



Bayer MaterialScience



## **Polyurea Coating Composites - High productive, long lasting and decorative**



**PDA Europe Conference,  
Sitges, España, November 15-17 2010**

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Bayer MaterialScience AG, K. H. Wuehrer



Pictures provided by PDA Europe

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Pictures provided by Bayer MaterialScience AG,  
Dodgers Stadium, Los Angeles, USA



**In-shop application**

**Time?**





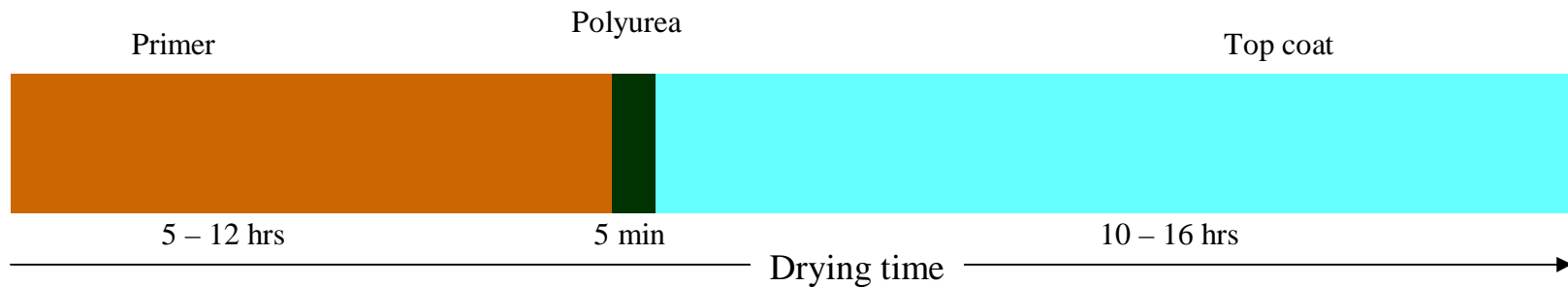
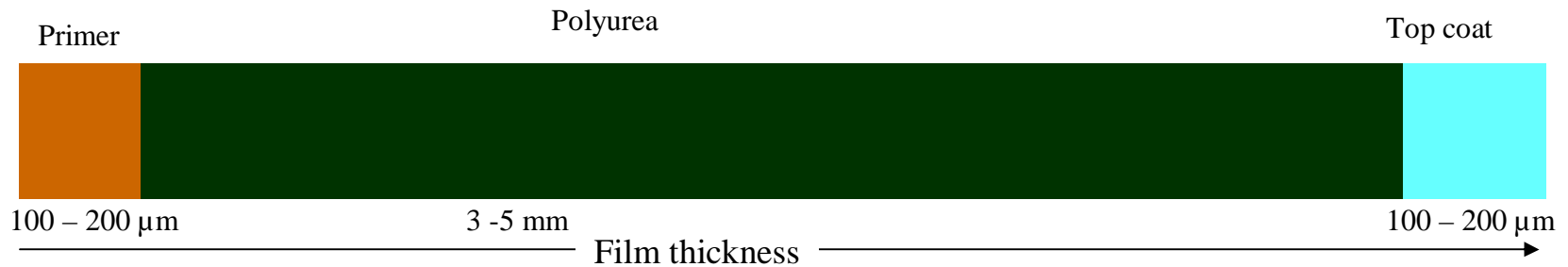
## Typical Polyurea Coating Composite

- Primer\* - e.g. 2K EP, 1K or 2K PUR
- High reactive Polyurea Coating
- Top Coat - 2K Polyurea or Polyurethane  
-optional-

\* More information regarding primers for concrete,  
please join “Applicator Training Course” from PDA Europe

### Typical Polyurea Coating Composite

- Primer - e.g. 2K EP, 1K or 2K PUR
- High reactive Polyurea Coating
- Top Coat - 2K Polyurea or Polyurethane



