



Bayer MaterialScience

## Polyaspartics – On the way to new markets

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-Conference

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Business Unit Coatings Adhesives & Specialties



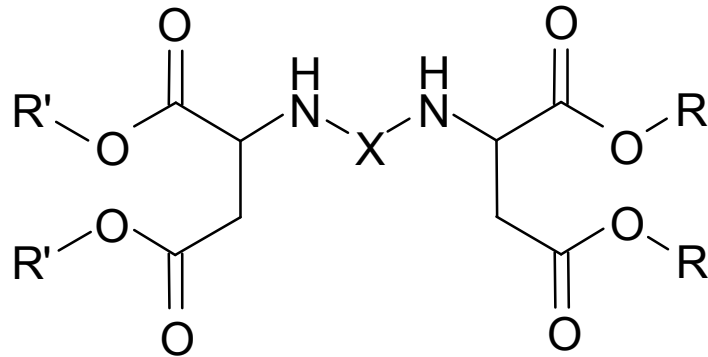
# Agenda

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1. Basic chemistry and benefits of Polyaspartics
2. Case study protective coatings ,Bayer Media Facade‘
3. Polyaspartic coatings for wind turbines
4. Recent developments

# Basic chemistry of aspartics



Structure of aspartics (generic)

- Aspartics are sterically hindered, secondary diamines
- The reactivity of the amine group towards polyisocyanates can be controlled by the variation of the rest X

