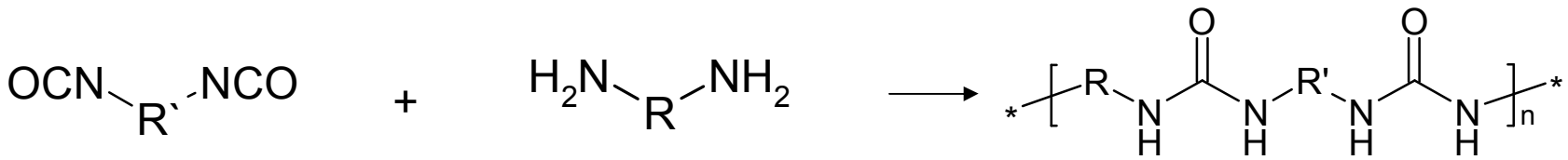
The amines family grows -

proven and novel members widen the field

Stephan Göttke
BASF SE

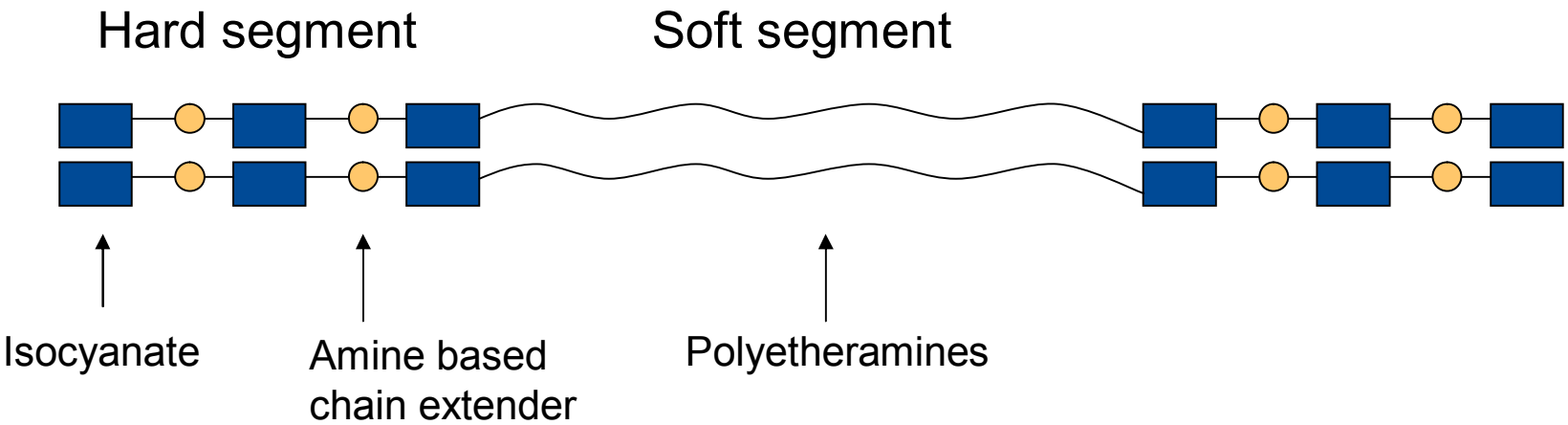
The Polyurea Reaction



Isocyanate Amine Polyurea

- Very fast reaction for spray application
- No catalysts are needed

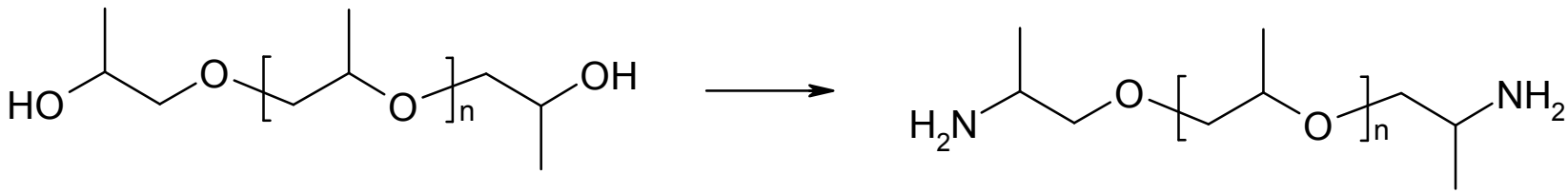
Morphology of Polyurea Elastomers



- Polyurea coatings are elastomers with hard and soft segments
- Chain extender and polyetheramine widely determine the material properties

