is independent of coating thickness for both Solyfast™ and DBTDL
- UV light has negligible impact on drying time of coating formulated with DBTDL

SOLYFAST + pot life extender – viscosity and coating dry time

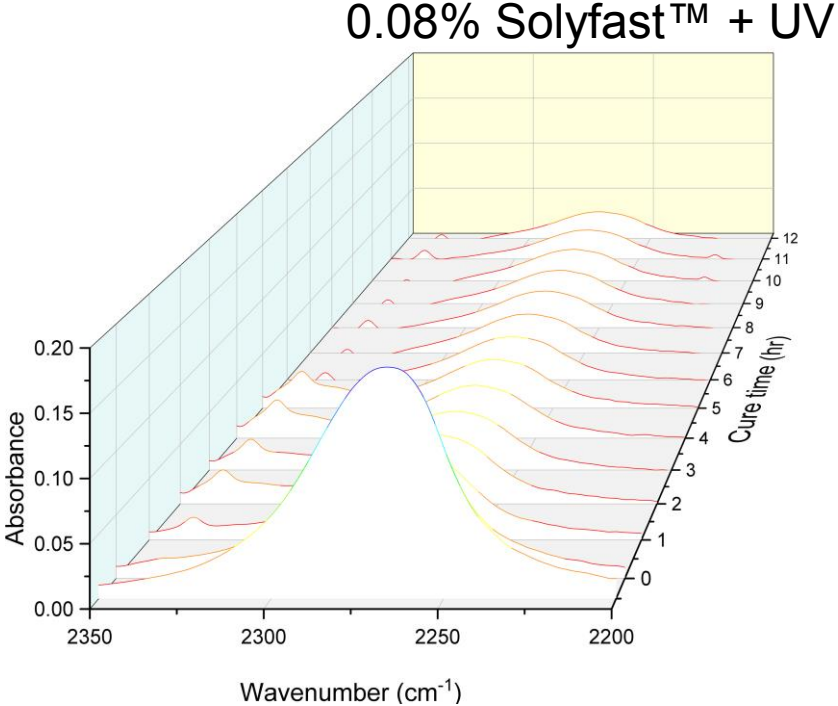
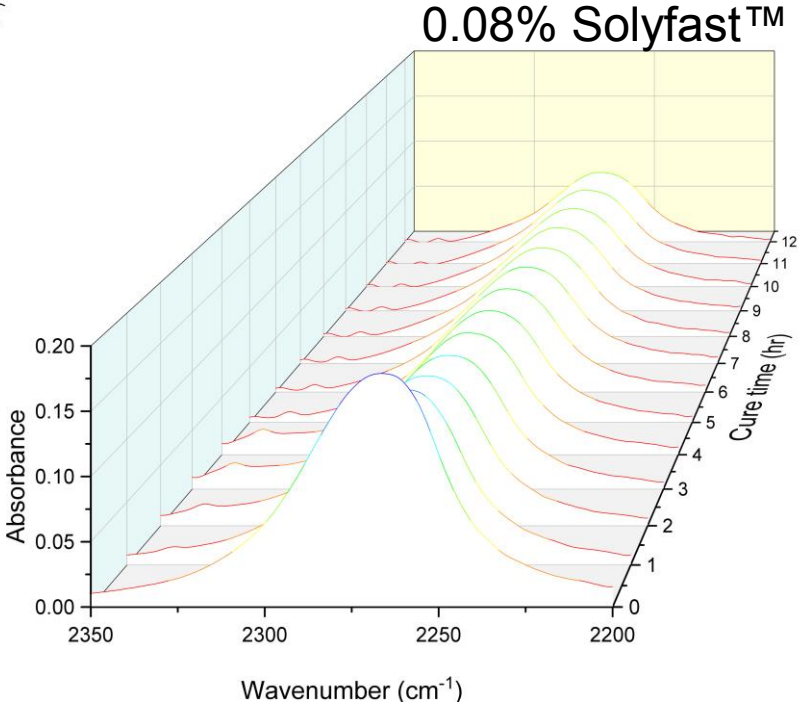
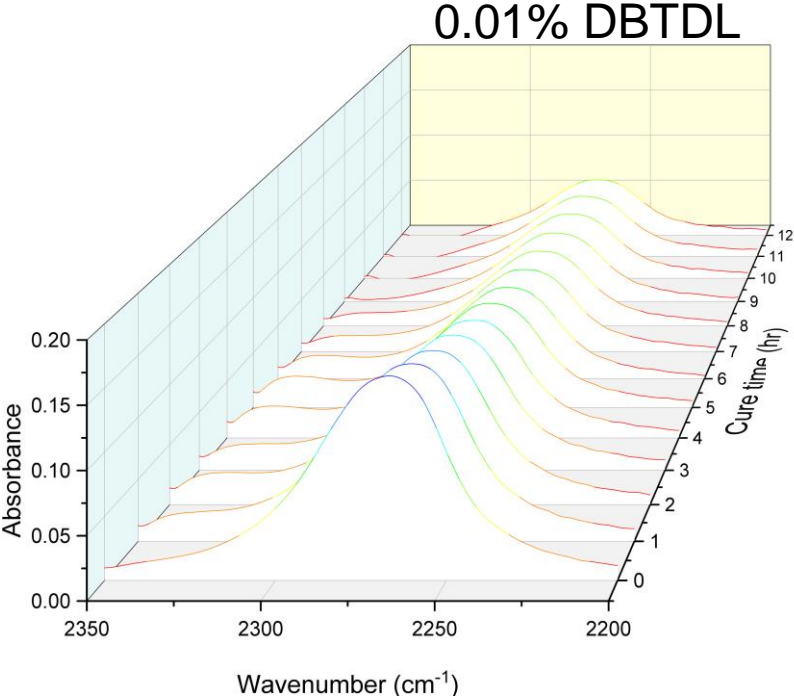