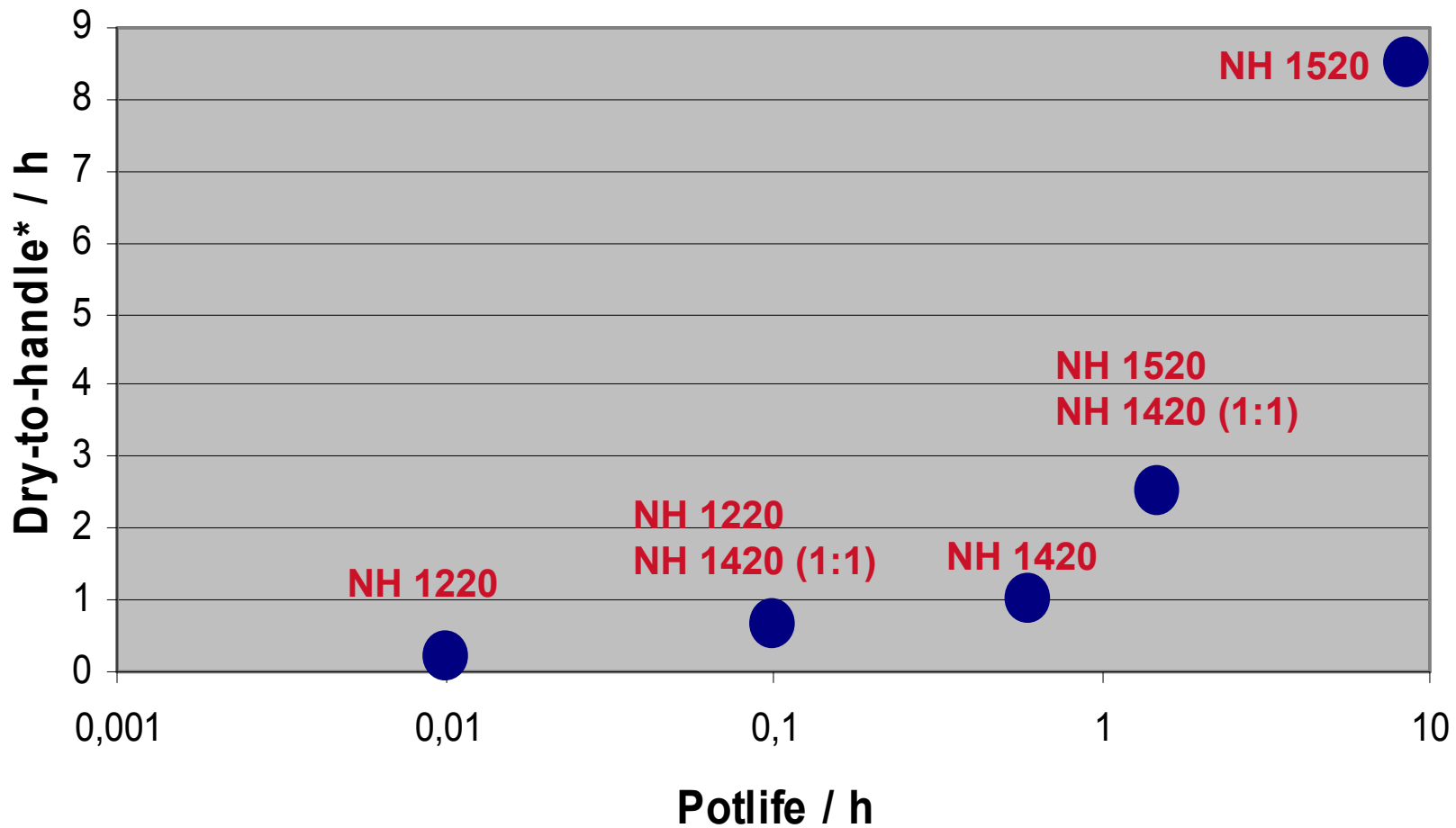
# Aspartics with different reactivity



Product	Solid content	Equivalent weight	Viscosity mPas	Reactivity
Desmophen NH 1520	100%	290	1500	low
Desmophen NH 1420	100%	276	1500	mid
Desmophen NH 1220	100%	234	100	high

- Main difference of the products is the reactivity towards polyisocyanates
- A wide range of drying time and potlife is possible

# Adjustment of reactivity by blending of aspartics



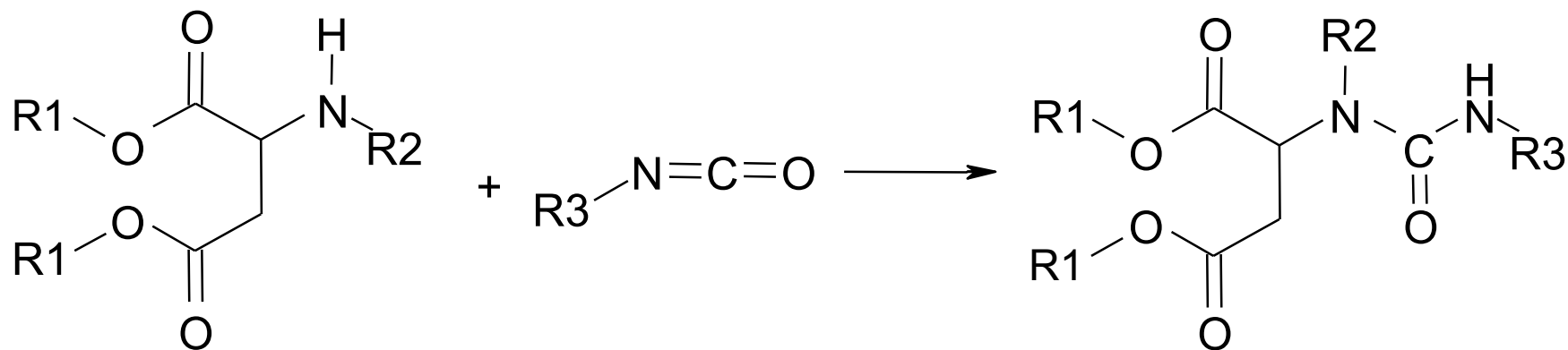
\* at 20°C / 50% rel. humidity

crosslinked with Desmodur N 3600

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# Reaction of aspartic with aliphatic polyisocyanate



Aspartic

Aliphatic polyisocyanate

'Polyaspartic'

## Suitable aliphatic polyisocyanates (examples)



Polyisocyanate	Solid content [%]	Viscosity @ 23°C [mPas]	NCO- content [%]	Functionality
Desmodur N 3900	100	700	23,7	3,1
Desmodur N 3600	100	1200	23	3,1
Desmodur N 3390	90 / BA	500	19,6	3,5
Desmodur N 75	75 / BA	170	16,5	3,8

➔ Functionality of the polyisocyanate should be  $> 3$

# Advantages of polyaspartics

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- Fast cure even at ambient temperature translates into a faster painting process and / or to faster return to service
- High film build makes it possible to reduce the number of coats in a paint system while maintaining the same overall thickness
- The improved productivity helps to reduce the overall cost of the painting process
- Ultra high solids to No-VOC possible
- Durability on the high level of aliphatic 2K-PUR topcoats

# Case Study Protective Coatings



Bayer Media Facade

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# Case Study Protective Coatings



- Substrate: Steel with rust or old coating, about 30.000 m<sup>3</sup>
- Surface preparation with shot blasting, Sa 2 ½
- Primer: MC PUR zinc-rich, 80 µm
- Topcoat: Polyaspartic, 140 µm

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# Case Study Protective Coatings



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# Polyaspartic Coatings for wind turbines



1. Tubular metal steel base tower

# Polyaspartic Coatings for wind turbines



Depending on the WPG location different corrosion categories\* are required:

Category C3: Urban and industrial atmosphere with moderate pollution.