Polyetheramines

Aminated C3-based Polypropyleneglycols



D series (functionality ca. 2)

MW	AHEW	Influence
230	120	hardness
400	220	hardness
2000	1000	elasticity

T series (functionality ca. 3)

MW	AHEW	Influence
403	160	rigidity
5000	1940	elasticity

Baxxodur™ PC 136

Aliphatic Chain Extender

Appearance	clear colorless liquid
Primary amine	< 20 mg KOH/g
Density (25°C)	0.988 g/cm³
Viscosity (25°C)	913 mPa * s
AHEW	136 g/equiv
Registration	EINECS, TSCA, IECSC

Baxxodur™ PC 136

Application and Material Properties

Typical processing latitude and film properties

Shore D	40 – 80
Gel time	5 – 15 sec.
Temp. stability	max. 90°C
90% property	ca. 4h

General properties provided by Baxxodur™ PC 136

- Wide hardness range can be covered
- Prolonged gel time for longer pot life
- Fast film property development
- Transparent films can be obtained
- Excellent color stability
- High temperature stability of films
- Superiour surface quality

Baxxodur™ PC 136

Superior Surface Quality

High gloss surface

Textured surface

- Excellent processability for various surface structures

Baxxodur™ PC 136

Results of the Color Stability Test

ISO 4892-2,A climate test ; DIN 53236 color metric test

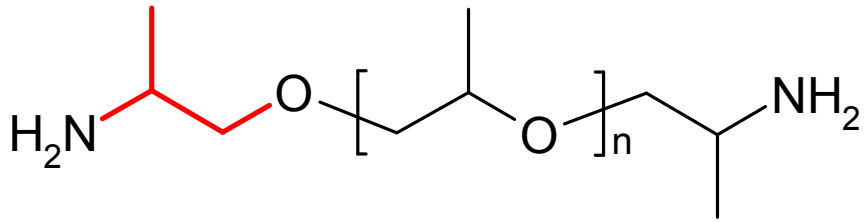
Test time	ΔE*ab = color shift	
500 h	0.63	
1000 h	0.85	
1500 h	0.96	
2000 h	1.13	
2500 h	1.19	
3000 h	1.30	~ 2.5 years field test

- Excellent color stability of Baxxodur™ PC 136 based systems
  (Test system: HDI-prepolymer; D2000/D400/Baxxodur™ PC 136)
- No visual color change after more than 2.5 years (simulated)
- Shifts of ΔE*ab < 1.5 cannot be recognized by human eyes

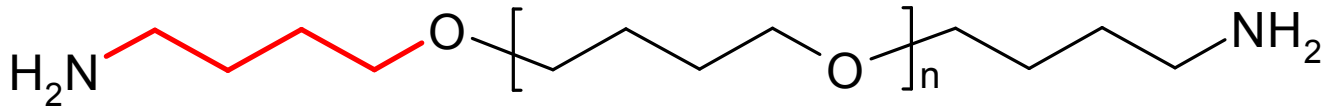
PolyTHF® Amines

Hydrophobic C4 based polyetheramines

C3-chain (PO-based) Polyetheramines



C4-chain (PolyTHF®) Polyetheramines
(idealized structure)



	Molecular weight [g/mol]	AHEW [g/equiv]	Viscosity [mPa*s]	Melting Point [°C]
D 2000	2000	1000	273 @ 23°C	- 29
T 5000	5000	1940	870 @ 23°C	- 50
PolyTHF® Amine	1700	ca. 800	194 @ 40°C	+ 24

