Polyurea Technology

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A few words about Polyurea technology

- Polyurea 2K-spray coating technology was introduced in the US in the late 1980s. Initially it made progress in Reaction Injection Moulding and sprayable coatings, now elastomeric coatings are more important.

- Polyurea systems are 100% solid they do not release volatile components and they react much faster than conventional polyurethanes.

- Additionally the polyureas produced are more mechanically stable and more hydrolysis resistant than conventional polyurethanes.
Polyurea Technology

We have three speakers today who will address different aspects of polyurea technology and use.

Carles Royo from GAMA who will introduce the subject
Cees Moorman from BASF who will discuss surface preparation
Marc Broekaert from Huntsman who will give some case studies of polyurea use.

Over to Carles
Introduction to Webinar and PDA Europe

(by Carles Royo)
Housekeeping

• Q&A session
  If you have a question please open the box on the right hand side of your screen and type your question in that area. We’ll do our best to address all questions after the presentation.

• Presentation
  Note: A PDF version of the presentation will be available for download upon request only, but you will be able to view the entire, archived presentation again on demand, for free, at www.utecheurope.eu
Polyurea: What is this?

- 2-Component elastomer spray technology
- Introduced to the market in 1987 in USA followed by rapid expansion
- Annual market growth globally >10%
- NAFTA and Asia ahead, in Europe growing interest in recent years
Polyurea Definition

PDA definitions
Polyurea:

• Two-part system of which
  - One part is Isocyanate component (-NCO)
  - Other part is a resin blend component where the reactive group is amine ( -NH₂ or -NH-), no hydroxyls (-OH)

Polyurethane-polyurea hybrid

• If the reactive groups are both amine and hydroxyl
PDA Objectives

PDA Europe was founded in 2007 by companies representing the entire value chain from raw material and formulation suppliers via equipment suppliers and applicators to specifiers...

• To pursue the interests of the European polyurea industry
• To promote the exchange of ideas for the development of the highest standards and operating efficiency within the European polyurea industry
• To develop methods for improving the conditions and advancing the best interests of the European polyurea industry
• To create lasting good will between the members and those who manufacture, specify, apply and purchase polyurea materials and services all around Europe
PDA Events

PDA Europe is editing status reports, organizing conferences, working groups

  More courses planned for the future depending on geographical demand...


- UTECH Conference and Tradeshow April 17-19,2012, Maastricht/NL (polyurea conference session (April 19) & booth at tradeshow)
  Conference session at Construmat 2013 Barcelona May 23rd, Booth at PUTECH Eurasia 14-16 Nov Istanbul

- Joint working group with Deutsche Bauchemie e.V. for regulatory approvals (DIN/EN)
10 Reasons to Join PDA Europe

1. Benefit from key information and business developments affecting the polyurea industry on European and international level.
2. Shape the future of the polyurea industry in Europe.
3. Jointly pursue and promote the interests of the industry in front of relevant European organisations and institutions.
4. Be part of the developments and the sharing of best practices.
5. Benefit from ‘members only’ discounts on technical information, training courses and the annual conference.
6. Increase your company’s visibility by participating, speaking and exhibiting at the annual conferences.
7. Actively contribute to the PDA Europe committees meetings and activities.
8. Increase market perception and acceptance of the polyurea technology.
9. Network with European and international industry representatives.
10. Have a global perspective on the polyurea industry through continuous links with the United States (PDA) and other regions of the world.
PDA Europe

Surface Preparation
2013

Cees Moorman
Chairman Training & Education Committee
• What is concrete?

  ▪ Concrete has been around for 2500 years
    ▪ Romans used it in the Coloseum
    ▪ Using natural cement
• What is concrete?
  
  ▪ Concrete composition
    ▪ Cement
    ▪ Water
    ▪ Sand
    ▪ Gravel
    ▪ Additives
So where do we start

- We start with an initial inspection of the substrate / spray surface
- Minimal adhesion for crack bridging systems
  - Non trafficked : 0,8 N/mm²
  - Trafficked : 1,5 N/mm²
  - The concrete must be minimum 28 days old
    - This is common used value in this period concrete finish the hydration of cement
  - It is however no guarantee that the surface is ready for application
  - Concrete contains more water than needed for hydration
  - This water needs to come out
  - It will come out to the top
- Adhesion is only as good as the surface below the Polyurea membrane
Cracks and concrete pathology

- 4 types of cracks need to be considered
  - (1) Dry static cracks and the (2) dry dynamic cracks
  - (3) Wet static cracks and the (4) wet dynamic cracks