Category C5: Coastal and offshore areas with high salinity.



\* according to ISO 12944

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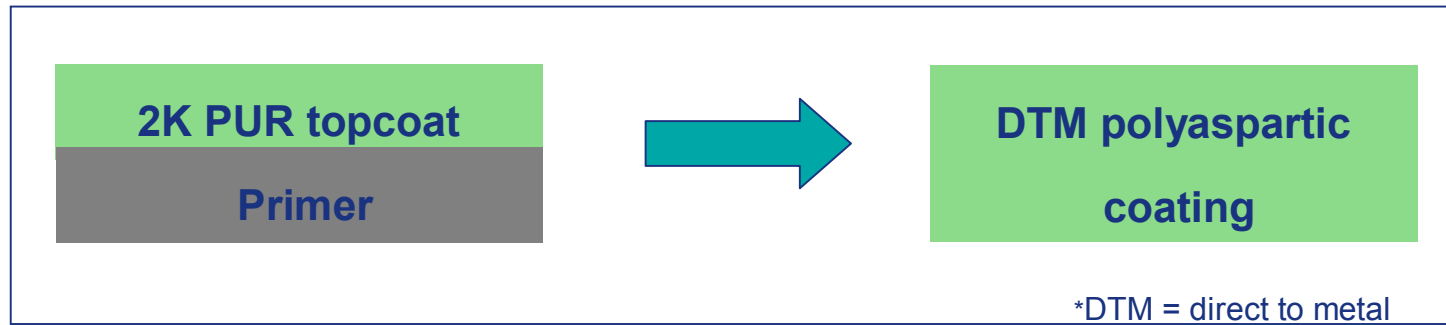


