



# Products for polyurethane dispersions

Complete palette for high performance & low impact

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## Limitless formulation freedom

Aqueous polyurethane dispersions (PUDs) are widely appreciated for their versatility, high performance, and low environmental impact – and because they enable formulators to customize precise properties, such as durability, hardness and flexibility, for each specific application including:

- Hard, highly durable coatings for wood parquet flooring
- Highly flexible and abrasion-resistant coatings for leather and textiles
- Weather-resistant, non-yellowing outdoor coatings for wood, metal and plastic surfaces
- Soft-feel coatings for plastics such as mobile phones and car dashboards
- Adhesives in footwear, wood products, furniture and automotive interiors

The low environmental impact of PUDs comes from their low VOC (volatile organic compound) content, since they are dispersed in water, rather than organic solvents. This means that PUD coating systems are more environmentally sound and increasingly attractive solutions, being both friendlier to the environment and to the people who use them.

## Your complete polyurethane partner

As leading global suppliers of high-performance essentials and specialties, we offer you an extensive range of raw materials including polyols, isocyanate monomers, dispersing monomers, isocyanate cross-linkers and more – all dedicated to the formulation and differentiation of the full range of PUDs.

Polyurethanes is our largest product and development field and our dedicated polyurethane team supports you in developing and tailoring new polyurethane dispersion technology and applications.





## Our wide range of products for polyurethane dispersions

### Polyols

**Capa® polycaprolactones** – for PUD coatings with superior flexibility and high abrasion resistance

**Oxymer® polycarbonate diols** – for maximum UV and outdoor durability, chemical resistance and hydrolytic stability

### Dispersing monomers

**Bis-MPA (Dimethylolpropionic Acid)** – anionic dispersing monomer of choice, key raw material for anionic PUDs

**Ymer™ N120** – polymeric non-ionic dispersing monomer for non-ionic stabilization

### Isocyanate monomers & cross-linkers

**IPDI (Isophorone Diisocyanate)** – key resin building block for exceptional weathering resistance, improved hardness and chemical resistance

**HDI (Hexamethylene Diisocyanate)** – for excellent flexibility, abrasion resistance and weathering resistance

**Scuranate® TDI (Toluene Diisocyanate)** – good balance of price and performance for adhesives and coating applications where yellowing is less of a concern

**Easaqua™** – self-emulsifying isocyanate cross-linkers for waterborne polyurethane formulations

### Polyalcohols

**TMP, Neo & BEPD** – fine-tuning polyalcohols for adjusting hardness, surface tension and branching

## SUSTAINABLE DEVELOPMENT

### Seeing the bigger picture & acting on it

We believe in improving everyday life – making it safer, more convenient, more fun, and more environmentally sound for millions of people all over the world. And we achieve this through innovative chemistry. It is how we provide you with solutions that maximize performance and minimize environmental impact all at once, enabling you to create greater value for your business, your customers, their customers, and all the way through to end users. Here are some of the things we are doing to ensure it:

► Over 80% of our R&D work is focused on developing more efficient and environmentally sound products and processes, enabling cuts in environmental impact.

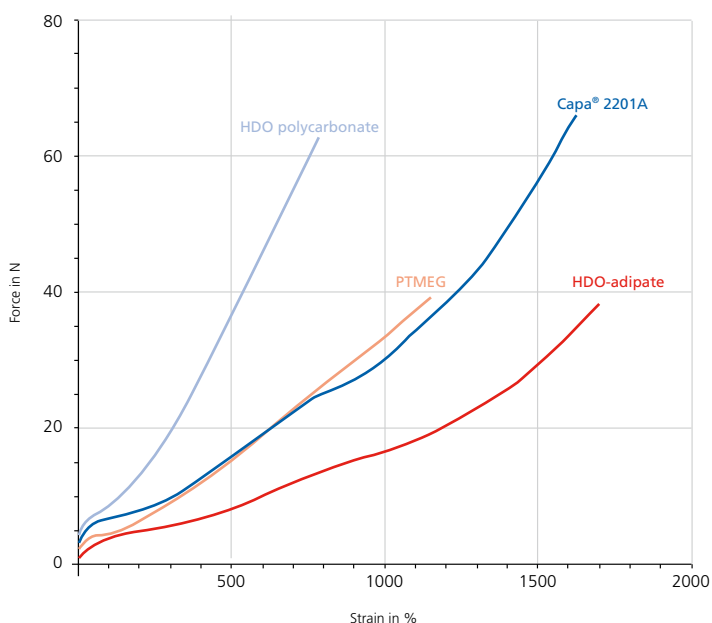
- We are in the process of systematically mapping the carbon footprints and lifecycle impact of our main products. We will provide complete carbon footprint information on about 15 by 2011, including TMP, Neo and selected isocyanates.
- We actively search for renewable alternatives to conventional raw materials and we focus on bringing the carbon footprint and lifecycle impact of the product to an absolute minimum.

