New innovative high-performance hardeners from Covestro: efficiency, sustainability and more

Ramspec 2016
12-13 October 2016

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A SERIES OF INNOVATIVE HIGH-PERFORMANCE HARDENERS ARE THE NEW CONTRIBUTION TO MORE EFFICIENT, SUSTAINABLE AND RELIABLE POLYURETHANE COATINGS.

**DESMODUR® eco N 7300**
First hardener with 70% renewable content for more sustainable PU coatings at same high performance level.

**DESMODUR® N 3580**
High functional hardener for very fast curing, perfect adhesion, excellent film resistance and self-healing properties.

**BAYHYDUR® 2858 XP**
Ready to use universal hardener for demanding 2K water-based PU applications when easy handling and versatility matters.
DESMODUR® eco N 7300
Renewable raw materials

Much more than just a “nice to have” for sustainable marketing

- Technical breakthroughs in biotechnology
- Scarcity of fossil resources
- Process costs

Renewable material %
Carbon footprint / LCA
Regulations / Certificates
Corporate strategies

Product differentiation
Improve performance

Environment
Performance
Biobased Pentamethylene Diisocyanate (PDI)
A new building block for polyurethane chemistry

- The first isocyanate with significant biocontent: 71% renewable carbon*
- Produced very efficiently from biomass combining biotechnological and chemical processes, e.g. energy efficient gas phase technology
- First diisocyanate in 30 years to be fully developed and scaled-up
- The corresponding derivatives are similar to hexamethylene diisocyanate (HDI) based ones, yet offer some advantages

High performance enabled by nature

* Confirmed by radiocarbon method $^{14}$C measurement according to ASTM-D6866 standard
High performance enabled by nature

The first biobased polyurethane crosslinker

- **DESMODUR® eco N 7300**: first PDI derivative launched April 2015 at the European Coatings Show
- Full REACH registration to be completed in 2016
- Development of technology platform based on PDI
- Innovation multi-awarded:
Desmodur® eco N 7300
Product Data & Characteristics

<table>
<thead>
<tr>
<th>Polyisocyanate</th>
<th>Based on</th>
<th>Solids (%)</th>
<th>NCO (%)</th>
<th>Viscosity (mPa.s)</th>
<th>Color value (Hazen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desmodur® eco N 7300</td>
<td>PDI</td>
<td>100</td>
<td>≈ 21,5</td>
<td>≈ 9200</td>
<td>≈ 30</td>
</tr>
<tr>
<td>Desmodur® N 3300</td>
<td>HDI</td>
<td>100</td>
<td>21,8 ± 0,3</td>
<td>3000 ± 750</td>
<td>≤ 40</td>
</tr>
</tbody>
</table>

- Desmodur® eco N7300 is a near drop-in to HDI-polyisocyanurates like Desmodur® N3300
- The viscosity in standard solvents is comparable
Desmodur® eco N 7300 vs. HDI-trimer

Near drop-in with upside potential

* 70% renewable carbon, 14C measurement according to ASTM-D6866 standard

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**Desmodur eco N 7300**
Pentamethylene diisocyanate (PDI) trimer

**Desmodur N 3300**
Hexamethylene diisocyanate (HDI) trimer

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* 70% renewable carbon, 14C measurement according to ASTM-D6866 standard
Desmodur® eco N 7300 vs. HDI-trimer

High performance in weathering resistance: Accelerated weathering

Weather resistance 6000h SAE J 2527

Accelerated weathering

Gloss and color change over weathering period

Covestro starting point formulation OEM based on an acrylic polyol.
Desmodur® eco N 7300

Multiple applications

High performance enabled by nature

You can potentially use Desmodur® eco N 7300 wherever HDI trimers are used
100 % performance

coco less emissions

70 % bio-based

High performance enabled by nature
DESMODUR® N 3580
Desmodur® N 3580
To speed-up your system

<table>
<thead>
<tr>
<th>DESMODUR N 3580</th>
<th>6-functional</th>
<th>500 mPas (80% in BA)</th>
</tr>
</thead>
</table>

- High functional
- Elastic
- Improves scratch resistance
- Self-healing capability.
- Increased chemical resistance
- Fast curing
Fast curing = increased process efficiency
Desmodur® N 3580 in ACE, industrial and auto refinish coatings

- Elastic, high functional Desmodur ® N 3580: further increase in productivity, improved adhesion on basecoat

Desmodur® N3390
viscosity (90%BA/SN) 550 mPas, functionality ~3.5

Desmodur® N3790
viscosity (90%BA) 1800 mPas, functionality ~4.1

Desmodur® N3580
viscosity (80%BA) 500 mPas, functionality ~6
Improved mechanical and chemical resistance

Desmodur® N 3580 in plastic coatings

- + 33% higher initial hardness vs. standard crosslinker
- No impression marks after packaging (early mechanical resistance)
- Improved chemical resistance: Ethanol containing gasoline

![Graph showing hardness and resistance comparison between different formulations.](image)

- **Hardness/ Koenig**
- **Early Mechanical Res.**
- **Chem. Res. - Gasoline (E 10)**
Scratch resistance and self healing clear coat

Desmodur® N 3580 for high functionality and high elasticity

Clearcoat formulation, curing at RT
Reflow, self-healing at RT

Scratching

Self-healing
60-70°C

“Plastic Deformation”

Clearcoat formulation, curing at 140 °C, 25 min
Crockmeter scratch-test using polish paper 9µ
Reflow/ self-healing: 2h 60°C
BAYHYDUR®
2858 XP
Bayhydur® 2858 XP

When ready to use crosslinker and performance matter

Bayhydur® 2858 XP is a universal crosslinker providing broad compatibility with different dispersions for high-performance wood coatings.