# Productivity and cost efficiency



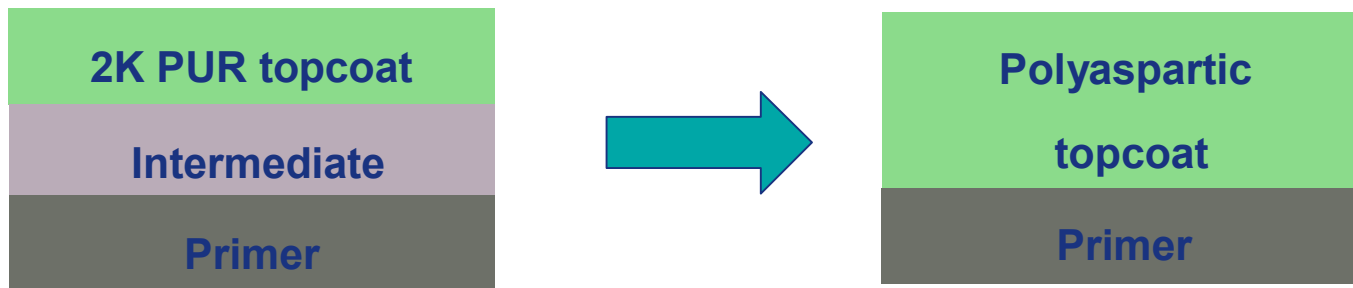
Industrial coating:  
Category C3

Substitution of the primer by a DTM-polyaspartic coating



Corrosion protection:  
Category C5

Substitution of the intermediate coat by polyaspartic coating

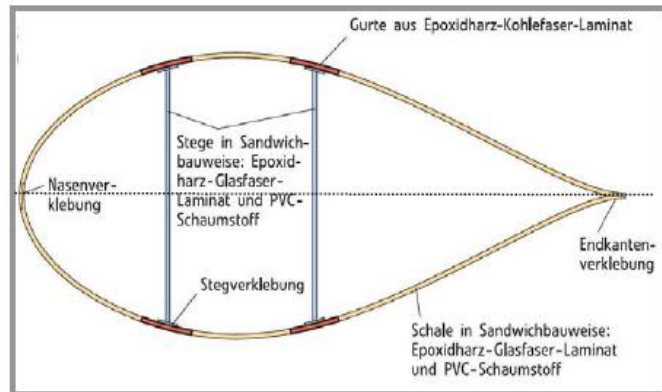


# Polyaspartic Coatings for wind turbines



- 1. Tubular metal steel base tower
- 2. Wind turbine blades

# Polyaspartic coatings for wind turbine blades



Polyaspartic putty/pore filler, primer and topcoat

Polyaspartic gelcoat

GFR EP- composite

# Polyaspartic coatings for wind turbines



## Benefits for blade production:

Example: Polyaspartic putty and pore filler

## Properties:

- Ultra high solid / solvent free
- Fast drying time
  - Sandability: after 3-4 h @RT,
  - Overcoatibility with topcoat: after 1-2 h @RT
- Consistency :  
Adjustable from low viscous for paint brush application up to liquid putty- or high viscous filler consistency

**Main Driving Force:** Increased application efficiency

# Recent developments for DTM- applications



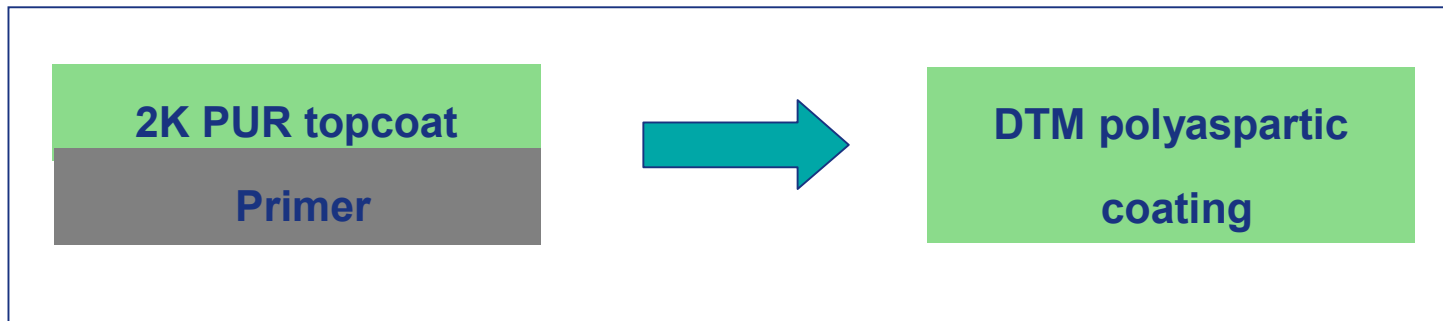
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## Recent developments for DTM applications

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- DTM (direct-to-metal) applications are ideal for polyaspartics



- Adhesion on pretreated metals (e.g. shot blasted) is typically excellent
- Adhesion on substrates like cold rolled steel or aluminum is often poor and has been a limitation so far

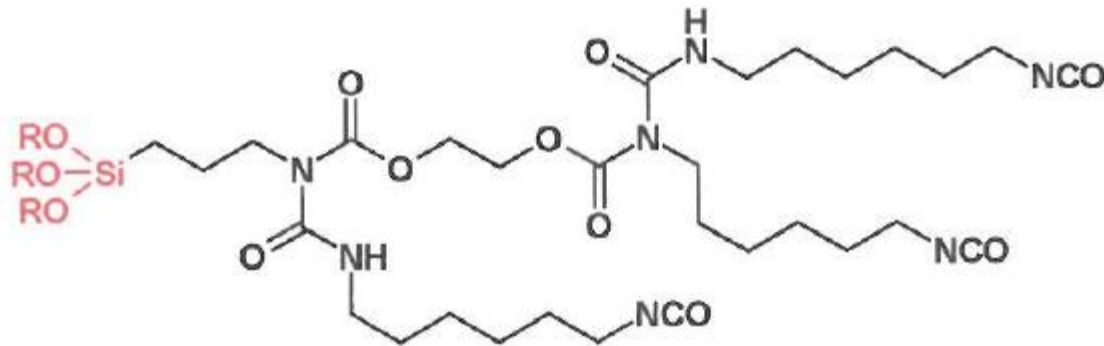
# Ways to improve adhesion

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- Adhesion to metals can be improved by silanes
- First approach has been to use commercial silanes as an additive together with polyaspartics, but no improvement in adhesion has been found
- Second approach has been to find a way to incorporate the silane functionality into the polymer matrix
- As a result a polyisocyanate with silane functionality has been developed