## Ideas to increase productivity = faster back to work

### 1. Primer

- determine re-coat window of conventional primers
- alternative, fast curing methods  
e.g. UV-curing

### 2. Top Coats

- fast curing technologies  
e.g. 1K PUR, Polyaspartic-Coatings,  
high reactive aliphatic polyurea

## **Additional limitations**

- No VOC **and** no emissions
- Mobile curing equipment
- On side application without a second spray equipment  
(roller or trowel application)
- In-shop application with low capital expenditure  
(use actual installations, no heat)



## 1. Primer

- Primer types

- A. Moisture curing urethane (MCU), MDI-prepolymer

- B. 2K Epoxi, Bisphenol A/F + phenalkamine curing agent

- C. Aliphatic MCU, silane modified HDI-polyisocyanate

- D. UV-cured urethane acrylate



## 1. Primer

### B. 2K Epoxi, Bisphenol A/F + phenalkamine curing agent

Guide formulation RUT 1974/1 , D.E.R. 358<sup>®</sup> / Cardolite<sup>®</sup> NC 558

- Pot life: approx. 70 min
- Drying time: approx. 12 hrs

			% by wt.
<b>Component 1</b>	DER 358	(1)	65.04
	<hr/>		
<b>Component 2</b>	Cardolite NC 558	(2)	32.51
	BYK-A 501	(3)	0.98
	Anti Terra 203	(3)	0.49
	Accelerator 960-1 CH	(4)	0.98
			100.00



## 1. Primer

### D. UV-cured aliphatic urethane acrylate

Formulated Desmolux<sup>®</sup> solvent- and reactive thinner-free

- Curing conditions: approx. 10 m/min  
Ga/Hg 80 W/cm  
approx. 600 mJ/cm<sup>2</sup> UV rate  
approx. 770 mW/cm<sup>2</sup>

## 2. Polyurea Coating

### -Fast setting 2K Polyurea Coating

Guide formulation WKHB 0108-PUA,  
Jeffamine<sup>®</sup> D 2000 / T 5000, Hardener<sup>®</sup> DT, Desmodur<sup>®</sup> XP 2727

Component A	Item		%
	1	Desmodur <sup>®</sup> XP 2727	50.9
Component B	2	Jeffamine D 2000 (1)	29.4
	3	Jeffamine T 5000 (1)	2.2
	4	Hardener <sup>®</sup> DT	12.3
	5	Bayferrox <sup>®</sup> 140 (2)	5.2
			100.0

### **3. Top Coat**

- Top coat types

E. Polyaspartic-Coating top coat

F. Aliphatic MCU

G. Aliphatic fast setting 2K polyurea

### 3. Top Coat

#### E. Polyaspartic-Coating top coat

Guide formulation WKHB 0106, Desmophen<sup>®</sup> NH 1420 / Desmodur<sup>®</sup> N 3900

- Working time: approx. 40 min
- Walkable after: approx. 1.5 hrs

Component A	Item	p.b.w.
	1 Desmophen <sup>®</sup> NH 1420	50.74
	2 Sylosiv <sup>®</sup> A 4 (1)	1.01
	3 Tego <sup>®</sup> Airex 944 (2)	0.51
	4 Tego <sup>®</sup> Wet 250 (2)	0.10
Component B	5 Desmodur <sup>®</sup> N 3900	47.64
		100.00

### 3. Top Coat

#### F. Aliphatic MCU

Guide formulation RR 5398, Desmodur<sup>®</sup> N 3400

- Drying time: approx. 4.5 hrs (@ 23°C / 50%)