You can increase your production efficiency with this ready-to-use crosslinker, supplied at 70% in PGDA.

Satisfy your customers need for low odor, low emissions and robust coating materials!
Excellent miscibility with PUD
Bayhydur® 2858 XP is an ideal crosslinker for flooring coatings

**Glossy 2K parquet formulation based on Bayhydrol UH 2593/1** (fatty-acid modified PUD)
Mixing ratio: 10% of B component on A component.

<table>
<thead>
<tr>
<th>Bayhydur</th>
<th>Bayhydur 2858 XP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crosslinker s.f</td>
<td>70% in PGDA</td>
</tr>
<tr>
<td>Miscibility</td>
<td>4-5</td>
</tr>
<tr>
<td>Sand dry (T1)</td>
<td>approx. 15’</td>
</tr>
<tr>
<td>Fully dry (T4)</td>
<td>approx. 42’</td>
</tr>
<tr>
<td>Pendulum hardness (s,König), 1 / 7d at RT</td>
<td>105 / 170</td>
</tr>
<tr>
<td>Water resistance</td>
<td>24 h</td>
</tr>
<tr>
<td>Ethanol resistance</td>
<td>5’ / 30’</td>
</tr>
<tr>
<td>Black heel mark resistance (BHMR)</td>
<td>4</td>
</tr>
<tr>
<td>Abrasion Taber CS10 mg loss after rev (10 N load)</td>
<td>35 mg loss</td>
</tr>
</tbody>
</table>

5=very good, 1=very bad
Complaint indoor air quality systems easier
Bayhydur® 2858 XP helps to fulfill indoor air quality regulations

Indoor air quality test according AgBB Scheme 2012

2K WB parquet coating based on Bayhydrol® UH 2593/1 and Bayhydur® 2858 XP
3 layers on oak 120 g/m² wet, 6 h between layers, without sanding, 3 d preconditioning

**TVOC**
Limits 3 d TVOC ≤ 10 mg/m³, 28 d TVOC ≤ 1,0 mg/m³

**Sum R**
Limits 28 d R≤ 1
Very high chemical resistance
Bayhydur® 2858 XP in furniture coatings

White pigmented 2K formulation for furniture based on Bayhydrol A 2651
NCO:OH ratio: 1,5

<table>
<thead>
<tr>
<th>Bayhydur</th>
<th>Bayhydur 2858 XP</th>
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<tbody>
<tr>
<td>Crosslinker supply form</td>
<td>70% in PGDA</td>
</tr>
<tr>
<td>Miscibility</td>
<td>5</td>
</tr>
<tr>
<td>Sand dry (T1)</td>
<td>approx. 25'</td>
</tr>
<tr>
<td>Fully dry (T4)</td>
<td>approx. 4 h 40'</td>
</tr>
<tr>
<td>Pendulum hardness (s,König), 1 / 7d at RT</td>
<td>135 / 160</td>
</tr>
<tr>
<td>Water resistance - 24h</td>
<td>5</td>
</tr>
<tr>
<td>Coffee resistance - 16h</td>
<td>5</td>
</tr>
<tr>
<td>Red wine resistance - 6h</td>
<td>5</td>
</tr>
<tr>
<td>Ethanol resistance - 1h</td>
<td>5</td>
</tr>
</tbody>
</table>

5=very good, 1=very bad
Chemical resistances according DIN 12720, 120 g/m² wet on melamine, dried overnight at 50°C
Higher film thickness with great surface

Bayhydur® 2858 XP in more robust furniture coatings

Clear glossy 2K formulation based on Bayhydrol A 2651

<table>
<thead>
<tr>
<th>Wet film thickness</th>
<th>Bayhydur 2858 XP 70% in PGDA</th>
<th>Standard hardener 70% in MPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 μm</td>
<td>0</td>
<td>1 S1</td>
</tr>
<tr>
<td>300 μm</td>
<td>0</td>
<td>2 S1</td>
</tr>
<tr>
<td>400 μm</td>
<td>1 S1</td>
<td>3 S1</td>
</tr>
<tr>
<td>500 μm</td>
<td>3 S1</td>
<td>4 S1</td>
</tr>
</tbody>
</table>

ISO 4628-2: 0= no bubbles, 5=many bubbles; S1=small bubbles; S5= big bubbles
RELIABILITY
VERSATILITY
EASY HANDLING
IMPORTANT FOR THE INDUSTRY

Clear
Pigmented
Miscibility
Long pot-life
High film thickness
On-site
Industrial
Low emissions
Low odour
Ready-to-use
Only with best hardeners you get best coatings

DESMODUR eco N 7300
DESMODUR N 3580
BAYHYDUR 2858 XP
Forward-Looking Statements

Forward-looking statements
This presentation may contain forward-looking statements based on current assumptions and forecasts made by Covestro AG. Various known and unknown risks, uncertainties and other factors could lead to material differences between the actual future results, financial situation, development or performance of the company and the estimates given here. These factors include those discussed in Covestro’s public reports, which are available on the Covestro website at www.covestro.com.
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