Polyurea as roofing, waterproofing material

Actual European EOTA and CEN activities and German regulation

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- Waterproofing polyurea kits/products for roofs, balconies and terraces (ETAG 005, German standards)
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- Waterproofing polyurea kits/products for indoor rooms (wet) rooms, ETAG 022, German standards)
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- CPD/CPR ER 3; Update Regulated dangerous substances, actual EOTA and CEN activities
- Summary
Overview - Application of liquid applied waterproofing kits

Waterproofing of indoor rooms (bath rooms)

Waterproofing of roofs, terraces, balconies

Waterproofing of traffic areas

Sealing of containments

Source Ch. Herold, DIBt, Berlin
Waterproofing Polyurea kits for roofs

- **ETAG 005 “Liquid applied waterproofing kits“ – For polyurea part 6, „Specific stipulations for kits based on polyurethane“ mostly is applied**
  - Requirements concerning performance according to Essential Requirements (ER CPD), e. g. mechanical resistance and stability, reaction to fire, emission of dangerous substances, durability, safety in use.
  - Categorisation according to use (examples):
    - Categorisation according to working life;
    - Categorisation according to climatic zone in use
    - Categorisation according to user loads (like pedestrian traffic, traffic or plants)
    - Categorisation according to surface temperature;

**Examples for application areas**
1. Flat roof, 2. balconies 3. terraces
4. extensive and intensive greening
5. Details,

Source: Deutsche Bauchemie, state of the art report
## Chronologic development of liquid applied waterproofing kits in German regulation

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>Liquid applied roof waterproofing kits were firstly listed in German DIBt “Construction products list” (BRL),</td>
</tr>
</tbody>
</table>
| 2001 | • Publication of ETAG 005  
• Integration of liquid applied roof waterproofing kits (PUR, MMA, UP)  
• Revision of “Flachdachrichtlinie” (flat roof guideline) of ZVDH (central association of roofers) with relation to liquid applied reactive resins |
| 2003 | Expansion in German “Construction products list (BRL) with applications for balconies, terraces and green roofs |
| 2004 | Integration of waterproofing with liquid applied reactive resins into BRL |
| 2008 | New edition of “flat roof guideline” of ZDVH |
| 2009 | • International IFD-guideline for planning and execution of roofs and waterproofing of roofs (flat roof guideline)  
• Integration of waterproofing liquid applied water proofing products in DIN 18195 (German general standard for application of waterproofing products). |
| 2010 | Publication of DIN 18531 (German standard for waterproofing of roofs) |

Source: Deutsche Bauchemie, state of the art report
Integration of polyurea products in German roof waterproofing regulation

- In Germany application of liquid applied waterproofing kits is ruled
  - For unused roofs (non-accessible; extensive vegetation) in:
    - DIN 18531 „Waterproofing of roofs“, part 1 to 4
    - ZVDH (central association of roofers) „Technical guideline for waterproofing = flat roof guideline“
  - For used roofs (accessible or intensive vegetation; balconies, terraces...) in
    - in ZDVH „flat roof guideline“
- In Germany for the time being polyurea is not integrated in DIN 18531, therefore is not integrated in „flat roof guideline“ of ZDVH

Open questions/topics:
- Complete list of references for polyurea products (with objects older than 5 years) necessary
- Control/measurement of layer thickness;
- Convincing of (traditional) roofers concerning the safe application of polyurea
Design of liquid applied roof waterproofing kits for non-accessible roofs – DIN 18531

<table>
<thead>
<tr>
<th>Materials</th>
<th>Application category</th>
<th>min. layer thicknessa (mm)</th>
<th>loading classes (mech., temp.)</th>
<th>performance classes according to ETAG 005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible unsaturated polyester resins (UP)</td>
<td>K1</td>
<td>1,8</td>
<td>IA, IIA, IB, IIB</td>
<td>climatic zone M; expected work life W3</td>
</tr>
<tr>
<td>Flexible polyurethane resins (PUR) 1K, 2K</td>
<td></td>
<td></td>
<td></td>
<td>roof slopeb S1, S2, S3, S4</td>
</tr>
<tr>
<td>Flexible reactive methylmethacrylate resins (MMA)</td>
<td>K2</td>
<td>2,1</td>
<td>IA, IIA, IB, IIB</td>
<td>user load P4</td>
</tr>
<tr>
<td></td>
<td>(demanding roof constructions)</td>
<td></td>
<td></td>
<td>lowest surface temperature TL3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>highest surface temperature TH3</td>
</tr>
</tbody>
</table>

- No single value of minimum layer thickness shall fall below 5%.
- Independent of the real roof slope, the roof slope classes S1 bis S4 must be proved.

Source: Deutsche Bauchemie, guideline for roof waterproofing
Waterproofing polyurea kits/products for areas with traffic and for bridge decks

- ETAG 033 Liquid applied bridge deck waterproofing kits (Sep 2010)

Polyurea products are directly mentioned in ETAG 033

2.2. Use categories/Product families/Kits and Systems

2.2.1 Sub-families

Currently available Liquid Applied Bridge Deck Waterproofing Kits are based on one or more of the following chemistries:
- Acrylics
- Epoxies
- Polyesters
- Polyureas
- Polyurethanes
- Water dispersible polymers.