**Due to a high impact of the humidity on the drying time,  
withdrawn from the testing program after pre-tests.**

### 3. Top Coat

G. Aliphatic fast setting 2K polyurea

**Due to the need of a 2nd spray equipment pushed back.**

## 4. Test procedure

- **Substrate:**
  - Pre-treated paving stone, 40 x 40 x 4 cm
  - cohesion/pull off test > 3.5 N/mm<sup>2</sup>
- **Application conditions:**
  - Approx. 23°C / 60% humidity
- **Application tools:**
  - Primer + top coat by roller
  - Polyurea: Graco E-XP2, 190 bar, 70°C
- **Actual testing:**
  - Pull-off adhesion related to ISO 4654
  - 50 mm dolly

## 5. Recoat window test

- **Primer:**
  - Re-coated after 1 hr, 1d + 3d
    - Pre-testing results showed that primer A, B + C needed at least 1h curing time
    - Primer D could be re-coated after 5 min
  
- **Top coat:**
  - Re-coating started after 30 min and up to 3 d
    - Pre-testing results showed that surface temperature of the polyurea coating should be 30°C or lower due to negative influence on the top coat viscosity
  - Test done with Primer A + B only-

## 6. Aging of the coated test panels

- **Dry conditions:**
  - Stored in our lab @ 23°C / approx. 50%
  - 7 days, 1 month, 6 month
- **Wet conditions:**
  - Pavestones stored in water, 6 mon
  - water level approx. 1 cm above primer

## 7. Test results Primer

### - Dry conditions:

Primer	Re-coated after	Result
A. Aromatic MCU	1h	Cohesion failure
	1d	Cohesion failure
	3d	Cohesion failure
B. 2K Epoxi	1h	Cohesion failure
	1d	Cohesion failure
	3d	Cohesion failure
C. Aliphatic MCU with silan- functionality	1h	Cohesion failure
	1d	Failure primer/polyurea > 1.5 N/mm <sup>2</sup>
	3d	Failure primer/polyurea > 1.5 N/mm <sup>2</sup>
UV-cured urethane acrylate	1h	Cohesion failure
	1d	Cohesion failure
	3d	Failure primer/polyurea > 1.5 N/mm <sup>2</sup>

## 7. Test results Primer

### - Wet conditions:

Primer	Re-coated after	Result
A. Aromatic MCU	1h	Cohesion failure
	1d	Cohesion failure
	3d	Cohesion failure
B. 2K Epoxi	1h	Cohesion failure
	1d	Cohesion failure
	3d	Cohesion failure
C. Aliphatic MCU with silan- functionality	1h	Cohesion failure
	1d	Failure primer/polyurea > 1.5 N/mm <sup>2</sup>
	3d	Failure primer/polyurea > 1.5 N/mm <sup>2</sup>
UV-cured urethane acrylate	1h	Cohesion failure
	1d	Cohesion failure
	3d	Failure primer/polyurea > 1.5 N/mm <sup>2</sup>

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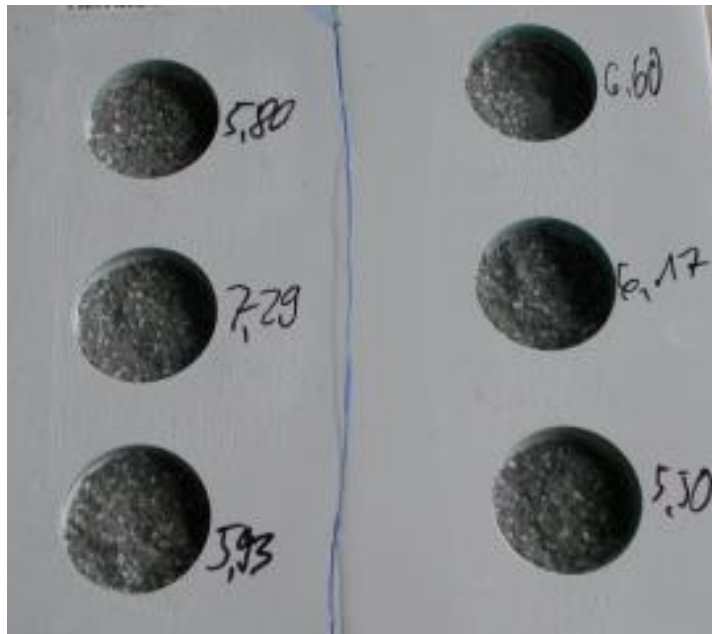
Primer B, 1h