- Including a small amount of PDO in formulation containing SOLYFAST significantly increases the pot life
- Addition of PDO has a small impact on the dry time of formulations containing SOLYFAST

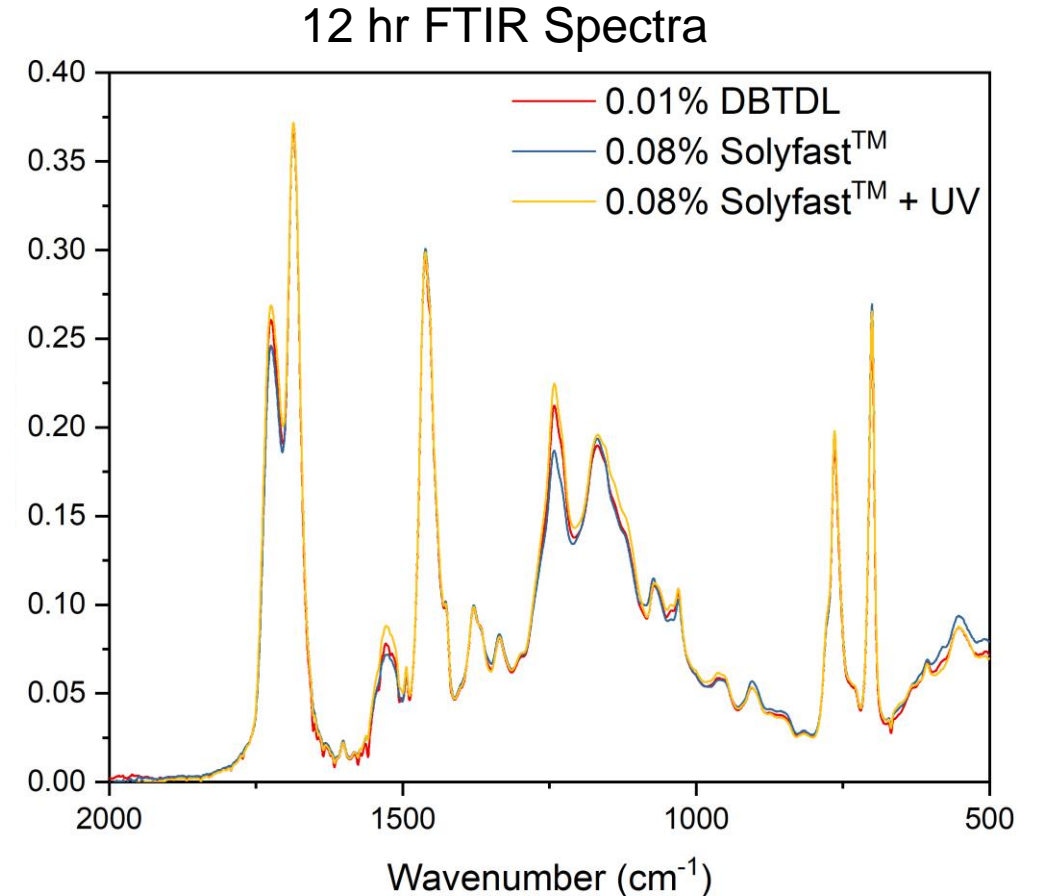
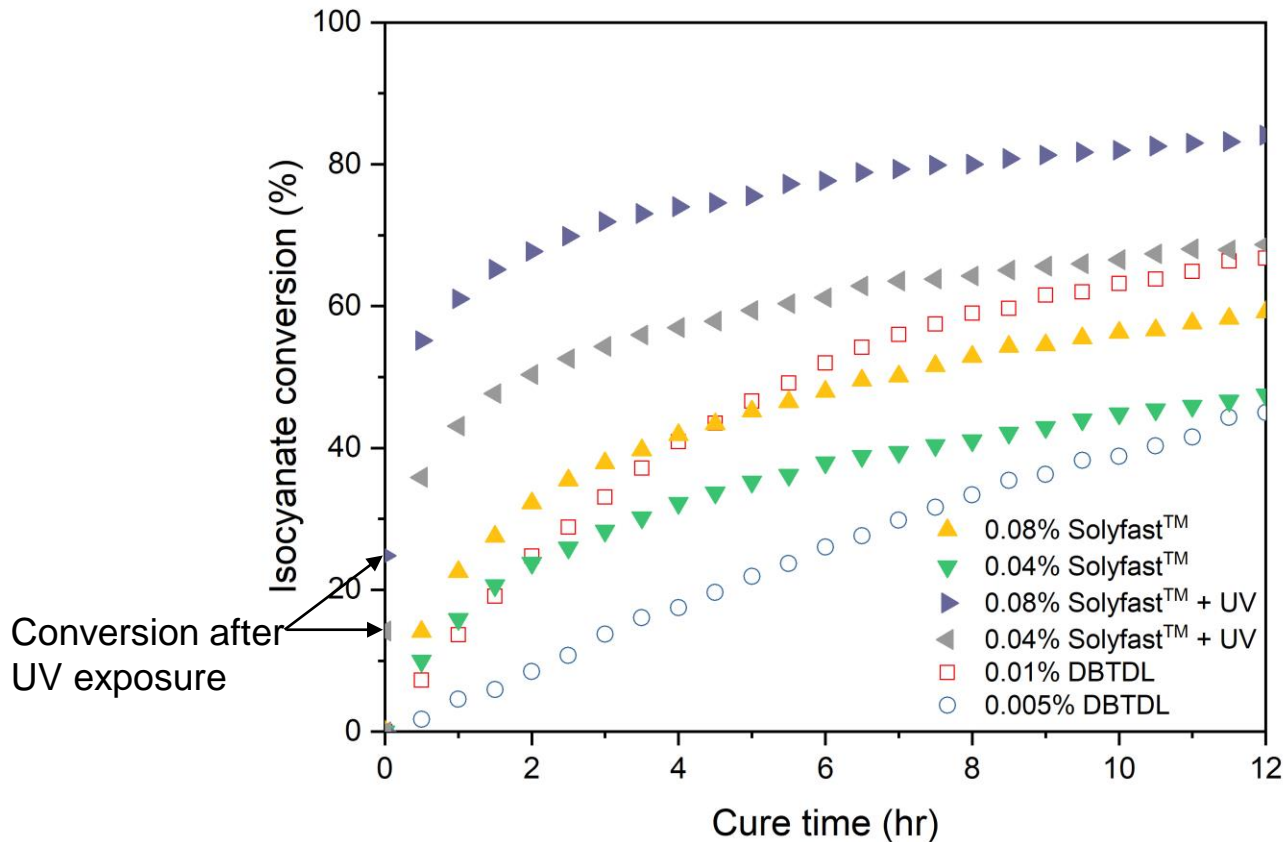
Measuring NCO concentration with FTIR



