Technical presentation

An introduction to the Incozol range
American coatings show 2016
INTRODUCTION TO THE INCOZOL RANGE

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APPLICATIONS ENGINEER

AMERICAN COATINGS SHOW
2016
The Incozol Range

Oxazolidines
- Moisture Scavenger
  - Incozol 2
- Reactive Diluent
  - Incozol LV
- Latent Curing Agents
  - Incozol 4
  - Incozol EH

Aldimine
- Incozol BH
WHAT IS AN OXAZOLIDINE - CHEMISTRY

- A five membered heterocyclic ring structure containing nitrogen and oxygen

**General Oxazolididine Structure**

- A versatile additive for both 1K and 2K solvent borne and high solids polyurethane systems
WHAT IS AN OXAZOLIDIDINE - FUNCTIONS

Oxazolidine

Moisture Scavenger

Latent curing agent

Reactive diluent
WHAT IS AN OXAZOLIDINE - FUNCTIONS

- All Oxazolidines works as moisture scavenger

Schematic chemical reaction showing the hydrolysis of oxazolidine latent hardener and the latent hardener crosslinking reaction: firstly through the secondary amine and then primary hydroxyl groups.
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MOISTURE SCAVENGER

INCOZOL 2
APPLICATIONS – 2K POLYURETHANE TOPCOAT

WIND TURBINES

AUTOMOTIVE

AEROSPACE

MILITARY
PINHOLES - CAUSE

\[
\text{NCO} + \text{H}_2\text{O} \rightarrow \text{NH}_2\text{C}=\text{O} + \text{CO}_2
\]

[Image of pinhole material]
The role of a moisture scavenger is to prevent the generation of $\text{CO}_2$ and the problems associated with moisture contamination.

**Incozol 2**

*Mono-Oxazolididine Moisture Scavenger*

The reaction of Incozol 2 with moisture is a faster reaction than the one of Isocyanate reacting with water i.e. Incozol 2 preferentially reacts with water over Isocyanate.
BENEFITS OF USING INCOZOL 2 - STUDY

2K acrylic PU paint without Incozol 2 (left) and with Incozol 2 (right)

After 2000 hours prohesion test, panel without Incozol 2 shows rust through pin holes (left)
## INCOZOL 2 – FEATURES AND BENEFITS

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Scavenger &amp; Drying Agent</td>
<td>Prevents the generation of CO\textsubscript{2} gas leading to defect free films.</td>
</tr>
<tr>
<td>Compatible with different PU components</td>
<td>Greater latitude when formulating.</td>
</tr>
<tr>
<td>Very low viscosity</td>
<td>Ideal for high solids systems.</td>
</tr>
<tr>
<td>Low toxicity</td>
<td>Safer for formulators and applicators.</td>
</tr>
<tr>
<td>Low coloured liquid</td>
<td>Can be used in clear coats.</td>
</tr>
</tbody>
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REACTIVE DILUENT

INCOZOL LV
APPLICATIONS – 2K POLYURETHANE TOPCOAT

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SOLUTION – REACTIVE DILUENTS AND KEY REQUIREMENTS

Reactive Diluent

- Viscosity
- Cutting power
- Compatibility
- Defect Free
Consists of two five membered heterocyclic rings (containing an oxygen and a nitrogen atom) that are joined by a carbonato link.
In order to manufacture a high solids coating (e.g. automotive) the polyol component is modified with pigments, extenders and additives. The overall viscosity can be too high to apply.

It is possible to replace a percentage of the polyol component with a reactive diluent (Incozol LV) to reduce the overall viscosity of the system in turn reducing the solvent demand and enabling VOC compliance and higher solids.

![Graph showing viscosity changes with polyol replacement by Incozol LV](image-url)
VOC REDUCTION OF 2K LACQUER BY ADDITION OF INCOZOL LV

![Graph showing system non-volatile content (%) vs. % polyol replacement by Incozol LV](image_url)

- **Des A365/Des N3390**
- **Set C1152/Tol75MX**
- **Mac SM515/Tol.75MX**
- **Mixed Acrylic/Polyester**

% Polyol Replacement by Incozol LV vs. System Non-Volatile Content (%)