PolyTHF® Amines

Mechanical properties at constant hard segment content

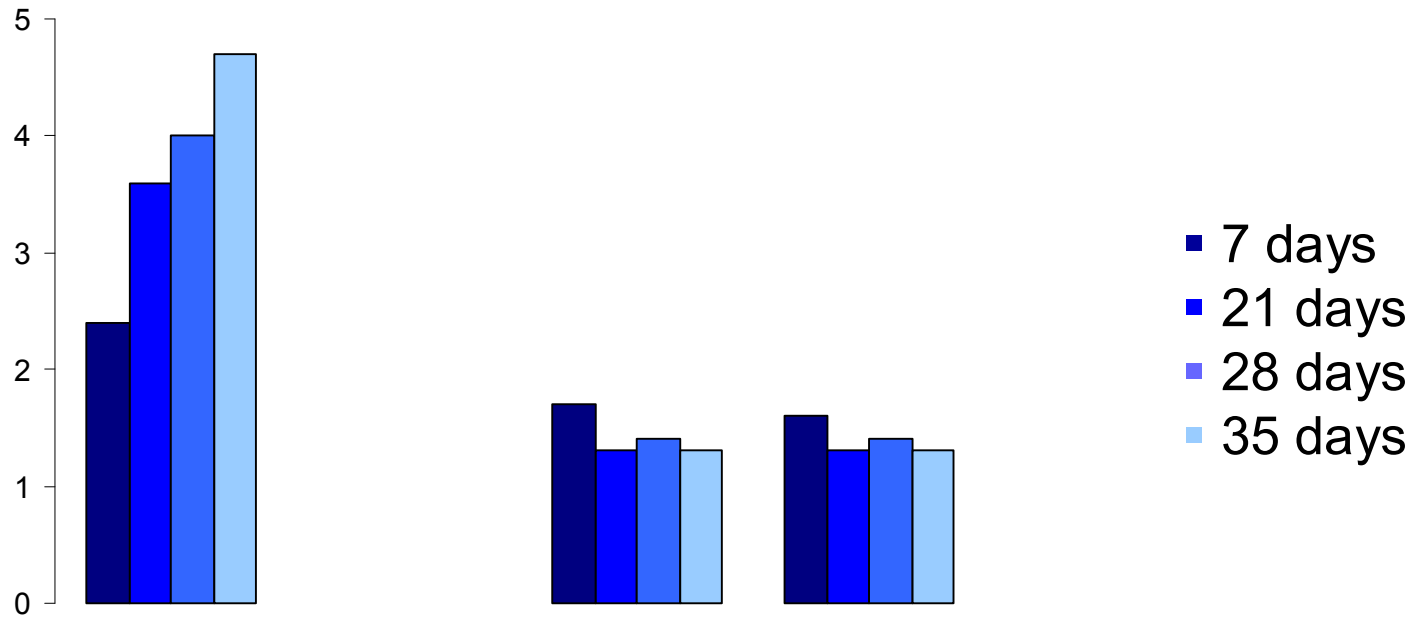
		Standard	PolyTHF® Amine systems	
D2000	pbw	65,7	61,2	51,2
T5000		5,6		
DETDA		28,8	28,8	28,8
PolyTHF® - amine 1700			**10,0**	**20,0**
MDI-prepolymer (PPG 2000 based)	% NCO	15,0	17,0	17,0
*Hard segment content %		**40**	**42**	**42**
Shore D		44	52	53
Tensile strength	MPa	16	25	24
Elongation	%	400	380	340
Tear strength	kN/m	67	68	70
Abrasion	mm^3	187	145	150

*All formulations have been sprayed @ Volume ratio 1:1 and Index 105

PolyTHF® Amines

Water uptake during 90°C humid ageing periods

- Lower water uptake of PolyTHF® Amine formulations
- Less swelling (*less delamination*) of the coating material

