Polyaspartics – Innovative binders for cost effective coating concepts
What are success factors for innovative binders?

- Cost-efficient
- Quality-compliant
- Environmentally acceptable
Success factors for innovative binders

**Quality-compliant**
- The high performance level of the previous systems shall be retained
- A simple and robust application under various climatic conditions must be possible

**Environmentally acceptable**
- Reduction of the VOC-Emissions by minimizing the solvent content
Cost Efficient

Due to the cost pressure on the end user a increased productivity of the coating process is often demanded.

This can be obtained by:

- Quicker drying times of the coatings
- Reduction of the number of layers in a coating operation which eliminates the costs of one working step

This requirements can be met by Polyaspartics
The term ‘aspartic’ is a generic term derived from the aspartic acid

Aspartic acid (2-aminobutanedioic acid)
Synthesis of aspartics

\[ 2 \text{ Maleic acid diester} \quad \text{Diamine} \quad \rightarrow \quad \text{‘Aspartic’} \]
Aspartics with different reactivity

Structure of aspartics

![Chemical structure of aspartics](image)

<table>
<thead>
<tr>
<th>Product</th>
<th>Solid content</th>
<th>Equivalent weight</th>
<th>Viscosity mPas</th>
<th>Reactivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product A</td>
<td>100%</td>
<td>290</td>
<td>1500</td>
<td>low</td>
</tr>
<tr>
<td>Product B</td>
<td>100%</td>
<td>276</td>
<td>1500</td>
<td>mid</td>
</tr>
<tr>
<td>Product C</td>
<td>100%</td>
<td>234</td>
<td>100</td>
<td>high</td>
</tr>
</tbody>
</table>
Control of the reactivity by variation of the rest X in the amine

<table>
<thead>
<tr>
<th>X =</th>
<th>Reactivity</th>
<th>Gel time</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{CH}_2\text{CH}_3 )</td>
<td>low</td>
<td>8h</td>
</tr>
<tr>
<td>( \text{H}_3\text{C} )</td>
<td>mid</td>
<td>1h</td>
</tr>
<tr>
<td>( \text{CH}_3 )</td>
<td>high</td>
<td>&lt;5min</td>
</tr>
</tbody>
</table>
Reaction of aspartic with aliphatic polyisocyanate

Aspartic + Aliphatic polyisocyanate → ‘Polyaspartic’

- Polyaspartics are an aliphatic Polyurea Technology
Suitable aliphatic polyisocyanates

<table>
<thead>
<tr>
<th>Polyisocyanate</th>
<th>Solids content [%]</th>
<th>Viscosity @ 23°C [mPas]</th>
<th>NCO-content [%]</th>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product A</td>
<td>100</td>
<td>700</td>
<td>23,7</td>
<td>3,1</td>
</tr>
<tr>
<td>Product B</td>
<td>100</td>
<td>1200</td>
<td>23</td>
<td>3,1</td>
</tr>
<tr>
<td>Product C</td>
<td>90 / BA</td>
<td>500</td>
<td>19,6</td>
<td>3,5</td>
</tr>
<tr>
<td>Product D</td>
<td>75 / BA</td>
<td>170</td>
<td>16,5</td>
<td>3,8</td>
</tr>
</tbody>
</table>

Functionality of the polyisocyanate should be > 3
Properties of polyaspartic- coatings

- Rapid drying at ambient temperature leads to a faster application process

- High film build enables one coat in the coating process to be saved

- The combination of this benefits leads to increased productivity, which makes a contribution to reducing overall costs
Productivity and cost efficiency of polyaspartic coatings

**Industrial coating:** Substitution of the primer by a DTM-polyaspartic coating

```
2K PUR top coat
Primer

DTM polyaspartic coating
```

*DTM = direct to metal

**Corrosion protection:** Substitution of the intermediate coat by a polyaspartic coating

```
2K PUR top coat
Intermediate
Primer

Polyaspartic coating
Primer
```
Productivity and cost efficiency of polyaspartic coatings

![Dry to handle times at different ambient temperatures](image)

- **15°C**
- **25°C**

- **Time [h]**
  - Topcoat
  - Intermediate
  - Primer

- **Products**
  - Standard
  - Polyaspartic
Low VOC-level of polyaspartic coatings

- VOC-level of industrial / protective coatings is typically around 150g/L
- Flooring application are virtually solvent free

Example of VOC reduction for protective coatings with total DFT of 240µm
Performance of Polyaspartic Coatings

Polyaspartic coatings are furthermore characterized by

- Pot life and drying time can be adjusted within a wide range
- Curing at low temperatures
- Flexibility and long term elasticity
- Reparability
- Resistance to acid and alkali
Gloss Retention of Polyaspartic Coatings

Florida Exposure / 5° south

Gloss / 60° vs. Time / month
Case Study- Corrosion Protection

Cement production unit with zinc rich primer and polyaspartic topcoat
Polyaspartics are used for the steel construction of the 'Bayer Media Facade' and the stadium 'BayArena'
Case Study Industrial coatings / ACE*

Polyaspartic coatings are used as a single coat for the ACE-market

*ACE = Agricultural, Construction and Earthmoving Equipment
Case Study- Flooring

Walt Disney World of Sports Baseball Stadium / Orlando Florida
Different applications—same benefits: high productivity and low VOC
Summary

- Aspartics are sterically hindered aliphatic amines that react with polyisocyanates to form polyaspartics, which is an aliphatic polyurea
- Ultra high solids to meet VOC-regulations
- Rapid drying characteristics at ambient temperature
- High film build enables a reduction in the number of coats
- Increased productivity leads to cost efficiency of the application process
- Innovation that pays off