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20 | 12 May 2016

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# INCOZOL LV - SUMMARY

<table>
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<tr>
<th>Features</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Reactive Diluent</td>
<td>Developed to replace a portion of the polyol component enabling the formulation of high solids, low VOC coatings.</td>
</tr>
<tr>
<td>Moisture Scavenger</td>
<td>Prevents the generation of CO$_2$ gas leading to defect free films.</td>
</tr>
<tr>
<td>Multifunctional (f = 4)</td>
<td>Enables greater formulation flexibility.</td>
</tr>
<tr>
<td>Very low viscosity</td>
<td>Suitable for spray applications.</td>
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<tr>
<td>High degree of moisture tolerance</td>
<td>Improved stability to repeated opening of containers.</td>
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</tbody>
</table>
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LATENT CURING AGENTS

INCOZOL 4
INCOZOL EH
APPLICATIONS – 1K MOISTURE CURE PU COATING

- ROOF COATING
- WATERPROOFING
- BALCONY COATING
- WALKWAYS AND STEPS
FOAMING IN HIGH BUILD APPLICATION - CAUSE

\[
\begin{align*}
\text{NCO} + H_2O & \rightarrow N\text{H} \quad C=O + CO_2 \\
\text{NCO} & \quad H
\end{align*}
\]
Latent hardener is an inert additive until exposed to moisture. It hydrolyses and ring opens in the presence of moisture, producing amine and hydroxyl groups which will readily react with any isocyanate present.
INCOZOL 4

- The standard bis-oxazolidine latent hardener in the Incozol range

- It has a higher viscosity than other oxazolidines (10,000 cps) due to the presence of urethane groups linking the oxazolidine rings, leading to hydrogen bonding. Once reacted with water and ring opening has taken place, it can be used as a bi- or tetra- functional molecule

- Not recommended for 2 pack systems because of its high viscosity and its tendency to crystallise

- Can be used with all industry standard prepolymer
INCOZOL EH

- Can be stored at sub-zero temperatures without signs of crystallisation
- Has excellent in-can storage stability in 1K aliphatic PU systems
- Improves cure speed of 1K PU systems without the need for additional metal catalyst
- Has more acceptable odour compared to standard bis-oxazolidines
BENEFITS OF LATENT HARDENER – 1K PU COATING

- Moisture Scavenger

Without Latent Hardener

With Latent Hardener (EH)

- Faster through cure – Early walk on time

[Bar chart showing comparison of Touch-Dry Time and Walk-On Time between Control and Inc EH]
BENEFITS OF LATENT HARDENER – 1K PU COATING

- Improved durability through crosslinking
BENEFITS OF LATENT HARDENER – 1K PU COATING

- Chemical Resistance

### Chemical Resistance

**Key:**
- 5 = Film Untouched
- 0 = Film Completely Destroyed

### Stain Resistance

**Key:**
- 5 = Film Untouched
- 0 = Film Completely Destroyed
## LATENT HARDENERS - SUMMARY

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<tr>
<td>Moisture Triggered Chemistry – atmospheric moisture triggers the curing process</td>
<td>Waterproof membranes are capable of curing in a wider range of conditions including extreme temperature ranges and humidity variations. Unlike traditional polyurethane systems they do not release CO(_2) which often causes gassing and application is not delayed by adverse weather conditions.</td>
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<tr>
<td>Multifunctional (f = 4)</td>
<td>Faster through-cure leading to increased tensile strength and tougher, more durable films.</td>
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<tr>
<td>Improved durability through crosslinking</td>
<td>Better final hardness and excellent ultimate tensile strength</td>
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### OXAZOLIDINE SELECTION GUIDE

<table>
<thead>
<tr>
<th></th>
<th>Moisture Scavenging</th>
<th>Use with low NCO prepolymer</th>
<th>Lowering Viscosity</th>
<th>Reducing VOC</th>
<th>Low Temp Storage &amp; Handling</th>
<th>Stability in 1K Aliphatic Systems</th>
<th>Stability in 1K Aromatic Systems</th>
<th>Use in 2K Systems</th>
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<tbody>
<tr>
<td><strong>Incozol 2</strong></td>
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<td><strong>Incozol LV</strong></td>
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<td><strong>Incozol 4</strong></td>
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<td><strong>Incozol EH</strong></td>
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- **Recommended**
- **Suitable**

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The Incozol Applications

1K Aliphatic Moisture Cure Membrane Coating
- Incozol EH
- Incozol 4

2K PU Coatings
- Automotive Refinish
- 2K Polyaspartics Coatings
- Incozol 2
- Incozol LV

1K Aromatic Sealants, Adhesives and Coatings
- Incozol BH
THANK YOU FOR YOUR ATTENTION

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APPLICATIONS ENGINEER
See you soon on our websites