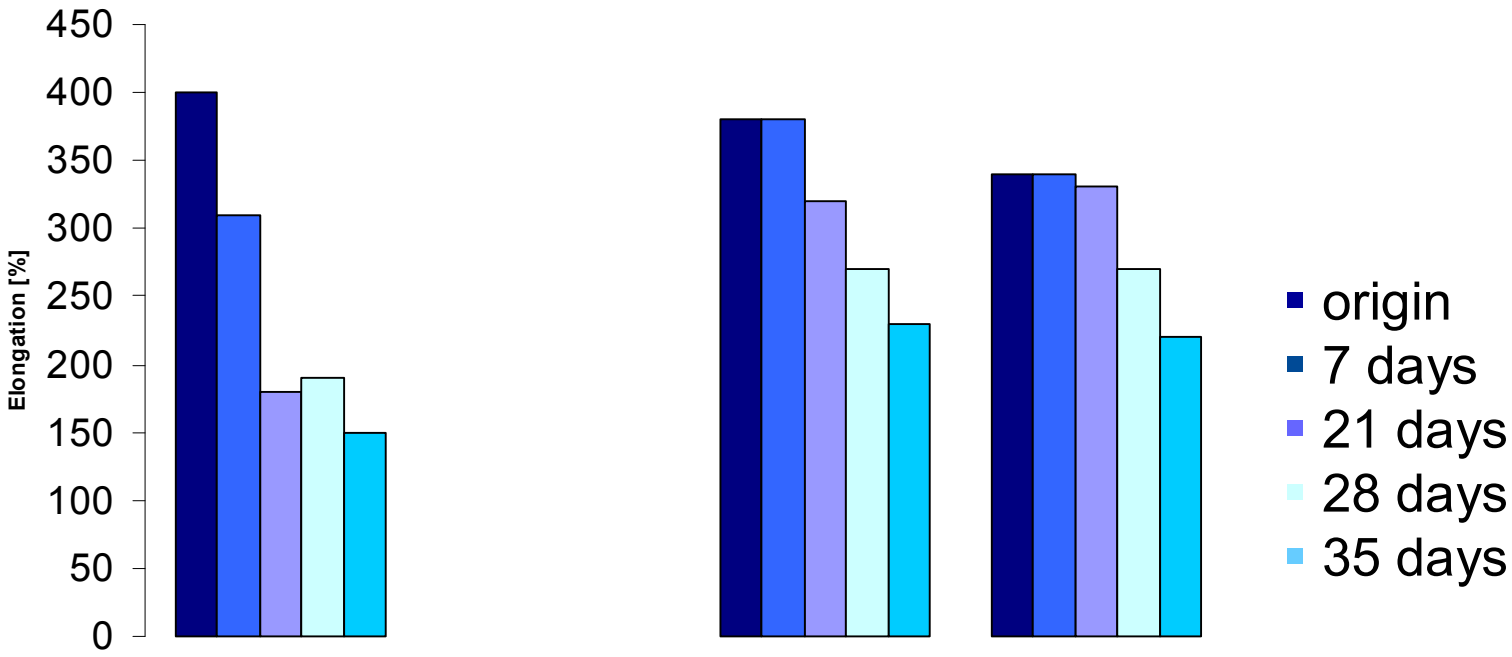


D2000	65,7	61,2	51,2
T5000	5,6		
PolyTHF® Amine 1700		**10,0**	**20,0**
DETDA	28,8	28,8	28,8