Primer C, 1d

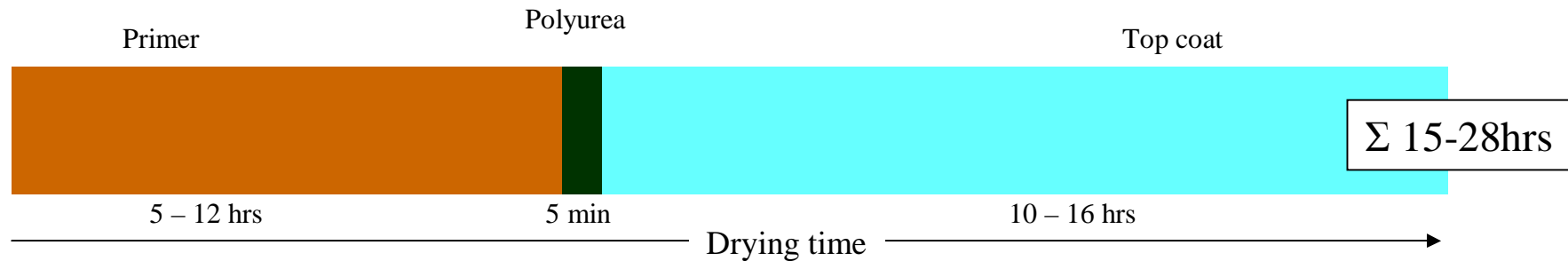
## 8. Test results Top Coat

- Under all conditions: Cohesion failure



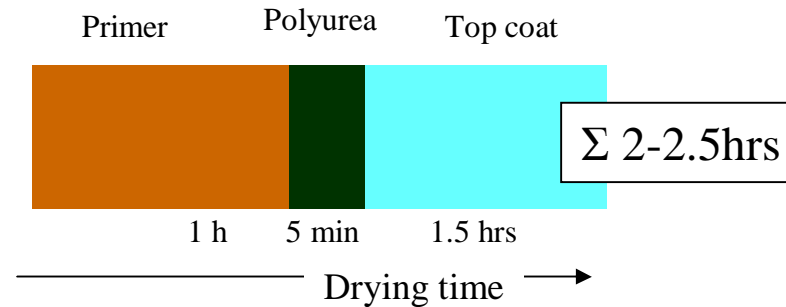
- Surface temperature after 2 min: approx. 75°C
- Surface temperature after 30 min: approx. 28°C

## 9. Conclusion

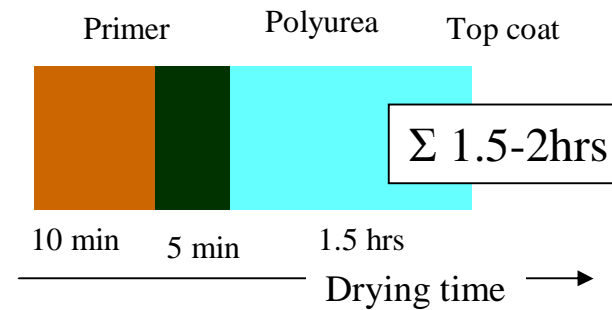


## 9. Conclusion

- On-side application  
(conventional primers)



