LOW MONOMER – FAST BOND ADHESIVES

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• Definition

– The reaction between an “Isocyanate” Group and a “Hydroxyl” Group creates a “Urethane” Group
Isocyanates

- Functional Group (-NCO)
  - “Isocyanate” Group
  - -N=C=O
Polyols

- Functional Group (-OH)
  - “Hydroxyl” Group
  - -O-H
Isocyanates (-NCO)

- Aromatic

- Aliphatic
Prepolymer
(Made by the adhesive company)
Prepolimer definition

Prepolimer are defined by:

- Backbone used to give special proprieties to the final polymer (thermal/chemical/wettability etc.)
- Viscosity
- Isocyanate monomer content defined as follow:
  - Isocyanate monomer is commonly defined as “residual monomer”, “free monomer” or “monomer un reacted”
  - Isocyanate monomer % express the concentration of the monomer into the prepolimer prior to full polymerization
Prepolimer

- Isocyanate monomer percentage doesn’t mean the isocyanate monomer content but refer to the concentration of NCO groups both linked to the chain or free.
- While the “part” of NCO groups linked to the chain are not “free” to migrate throught the substrate, the free monomer yes (small molecules) giving issue of PAA.

![TDI monomer](image1.png) ![Isocyanate Prepolimer (simplified)](image2.png)
How the PAA are formed?

Isocyanate monomer + water
How the PAA are formed?

\[
\text{Ar (NCO)} \quad \text{Isocyanate Monomer} \quad \text{H}_2\text{O} \quad \text{water}
\]

\[
\text{Ar-NHCOOH} \quad \text{Carbammic acid (instable)}
\]

\[
\text{Ar-NH}_2 + \text{CO}_2 \quad \text{PAA}
\]

\[
\text{Ar-NH}_2 + \text{Ar-NCO} \quad \text{Ar-NHCONH-Ar} \quad \text{Poliurea}
\]
Initial Polymerization
(Conducted in your plant)

Functional Group  +  Functional Group

Adhesive

Functional Group  +  Functional Group

Co-reactant
Polymer Chain Extension
Curing mechanism

Two components adhesives are normally formulated with a mix ratio between the two components leaving an excess of NCO equivalent for side reaction with OH groups from inks or further reaction with moisture (water)... 

So the curing mechanism could be simplified by a first reaction between NCO part of comp. 1 with OH part of comp. 2 but also by a side reaction between “exceed NCO equivalent” with further OH groups as above described....this basically translate into a “enviromental dependent” curing process of PU system:

Higher temperature/Humidity  faster curing process
New development: Fast Cure/ultra fast PAA decay

We worked on two aspects:

- Reduced the percentage of free monomer reducing risk of PAA formation (from our plant by making the pre polymer)
- Improve the curing speed between the two components leaving “enviromental dependant curing process” marginal (at your plant...fast reaction between the two components)

Allowing for:

- Fast supply chain for converter (faster slitting and delivering of laminates to end user)
- Superior safety of laminates to pack food stuff
Thank you.

QUESTION?

For more detailed info....please contact me
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