2.2.2 Use Categories

In order to facilitate the assessment process the areas of use are categorised as follows:

- (A) With overlay and intended to receive vehicular traffic:
  - A.1 Overlay of coarse bituminous mixture applied at (160±10)°C (CBM)
  - A.2 Overlay of mastic asphalt applied at 220°C to 250°C (MA)
  - A.3 Overlay of low temperature mastic asphalt (LMA) applied at a minimum temperature of <220°C (LMAmin) and maximum temperature <250°C (LMAmmax)
  - A.4 Non-asphaltic overlays (see 2.3.5).
- (B) Without overlay (exposed) and intended to receive only pedestrian or cycle traffic.
- (C) Without overlay (exposed) and un-trafficked (including special case of un-ballasted rail bridges).
Waterproofing polyurea kits/products for areas with traffic – German DIN 18532

- Waterproofing for areas with traffic for concrete constructions for maintenance of “fitness for use” and preventing transport of water
  - ETAG 033 Liquid applied bridge deck waterproofing kits (Sep 2010)
  - EN 1504-2 “Surface protection systems (park decks)” – specific surface protection systems also can function as a waterproofing membrane

- Horizontal concrete parts in inner and outer regions of buildings

- Use category: pedestrian or vehicle traffic; (Germany classes N1, N2, N3, N4);

- Loads: mechanical loads, climatic loads, loads from water under pressure, salts, freeze/thaw-cycles

Open questions/topics:
- List of references for polyurea products (with objects older than 5 years) was transmitted to standardization committee; not yet decided
- PUR-products and PU-products should be summarized in one product group
Waterproofing for building parts in contact with soil (German DIN 18533)

- Waterproofing for building parts in the soil or building parts covered with soil – waterproofing against groundwater and soil moisture
  - No European standard/ETAG for liquid applied waterproofing in this use
- Horizontal concrete parts in inner and outer regions of buildings
- Use category: no use
- Loads: surface water; soil moisture; water under pressure (ground water, impounding water,); mechanical loads (from underground, from loads of the building)
- Examples: external walls in the soil; bottom slab,

Open questions/topics:
- If relevant application, list of references for polyurea products (with objects older than 5 years)
- PUA-products and PUR-products should be summarized in one product group
Waterproofing polyurea products/kits for indoor (wet) rooms – DIN 18534

- Waterproofing of indoor building parts against tap water and cleaning water
  - ETAG 022: Watertight covering kits for wet room floors and or walls
  - Part 1: Liquid Applied Coverings with or without wearing surface – July 2007 -
    (Part 2: Kits based on flexible sheets – March 2011; Part 3: Kits based on
    inherently watertight boards – March 2011)
  - hEN 14891 “Liquid applied waterproofing membranes for use beneath ceramic
    tiling”– for swimming pools and outside areas

- Indoor applications in which floor and wall surfaces are exposed to water

- Use category: by individuals, by industry

- Loads: direct and indirect stress by water/cleaning water; mechanical load

Open questions/topics:
- If relevant application, list of references for polyurea products (with
  objects older than 5 years)
- PUA-products and PUR-products should be summarized in one product
  group
Waterproofing for building parts in contact with soil (German DIN 18535)

- Waterproofing of container and basins against filling water
  - No ETAG for liquid applied waterproofing in this use
  - EN 1504-2 “Surface protections systems” could be referred to

- Use category: “through filling water”

- Loads: filling water, salts and other ingredients; mechanical loads

- Examples: drinking water container, swimming pools, rain retention basins,

**Open questions/topics:**

- Relevant application for polyurea, list of references necessary (**with objects older than 5 years**)
- PUA-products and PUR-products should be summarized in one product group
Summary - Standards for waterproofing products/kits in Germany

- Polurea products shall be integrated in all standards for waterproofing, especially for waterproofing of roofs and traffic areas.

- Lists of references for polyurea products (with objects older than 5 years) are necessary for all applications.

A lot of convincing and discussion in the national standarization committees is necessary.

Source Ch. Herold, DIBt, Berlin.
CPD ER 3 – CPR  BRCW 3

Hygiene, health and the environment – dangerous substances
Actual Situation- CPD/CPR


European Commission issued 43 mandates to CEN to elaborate harmonized European standards (hEN)

CEN published about 250 hEN

Essential requirements of the Construction Products Directive (CPD)
1. Mechanical resistance and stability
2. Fire safety
3. Hygiene, health and the environment
4. Safety in use
5. Protection against noise
6. Energy economy and heat retention

3. Hygiene, health and the environment
The construction work must be designed and built in such a way that it will not be a threat to the hygiene or health of the occupants or neighbours, in particular as a result of any of the following:
— the giving-off of toxic gas,
— the presence of dangerous particles or gases in the air,
— the emission of dangerous radiation,
— pollution or poisoning of the water or soil,
— faulty elimination of waste water, smoke, solid or liquid wastes,
— the presence of damp in parts of the works or on surfaces within the works.