PolyTHF® Amines

Elongation after 90°C humid ageing period

- PolyTHF® Amine based polyurea coatings stay more elastic

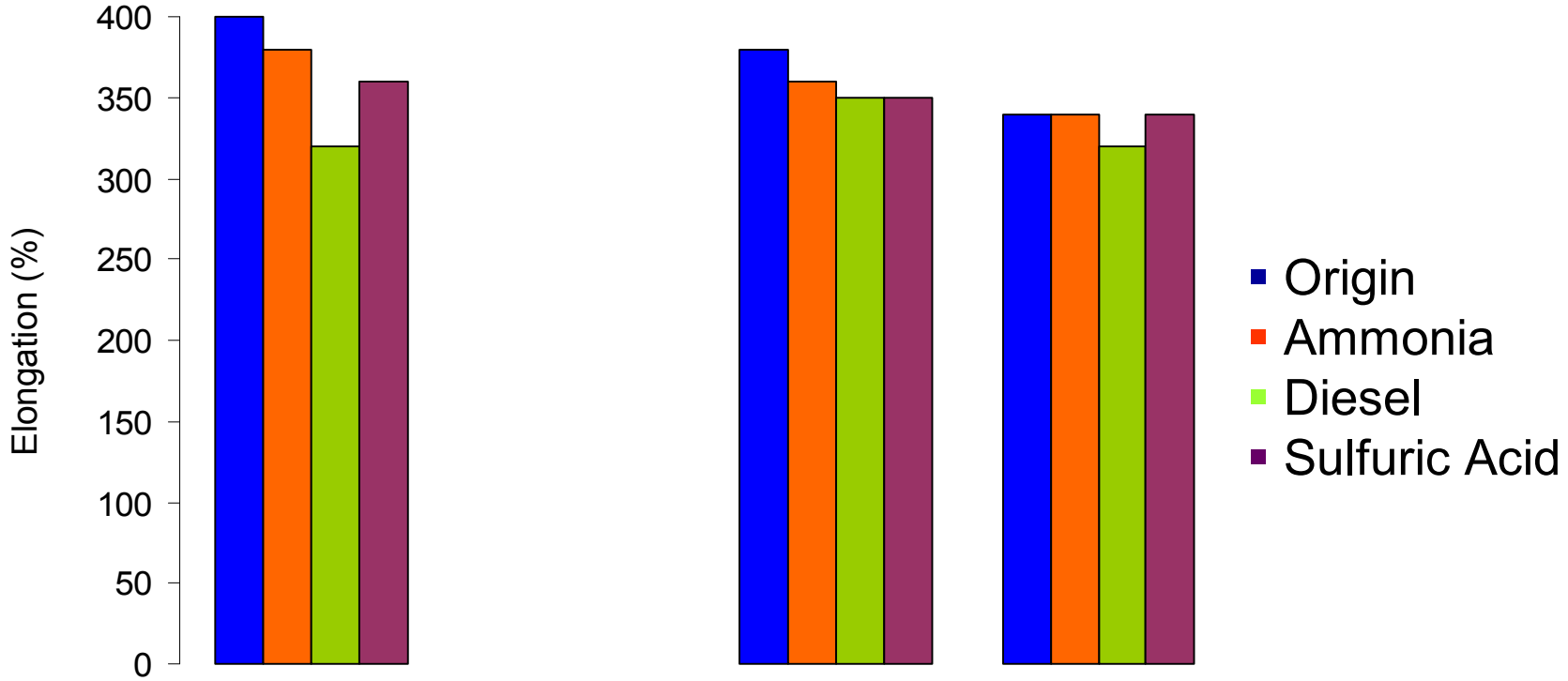


D2000	65,7	61,2	51,2
T5000	5,6		
PolyTHF® Amine 1700		**10,0**	**20,0**
DETDA	28,8	28,8	28,8

PolyTHF® Amines

Elongation after 7days storage in different chemical media

- PolyTHF® Amines do not deteriorate the chemical resistance



D2000	65,7	61,2	51,2
T5000	5,6		
PolyTHF® Amine 1700		**10,0**	**20,0**
DETDA	28,8	28,8	28,8

PolyTHF® Amines
Polyetheramines based on C4 backbones

PolyTHF® Amines

- are based on C4-backbones for improved elastic properties
- are hydrophobic products for improved wet performance
- do contain primary and secondary amino groups
- are developmental products available at different molecular weights

Molecular weight [g/mol]	AHEW [g/equiv]	Viscosity [mPa*s]	Melting Point [°C]
1700	ca. 800	194 @ 40°C	24
350	ca. 165	50 @ 20°C	- 7

Raw materials for polyurea by BASF

- **Polyetheramines**
  D230, D400, D2000
  T403, T5000

- **PolyTHF® Amines (under development)**
  PolyTHF® Amine 1700
  PolyTHF® Amine 350

- **Aliphatic chain extender**
  Baxxodur™ PC 136

- ***MDI isocyanates and prepolymers***

Further information

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