# Polyisocyanate with improved DTM-adhesion



Desmodur XP 2714 (Idealized structure)

- HDI-based polyisocyanate with allophanate structure
- Solids 100%, NCO-content approx. 16%, viscosity approx. 1300mPas
- Every molecule has beside the isocyanate groups a silane functionality

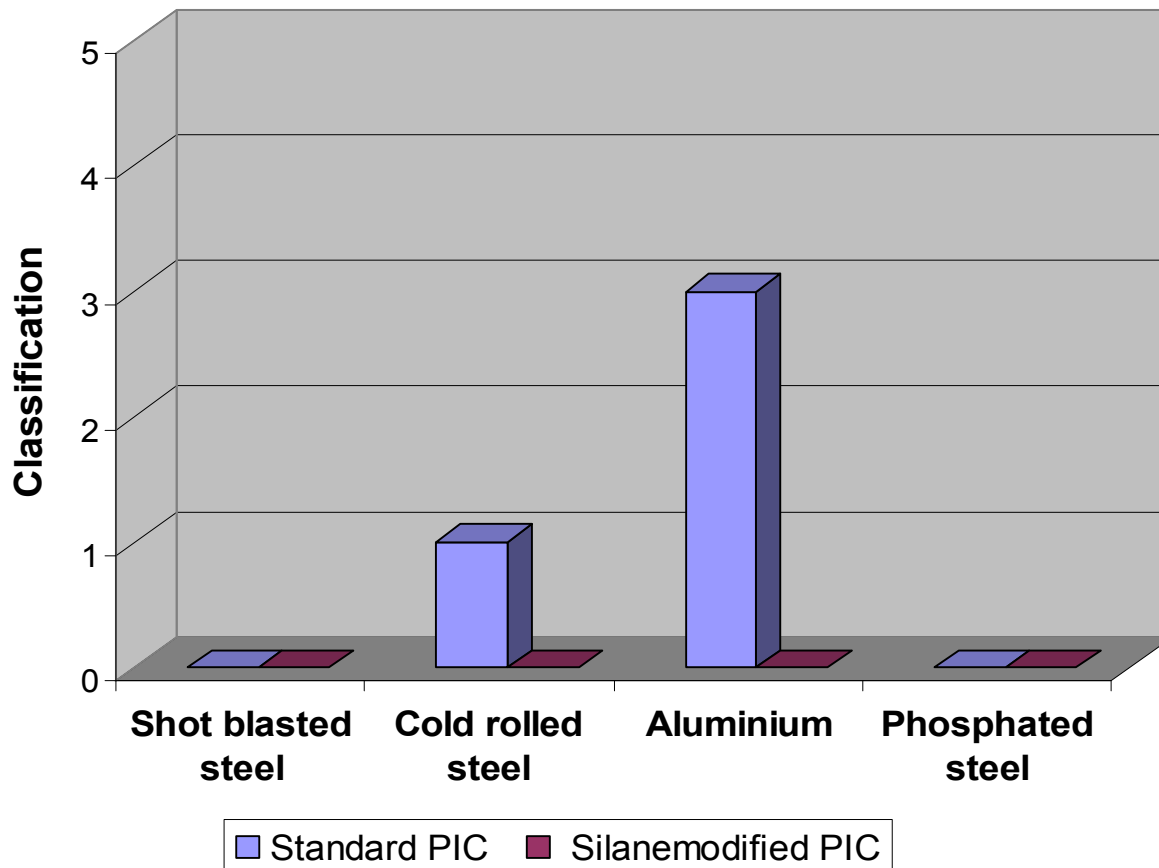
# Adhesion testing

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- Adhesion on shot blasted steel (reference), cold rolled steel, aluminum and phosphated steel has been tested
- A cross-cut test according to ISO 2409 test has been used to test the adhesion, Ranking from 0 = no delamination to 5 = complete delamination
- The adhesion testing has been distinguished between ,dry‘ and ,wet‘ adhesion