- Can have serious consequences if not dealt before application of the Polyurea membrane
  - Problems during pour can cause problems later
  - It breathes
  - It becomes wear and rot
  - It has many problems and defects

- 5 basic pathologies
  - Carbonation
  - Sulphate attack
  - Chemical attack
  - Structural problems
  - Alkali-Silica reaction
Concrete surface requirements

- Humidity of concrete surface
  - Very important key for primer
  - But adhesion will fail
  - When you spray on moisture, there will be no adhesion

- General recommendation: 4 – 5 %
  - Needs to be measured
  - Contact hygrometer, only for the surface
  - Carbide bottle
  - Recommended because in-depth measurement
  - Destructive test

- Before application of primer
  - After each weather change or water contact to the surface

- Make 3 relevant readings per 500 m²
  - One against exterior wall
Concrete surface requirements

- Open porosity
  - Important for penetration and adhesion of the primer
  - Identification of curing agents are in the concrete
    - Wax like compounds

- Droplet test
  - Apply a drop of water
  - Needs to be absorbed within 5 minutes
  - If pearls are formed, curing agents are present

- Before application of primer
  - Take 5 relevant readings per 500 m²
Concrete surface requirements

- Substrate cohesion
  - Minimum 1.5 N/mm² (for good quality concrete)
  - 50% substrate failure

- Pull of adhesion test
  - Destructive test

- Before application of primer

  ➢ Take 3 relevant readings per 500 m²
Concrete surface requirements

- Ambient conditions
  - Although not only a surface condition
  - Recommended to check during initial inspection
  - Determine actions required

- Temperature
- Relative humidity
- Wind and wind direction
- Substrate temperature
- Dew point issues
Concrete surface requirements

- Temperature
  - Can impose limitations of use of products
  - Measure using a calibrated thermometer
  - Threshold temperatures
    - Epoxy Primers: +5 to +30 °C
    - Polyurethanes Primer: +12 to +30 °C
    - Special products for lower/higher temperatures
    - Polyurea membrane: -25 to +50 °C

- 1 reading in open surface
- 1 reading per room in closed surfaces
Ambient conditions

- Relative air humidity
  - Can indicate problems with dew point
  - Measure using a calibrated hygrometer
  - Threshold maximum values
    - Pure Polyurea: 85 – 95 %
    - Hybrid systems: 65 %
    - Depend on system supplier

- 1 reading in open surface
- 1 reading per room in closed surfaces
Site control / Condition control
- Shielding the environment is absolute necessary
  - Spray application = aerosol
  - Legend that product is cured after few seconds
    - Droplets cure slower due to cooling effect
  - Overspray is not dangerous
    - Overspray will travel very far
      - Damage stock
      - Damage cars
      - Damage properties

1 reading in open surface

Never underestimate the mighty wind
Concrete surface requirements

- Substrate temperature
  - Important value to know
  - Indication of dew point problems
  - Indication of cold bridges
    - Condensation issues
  - Measure using contact thermometer or IR thermometer

- 3 relevant readings per 500 m²
  - 1 reading against exterior wall
  - 1 reading in doorway
Concrete surface requirements

- **Dew point**
  - Most important thing to control
  - Dew point means condensation
  - Humidity on substrate
    - Adhesion problems
    - Blisters
    - Formation of pinholes in membrane

- Calculated from air temperature / humidity readings
  - Either automatic system
  - Or use dew point tables
  - Surface temperature : 3 °C above dew point and rising

- 3 relevant readings per 500 m²
  - 1 reading against exterior wall
Initial Inspection and Log

- Because of the need for correct repair and identification of defects
  - Initial inspection
  - Log of defects
  - Inspection reports

- There are 2 basic rules in initial inspections
  - NEVER ASUME ALWAYS CHECK
  - TO MEASURE IS TO KNOW
- Project description list with all details
- All details need to be made before application of primer
- You must have a complete work plan before starting the work
• Surface preparation
  - Shot or grid blasting
    - Preferred method
    - Dust free possible
    - Dry method
    - Use oil free shot
    - Opens pores
    - Removes laitance and cement skin
    - Remove all dust and debris and stay shot after blasting

➢ The result from cleaning (blasting) by following the classification in the guideline from the ICRI as a profile CPS 3 to 5.
• Surface preparation

  ▪ Scarifying

    ▪ Useful when large portions of concrete need to be removed
    ▪ Removing thick rigid coatings
    ▪ Elastomeric coatings block teeth
    ▪ Rough surface treatment
    ▪ Leaves rough surface
    ▪ Can be used where shot blasting machine can not reach
    ▪ These areas will require levelling