The construction work must be designed and built in such a way that it will not be a threat to the hygiene or health of the occupants or neighbours.
Construction products regulation (CPR)

Comes into force:
- formal: first half of year 2011
- essential articles: 1. July 2013
- New expanded BRCW3 (ER3) – concerning the whole life cycle (not only use phase) and effects on climate
- New BRCW 7, Sustainability


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Horizontal Mandate M/366

16th March 2005: Mandate M/366 was issued by the European Commission to CEN

Goals: Harmonisation of
- Sampling
- Determination of composition
- Determination of release of RGDS
- Release scenarios
CEN/TC 351 – Actual Structure

CEN/TC 351
Construction products: Assessment of release of dangerous substances

<table>
<thead>
<tr>
<th>WG 1</th>
<th>WG 2</th>
<th>WG 3</th>
<th>WG 4</th>
<th>WG 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release into soil, ground water + surface water</td>
<td>Emissions into indoor air</td>
<td>Radiation</td>
<td>Terminology</td>
<td>Content</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AHG</th>
<th>TG 1</th>
<th>TG 2</th>
<th>TG 3</th>
<th>TG 4</th>
<th>TG 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validation</td>
<td>Barriers to trade/use</td>
<td>Horizontal test methods</td>
<td>Without testing/without further testing</td>
<td>Sampling</td>
<td>Evaluation of conformity</td>
</tr>
</tbody>
</table>
Release into soil, surface and ground water – ongoing activities

- Robustness validation for technical specifications is organised.
- Results expected 2012. Afterwards publishing of CEN-TS (July 2013), afterwards publishing of CEN-TS (July 2013)
- 2. validation phase (round robin): financing still open.

Open question: Communication of test results in the CE-mark

<table>
<thead>
<tr>
<th>Release scenario I</th>
<th>Tank test</th>
<th>CGLT</th>
<th>Percolation test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impermeable (metal surfaces, solubility)</td>
<td>Low permeable (diffusion)</td>
<td>Permeable (percolation)</td>
<td></td>
</tr>
</tbody>
</table>
Emission into Indoor Air – ongoing activities

- Test chamber method (EN ISO 16000 – 9) is suited to assess release of VOC/SVOC from construction products

- Target of CEN/TC 351/WG2: improve reproducibility and soundness of the test method
  - harmonize and limit test parameter (volume, air exchange rate, loading factor)

- Robustness validation is organised. Results expected 2012. (same timetable as indoor air)

- 2. validation phase (round robin): financing still open

- Open question: Communication of test results in the CE-mark

Classes of emission??
CEN/TC 351 - Standardization

CEN/TC 351/WGs: draft test standards/specification

- Draft test standard approved for validation
- Validation step 1: "robustness"
- Technical Specification - TS
- Publication: July 2013
- Validation step 2: "round robin"
- Publication
- EN standard
- Publication
- 2017 ??
Amendment of mandates concerning regulated DS

- **EC-EGDS**: Ongoing amendment of construction products mandates:
  - In the progress of the implementation of the CPD the EC issued mandates to CEN.
  - On the base of these mandates the product-TCs elaborated European harmonised product standards.
  - EGDS now is active to add the aspects of health, hygiene and environment (ER3-aspects) into the CP-mandates.
  - **As a rule**: Only if notified regulations concerning ER3 exist in the EU-MS, the relevant product standard/mandate will be amended to resolve barriers to trade.
Amendment of EC mandates concerning dangerous substances

- Status of revision of mandates:
  - 3 of 30 revisions of mandates have been presented to SCC, adopted and given to CEN:
    - M/103 “Thermal Insulation”; M/104
    - M/119 “Floorings“ (EN 13813, resin screeds)
    - M/125 “Aggregates“
  - 12 of 30 mandates are presently under internal discussion by COM-EGDS (final check EGDS June 2011) and were presented to SCC:
    - While MS reacted in favour of the mandates, CEN/TCs have concerns
European approvals – EOTA – EOTA-PT9 “Dangerous Substances”

- Products (Systems) too innovative or too complex to get standardized, can achieve an European technical approval (ETA), e.g. according to ETAG 005.
- EOTA-PT9 discusses how aspects of environment and health have to be considered in ETAs.
- Relevance of EOTA-Product goups (ETAGs) in relation to the different emission scenarios have partly been laid down.
- **Check lists** with dangerous substances and assessments classes have been elaborated.
- But: as long as TC 351 is not ready, test and assessment procedures are missing – therefore for the time being national methods are applied.
Summary

- CPD and the new CPR require information on environmental information. This information shall be integrated in CE-Mark.

- **CEN and EOTA** are preparing rules and/or test methods to address release into indoor air and soil, surface and groundwater.

- Members of CEN product TC’s shall be aware of the mandate expansions.

- Manufacturers/associations should be prepared to draft dossiers on environmental data.
Thank you for your attention!!

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