$$A = \epsilon \cdot l \cdot c$$

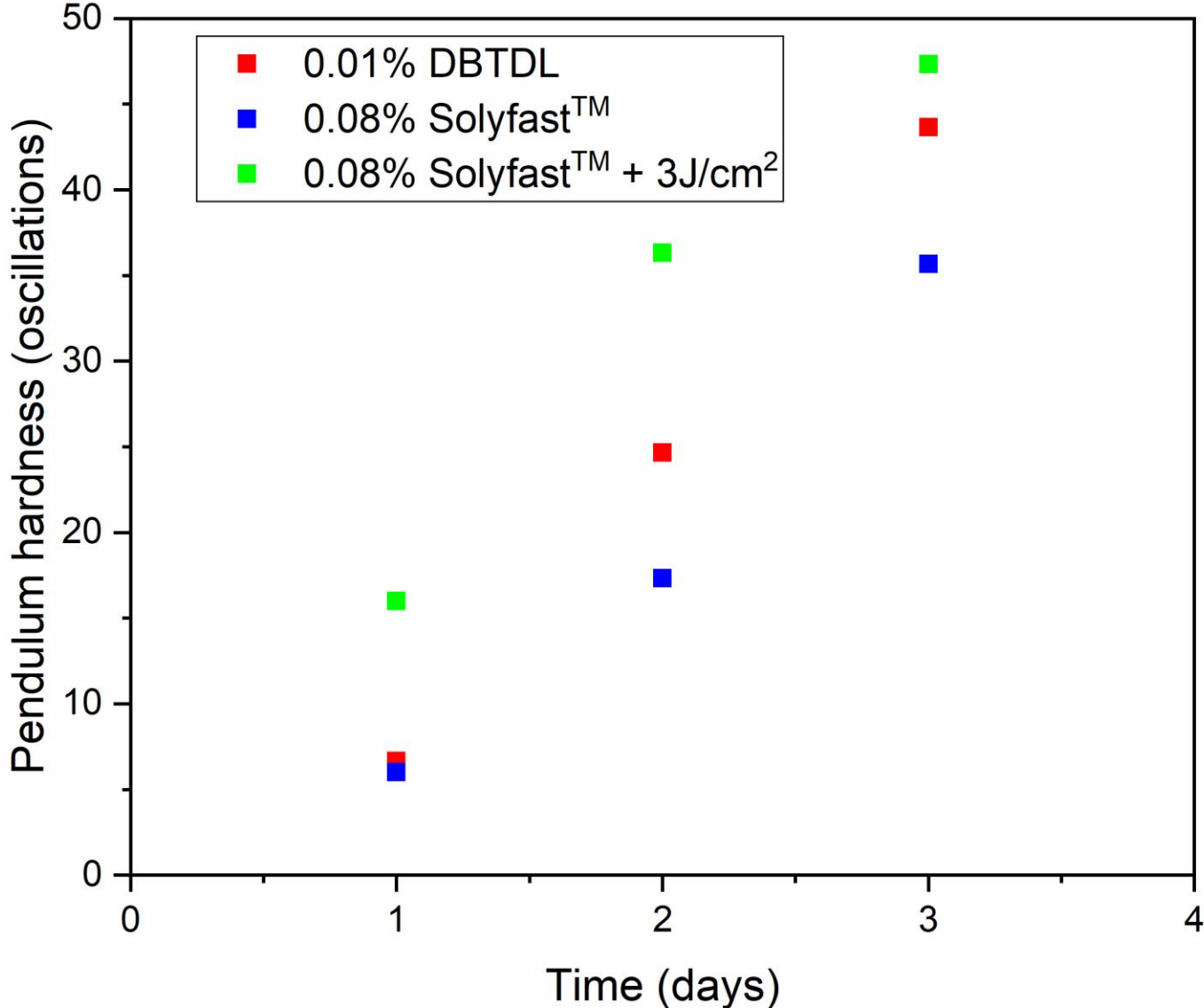


Quantifying cure rate with FTIR



- SOLYFAST promotes urethane formation with comparable selectivity to DBTDL
- Zinc octoate promotes urethane formation with higher urea selectivity than DBTDL