    ▪ Hint: Always scarify in the same direction in lines
• Surface preparation

  - Ultra high pressure water cleaning
  - > 750 bars
  - Excellent for removing thick dirt
  - Removes laitance

  - Wet technique
    - Allow sufficient drying time
    - Measure humidity in substrate
- Minimum concrete requirements
  - Concrete roughness
    - Concrete always has small imperfections
      - Pinholes
      - Bug holes
      - Offset formwork
      - Honeycombs
      - Stripping from surface preparation
  - Need to be dealt before application of membrane
    - Primer to seal porosity
    - Repair of weak or faulty areas
    - Levelling
- Details

  - Joints
    - 3 types of joints present in concrete constructions
      - Standard concrete joints with limited movement
        - Day joints
        - Construction joints
        - Cold joints
      - Expansion joints (movement in same plane)
        - Need to be isolated from membrane
      - Isolation joints (movement in different planes)
        - Need to be isolated from membrane
Details

- Cove fillets
  - All changes in plane need to be detailed.
  - Prevent sharp brakes in membrane
  - Needs to be provided in tender
• Concrete defects / repairs

  ▪ Pin holes

    ▪ Can create problems during spray application
      ▪ Shadows
      ▪ Pin holes

  ▪ Remedial techniques

    ▪ Self levelling epoxy screed
      ▪ Primer (recoat window)

    ▪ Cement based levelling coat
      ▪ Beware of water content (hydration curve)
      ▪ Primer needs to be chosen accordingly

    ▪ Scratch coat with primer
      ▪ Primer filled with dry quartz
• Concrete defects / repairs

  ▪ Small defects
    ▪ Mostly esthetical
    ▪ Will show through membrane
    ▪ Not structural
    ▪ Pin holes

  ▪ Cracks
    ▪ Dry dynamic cracks
      ▪ Smaller than 2 mm
        ▪ Chase out with U-shaped cut
        ▪ Fill with suitable elastic system
        ▪ Caulk / Poured system
      ▪ Larger than 2 mm
        ▪ Chase out with U-shaped cut
        ▪ Fill with suitable elastic system
        ▪ Provide a bond breaker
• Concrete defects / repairs

  ▪ Construction joints
    ▪ Found in all constructions
    ▪ Wall – slab
    ▪ Slab – upstand
    ▪ Joint around penetration

  ▪ Cove fillet
    ▪ Epoxy mortar
    ▪ Cement based mortar (beware of residual humidity)
    ▪ Select correct primer

    ▪ Primer filled with oven dried quartz sand
      ▪ Recoat time depends on primer

  ▪ Elastic caulk
    ▪ Shallow cove fillets only
• Concrete defects / repairs

  ▪ Wall joints
    ▪ Joints in same plane
    ▪ Between precast elements

  ▪ Chase out with V shaped cut
  ▪ Fill with suitable repair mortar
    ▪ Epoxy mortar
    ▪ Cementitious repair mortar (beware of humidity)
    ▪ Primer filled with oven dried quartz sand

  ▪ Recoat time depends on solution used
    ▪ Select correct primer
Concrete defects / repairs

- Raft and slab joints
  - Slight movement can take place
  - Loading of the surface
  - Clean out joint
  - Reconstitute edges with epoxy mortar
  - Fill with elastic system
    - Joint width < 20 mm
      - Depth = Width
    - Joint width > 20 mm
      - Depth = ½ Width
  - Provide bond breaker
• PRIMER APPLICATION

  ▪ Primer requirements

    ▪ Primer needs to be compatible with Polyurea technology

      ▪ Epoxy primer 2C
      ▪ Polyurethane primer 2C

    ▪ Temperature
      ▪ All primers have minimum and maximum application temperatures

        ▪ Minimum general 5 °C
        ▪ Maximum depends on formulation
        ▪ Solvent based systems

    ▪ For more detail information see the primer supplier info-sheet
• PRIMER APPLICATION
  
  - Application labour requirements
    
    - 4 man crew or multiplication
      - 1 x mixer and transport to application zone
      - 3 x distribution of primer onto surface
• PRIMER APPLICATION

  • Influences on pot life
    - Pot life = time to apply primer
      - After the pot life expires, the product can not be « moved »
      - Breaks links already formed
    - Temperature
      - Higher temperature = shorter pot life
      - Lower temperature = longer pot life
    - Mixed mass
      - Most 2-C product are exothermic reactions
      - Mass increases temperature quickly
      - Therefore distribute over surface as quickly as possible
      - Never work directly out of pail

  • Warning
    - Never apply primer beyond pot life
    - Never apply boiling or smoking primer
• PRIMER APPLICATION