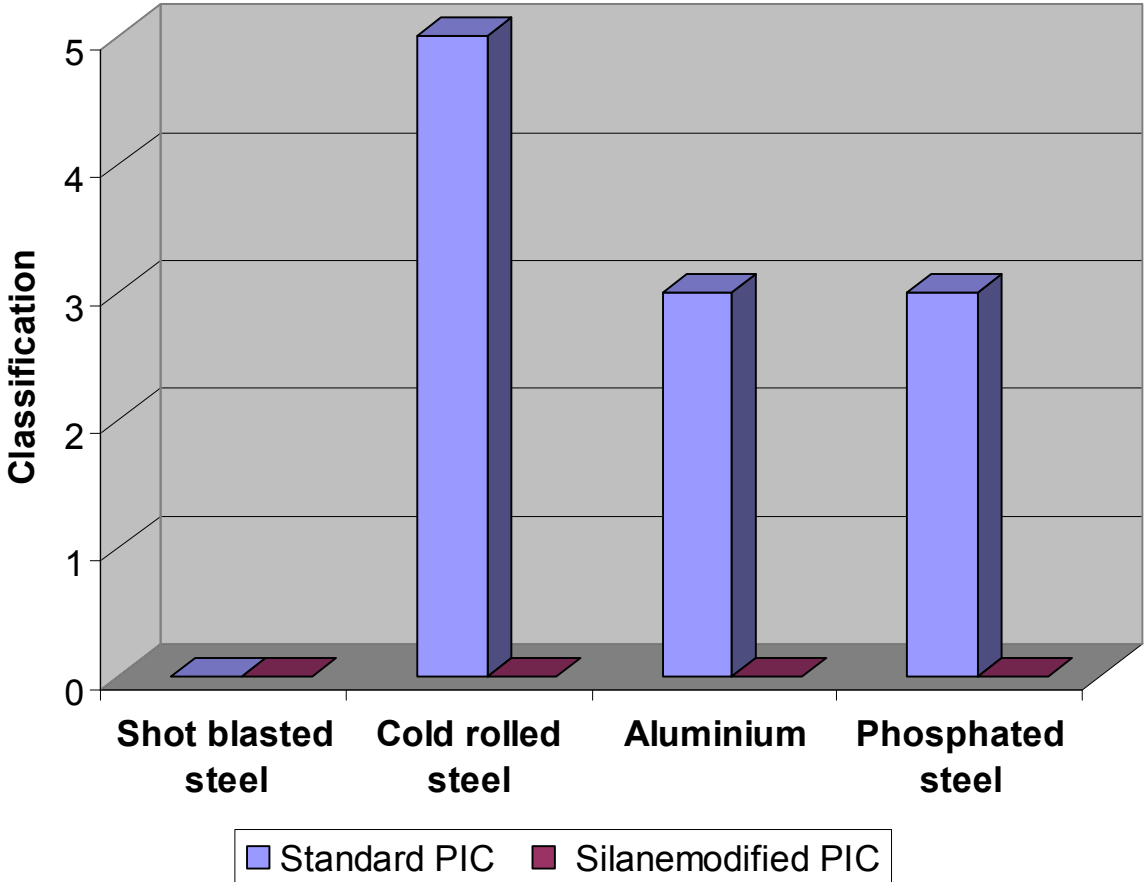
# Dry adhesion on various substrates



„Dry adhesion“ = Adhesion test after storage of the coated substrates for 7d at 23°C/50% r.H.

Cross-cut test according to ISO 2409 with 0 = no delamination, 5 = complete delamination

# Wet adhesion on various substrates



**‘Wet adhesion’ = adhesion test after 7d at 23°C / 50% r.H. + additional 14 d at 40°C 100% r.H. + 24h recovery**

**Cross-cut test according to ISO 2409 with 0 = no delamination, 5 = complete delamination**

# Drying profile silane modified polyisocyanate



	Desmodur N 3600 (Standard)	Desmodur XP 2714 (silane modified)
Potlife	approx.2h 30min	approx. 2h
Drying time tack free at 23°C / 50% r.H.	approx.50min	approx.60min
Dry-to-handle at 23°C / 50% r.H.	approx.2h	approx.4h 30min
Pendulum hardness (Koenig) after 7d	148 s	141s

- Dry-to-handle time becomes longer with the silane modified polyisocyanate
- Can be adjusted by the use of a higher reactive aspartic type or suitable catalyst

# Summary



## Polyaspartics are characterized by:

- Ultra low VOC
- Fast drying
- High film build
- Increased productivity



**Recent developments have shown that the direct-to-metal adhesion can be improved by a silane modified polyisocyanate**