# Performance essentials & specialties

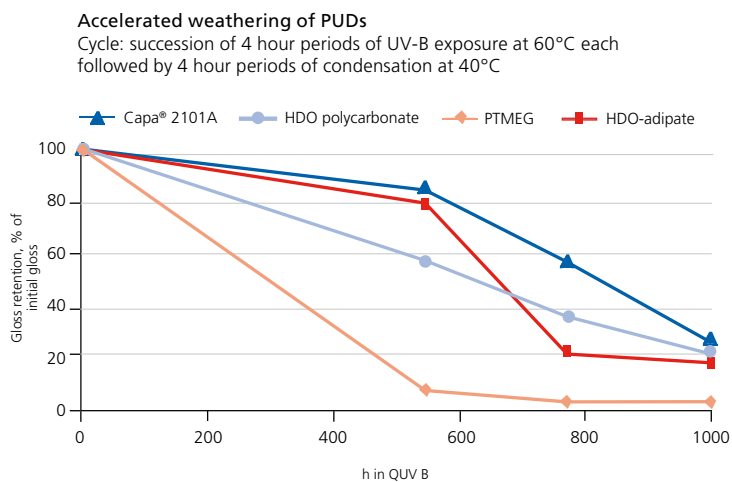
## Capa® polycaprolactones – enable solvent-free PUDs, best flexibility & strength

Capa® is our range of caprolactones, comprising monomer and polycaprolactones of varying molecular weight, functionality and initiating polyols. The unique chemical structure of Capa® polycaprolactones enables PUDs with very good hydrolytical stability and UV and outdoor durability, combined with excellent flexibility and abrasion and scratch resistance.

The unique ring-opening addition polymerization route used in the manufacture of polycaprolactones results in products with very low acid values and very narrow molecular weight distributions compared, for example, to adipate polyesters. The narrow molecular weight distribution enables products with very low viscosity, which is helpful in synthesizing PUDs with low or no solvent.



Graph showing flexibility/film stretch of various PUD coatings where Capa-based formulations show excellent balance between modulus and elongation



Graph showing the gloss retention of various PUD coatings where Capa®-based formulation shows best performance



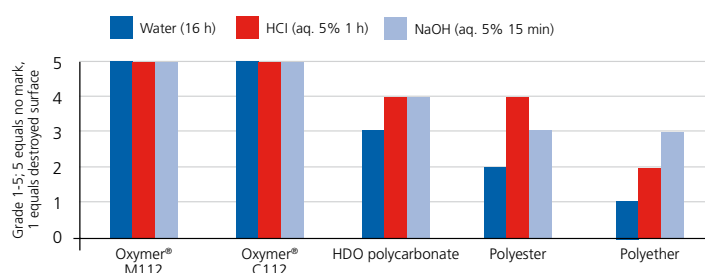
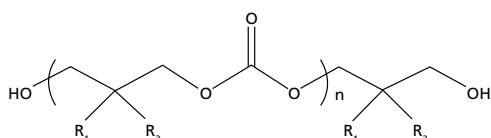


# Peak performance polyols

## Oxymer® polycarbonate diols – durability & perfect finish for performance polyurethanes

Our unique new range of Oxymer® specialty polycarbonates are, unlike conventional aliphatic polycarbonates, based on substituted aliphatic diols. Oxymer® polycarbonates offer all the advantages of conventional polycarbonate diols, including superior hydrolytical stability and outdoor durability. Oxymer® polycarbonate diols offer the highest UV and chemical resistance, hydrolytic stability and outdoor durability combined with high hydrophobicity, low surface energy and excellent acid and alkali resistance.