- Recoat window
- Recoat window = time between application first layer and application second layer or membrane
- Must be respected at all times
  - Too fast = cross reaction between components
  - Too late = glazed surface
  - Can be extended by broadcasting sand into primer

• Warning
  - Recoat windows is influenced by ambient conditions
  - Temperature
  - Humidity
  - Needs to be planned and executed with care
    - Prevent soiling of the un-primed surface
    - Prevent over-coating loose sand
    - Assure even distribution and avoid pooling

- When in doubt ask your supplier
• PRIMER APPLICATION

  - Extending the recoat window
    - Using broadcast sand 0.7 – 1.2 mm
  - Correct broadcast sand technique
    - Respect broadcast time of primer = longer than pot life
    - Always keep surface clean
    - Uniform distribution
    - Seeding trays or sand blaster without nozzle
    - Never throw sand into surface
    - Toss into the air
    - Grain size depends on membrane thickness
    - Consumption
      - Full saturation = approx 1 – 1.5 kg/m² sand
      - Partial saturation is possible but difficult to control
And then you can spray the POLYUREA

If you have questions post it on the webinar
CASE STUDIES

Marc Broekaert
Chairman Membership Committee
Polyaspartic topcoat over aromatic polyurea

Application
- Can be applied by phenolic resin core roller, high pressure spray, or through a cup gun under low pressure.
- Minimum film thickness of 5 mils (130 μ).

Curing
- At 21°C and 50% relative humidity, allow each coat to cure a minimum of 2-4 hours between each coat.
- Allow a minimum of 6 hours before permitting light pedestrian traffic and at least 24-48 hours before permitting heavy pedestrian or auto traffic on to the finished surface.
- Very sensitive to heat and moisture when uncured.

Staingard 6072 Product Features
- Quick Cure
- Color Stable, High Gloss
- Excellent Weatherability
- UV Resistant For Superior Gloss Retention
- High Tensile Strength
- Abrasion Resistant & Durable
- Topcoat over aromatic polyurea, polyurethane and epoxy applications

Seamless Waterproofing Membrane Application
- Can be applied by phenolic resin core roller, high pressure spray, or through a cup gun under low pressure.
- Minimum film thickness of 5 mils (130 μ).

Source: Bayer
Marble-like finish obtained with an acid stain combined with an aspartic clear sealant.
70,000 square feet (approx. 8000 sq meters)

General Properties of Decoshine
• Self-priming
• Excellent adhesion to concrete
• Excellent scratch and traffic resistance
Project The Botnia Line - 2007
Waterproofing New Railway Bridges, Sweden

Main requirements
• Watertight at 100 kPa water pressure
• Resistant to water, road salt, oil
• UV stable at direct sun exposure
• Non-corrosive against steel

System
• MICOPOX WP epoxy primer
• MICOREA S3 aromatic polyurea waterproofing membrane
• MICOPUR G polyurethane finish with 1 to 2 mm sand

Source: Elmico
Project The Botnia Line - 2007
Waterproofing New Railway Bridges, Sweden

Adhesion

Load bearing

Crack bridging

New Swedish Specification BVS 583.10
Project Wakobato 2009

Theme Parks
Phantasialand, Germany

Source: ThreeDeeFactory
Project Wakobato 2009

Theme Parks
Phantasialand, Germany

Source: ThreeDeeFactory
Huntsman Green Roof - September 2010

Initial bitumen roof

Polyurea coating

Final VYDRO® green roof

Sedum, grasses and other plants
4 cm of Lava stones, still 15% cavities

Filter membrane on top
4 cm thick VYDRO® substrate foam

4 mm of polyurea coating waterproof membrane

Source: Huntsman
Huntsman Green Roof - September 2010

Polyurea after 30 months weather exposure!

Source: Huntsman
Waterproofing of the 80 year old concrete on the approach spans of Sydney Harbour Bridge was necessary to preserve the structure from damages. High daily traffic load forced the authorities to find a solution with minimised traffic closure. Sika, one of the largest construction chemicals manufacturer worldwide, provided the best suitable solution with excellent crack bridging properties, perfect bond and shear strength at the shortest application time. The system is made of a polyurea membrane equipped with a hot melt pellets tack coat.

Source: Sika
Sydney Harbour Bridge - 2012

Waterproofing and Restoration

Milling followed by water jet cleaning

Drying of the surface prior to priming

Polyurea spraying

Products used:
Sika® Concrete Primer
Sikalastic® 841ST polyurea
Sikafloor® 161 tack coat
Sikalastic® 827HT hot melt pellets

Tack coat + Hot melt pellets
Q&A

THANK YOU!
Contact

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