Hardness development - SOLYFAST vs. DBTDL

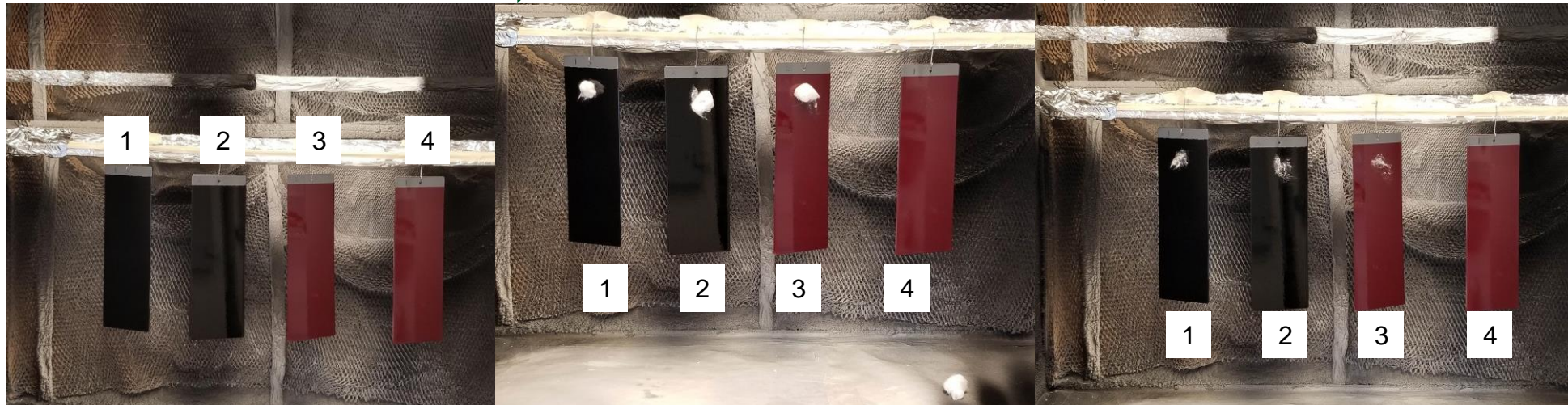


Field trial – SOLYFAST vs. DBTDL

2K PUR clear coatings were applied on top of colored base coat.

- 1: 0.01 wt% DBTDL
- 2: 0.01 wt% DBTDL 3 J/cm²
- 3: 0.08 wt% Solyfast™ No UV
- 4: 0.08 wt% Solyfast™ 3 J/cm²

Apply Coating. DFT: 1.2 mil → Apply Cotton Ball after 1 hour → Peel off Cotton Ball



Summary and conclusions - SOLYFAST

- SOLYFAST is designed to rapidly cure 2K-PUR coatings
- SOLYFAST offers:
 - ▶ Increased through-put – fast curing
 - ▶ Reduced waste – long pot life (exceptionally long pot life when small addition of PDO)
 - ▶ Cost savings due to coating curing at room temperature (UV instead of heat)
 - ▶ Flexible processing times – cure-on-demand
 - ▶ Healthier work environment – Sn free
- SOLYFAST can be used in both clear or pigmented coatings (thick or thin coatings), and with different JONCRYL products
- Cure rate can be tailored by changing SOLYFAST concentration and/or UV dosage

Contact Information & Questions

Technical Support	Position	Email	Phone
Ziniu Yu	Technical Specialist for Energy Curable Technologies	Ziniu.Yu@BASF.com	(248) 304-5238

Commercial Support	Position	Email	Phone
Avinash Bhaskar	Market Segment Manager for Automotive and Aerospace Coatings	Avinash.Bhaskar@BASF.com	(248) 304-5725

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