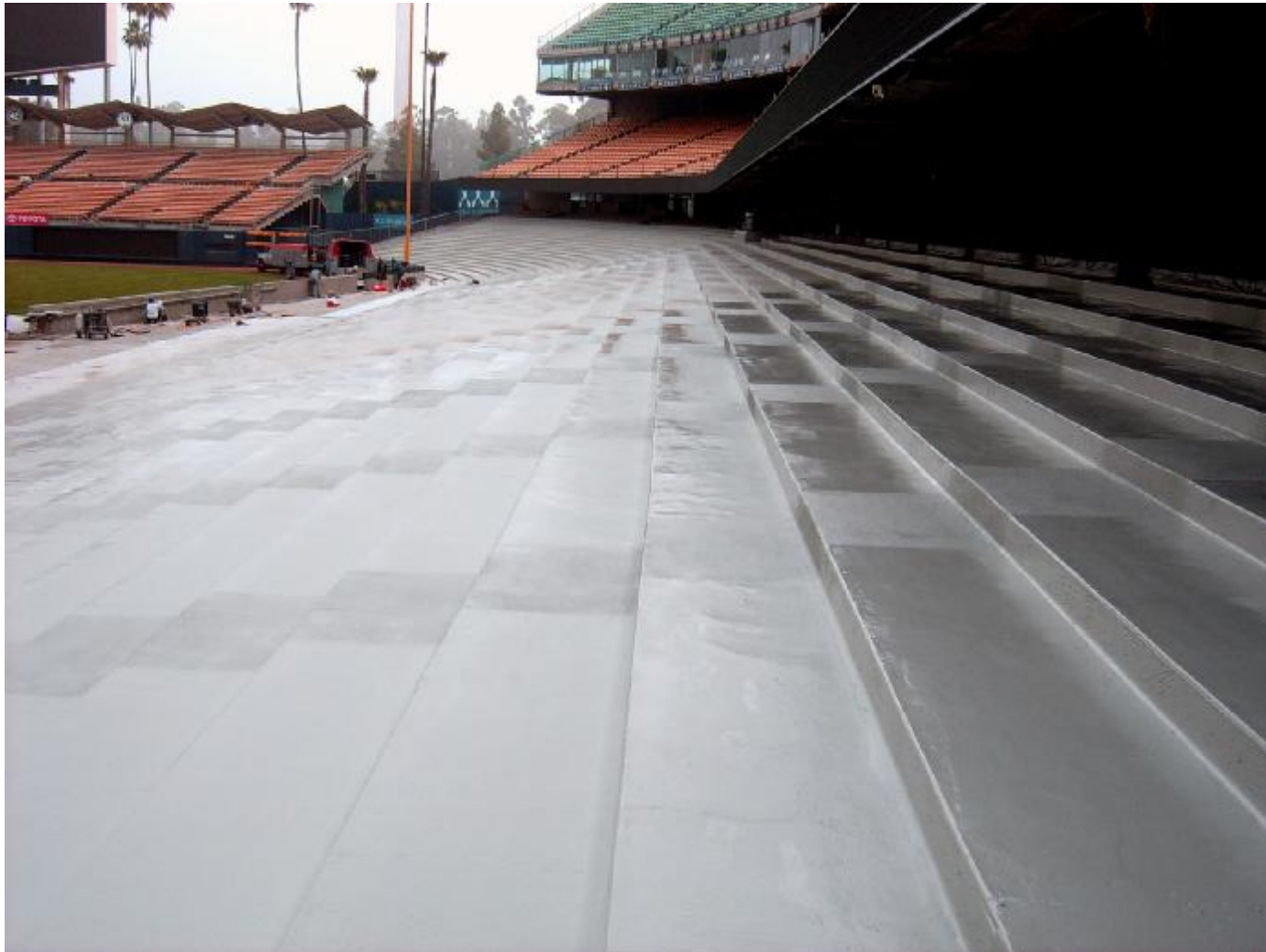
- In-door application  
(UV-cured primer)



## 10. Outlook

- In-door application:
  - Extended test program with different UV-cured primers, including dual cure types (UV-curing and NCO-function) for a longer re-coat window
  - Test program with a 2nd spray equipment for fast setting 2K polyurea top coats
- Out-door application:
  - Influence of different climate conditions

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# Question?