Oxymer®



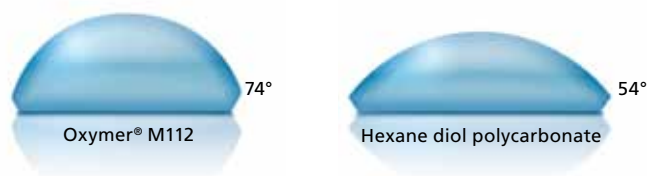
Graph showing the level of damage to a coating after exposure to various liquids and where Oxymer® displays best performance

## Oxymer® M grade

The Oxymer® M grade is a rigid, amorphous and highly hydrophobic polycarbonate diol with good wetting characteristics, suitable for low surface-energy coatings and substrates. With its high hydrophobicity, Oxymer® M grade also secures outstanding UV, water, acid and alkali resistance combined with excellent outdoor durability.

Thanks to the rigid carbonate-linkage and branched 1,3 diols, the Oxymer® M grade displays a relatively high glass transition temperature and high hardness compared to conventional polycarbonate diols. The Oxymer® M grade, a developmental product, is a non-crystalline aliphatic polycarbonate.

Contact angle of water droplets on PUD coatings based on Oxymer® M112 and hexane diol polycarbonate, with the Oxymer®-based coating displaying the highest hydrophobicity



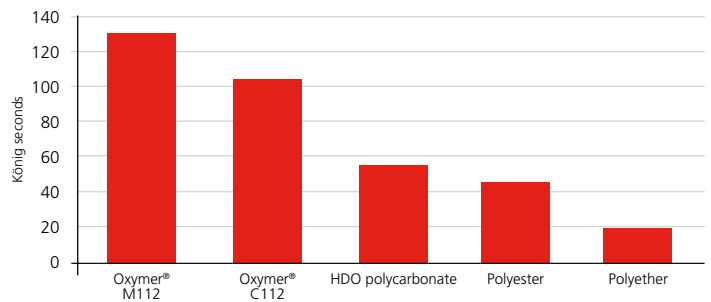


## Oxymer® C grade

Our latest development, the experimental Oxymer® C grade, is an amorphous polycarbonate diol with a surface energy and hydrophobicity closer to that of conventional macrodiols. The Oxymer® C grade, displays the same advantages as the Oxymer® M grade but with improved abrasion resistance, flexibility and adhesive properties. The Oxymer® C grade is also a non-crystalline aliphatic polycarbonate.

Product	Appearance	OH-number mg KOH/g	Viscosity, Pas (°C)	Tg (°C)
Oxymer® M112	Viscous liquid	112	1.1 (75)	-23
Oxymer® C112	Viscous liquid	112	1.5 (75)	-33

Pendulum hardness of PUD coatings  
Dry film thickness 30 µm ± 5 µm on glass

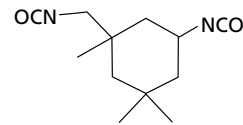


# Fine-tuning with isocyanate monomers & polyalcohols

## IPDI (Isophorone Diisocyanate) – the ideal monomer for PUDs

Thanks to the cycloaliphatic structure of IPDI and its good balance of reactivity between the two isocyanate groups, it is the ideal monomer for PUD synthesis and enables straightforward formulation and easy processing. The rigid cycloaliphatic structure improves chemical resistance, hardness, toughness and secures exceptional weathering in end products.

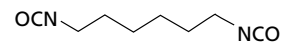
IPDI



## HDI (Hexamethylene Diisocyanate) – significantly increased flexibility & exceptional durability

The linear aliphatic structure of hexamethylene diisocyanate significantly increases flexibility, improves abrasion and scratch resistance, and gives the exceptional weathering resistance that is often associated with aliphatic isocyanates. The flexibility and abrasion resistance that HDI enables makes it perfect for leather and textile applications.

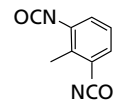
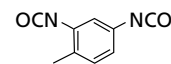
HDI



## Scuranate® TDI – balanced price to performance ratio

Scuranate® TDI offers a balanced price to performance ratio for applications where performance is important but yellowing is less of a concern, for example, in primers, indoor coatings and adhesives.

Scuranate® 2,4 & 2,6 Toluene Diisocyanate



### TMP, Neo & BEPD – fine-tuning hardness, surface tension & branching

With the incorporation of Neo (Neopentyl Glycol) in the pre-polymer you increase the hardness of the PUD coating.

With the long aliphatic side chains of BEPD (Butyl Ethyl Propanediol) you lower the surface energy and increase the water resistance of the coating.

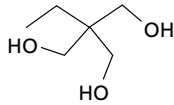
Finally, the incorporation of TMP (Trimethylolpropane) during the PUD synthesis achieves an increased and controlled degree of branching.



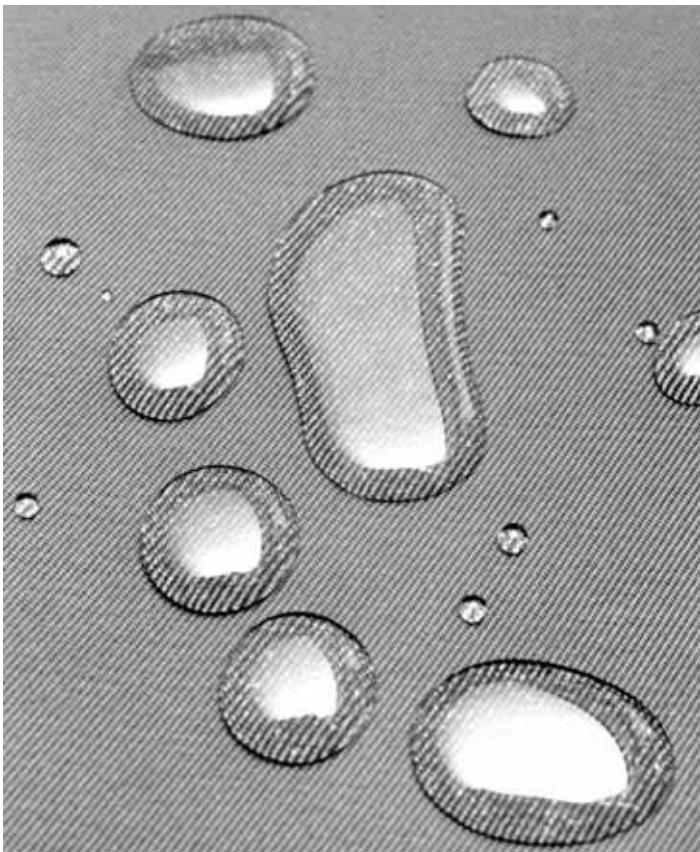
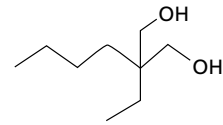
Neo



TMP



BEPD



# Designed for low impact & efficiency

## Easaqua™ – self-emulsifying cross-linkers for waterborne formulations

Our Easaqua™ product line is specifically designed for waterborne polyurethane formulators to tailor high performance 2K PUD coatings, and to meet the growing demand for easy-to-use and environmentally sound coating solutions. Our Easaqua™ range consists of hydrophilically modified polyisocyanates that self-emulsify in water. They work as cross-linkers in 2K formulations where they contribute to miscibility, fast drying, high gloss, low odor and low viscosity.

The main applications where our Easaqua™ range is ideal for waterborne polyurethane formulations are:

- Wood coatings for durable flooring and kitchen interiors
- Soft-feel coatings for plastics such as mobile phones and car dashboards
- Metal coatings for general industry
- Concrete coatings
- Automotive repair, transportation and agricultural equipment coatings

As formulation requirements have evolved, so has our line of Easaqua™ polyisocyanates. We now offer several new products for even easier mixing and faster drying.

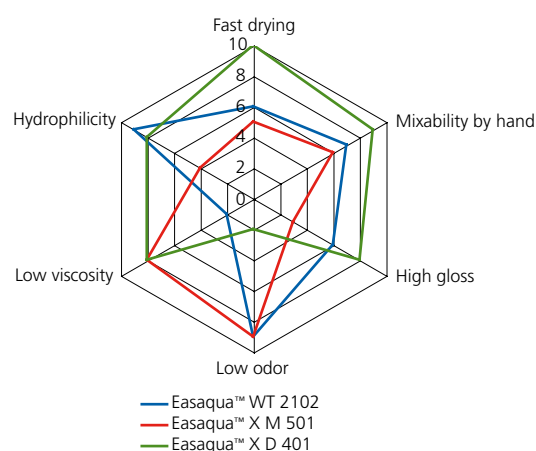
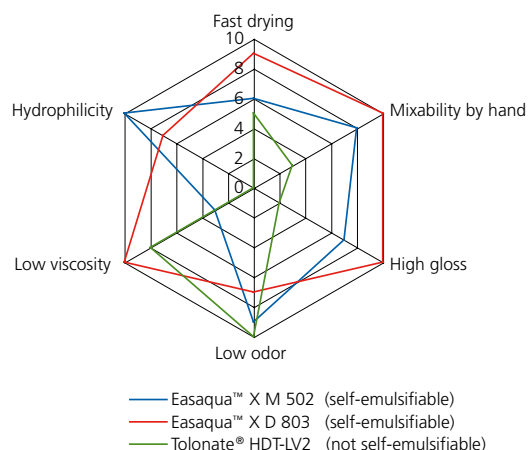
### Self-emulsifiable polyisocyanates:

- Easaqua™ WT 2102
- Easaqua™ X M 501
- Easaqua™ X M 502
- Easaqua™ X D 401
- Easaqua™ X D 803

### Emulsion of blocked polyisocyanate:

- Easaqua™ WT 1000

Key properties



## Product data summary

### Polyols

	Appearance	Functional groups	Hydroxyl number, mg KOH/g	Molecular weight, g/mol	Viscosity, mPas (°C)	Polymer chemistry
<b>Polycaprolactones*</b>						
Capa® 2054	Liquid/paste	2 hydroxyl	204	550	60 (60)	Polyester
Capa® 2100	Wax	2 hydroxyl	112	1,000	150 (60)	Polyester
Capa® 2101A	Wax	2 hydroxyl	112	1,000	150 (60)	Polyester
Capa® 2200	Wax	2 hydroxyl	56	2,000	480 (60)	Polyester
Capa® 2201A	Wax	2 hydroxyl	56	2,000	390 (60)	Polyester
Capa® 2302A	Wax	2 hydroxyl	37	3,000	1,100 (60)	Polyester

### Polycarbonate diols\*\*

Oxymer® M112	Viscous liquid	2 hydroxyl	112	1,000	1,100 (75)	Polycarbonate
Oxymer® C112	Viscous liquid	2 hydroxyl	112	1,000	1,500 (75)	Polycarbonate

### Polyalcohols

Neo (Neopentyl Glycol)	Flakes	2 hydroxyl	1,077	104.2	N/A	N/A
BEPD (Butyl Ethyl Propanediol)	Semi-crystalline	2 hydroxyl	695	161	N/A	N/A
TMP (Trimethylolpropane)	Flakes	3 hydroxyl	1,247	135.1	N/A	N/A

\* For the complete range of Capa® polycaprolactones see the Capa® brochure

\*\* Development and experimental products

### Dispersing monomers

	Appearance	Functional groups	Hydroxyl number, mg KOH/g	Molecular weight, g/mol	Viscosity, mPas (°C)	Polymer chemistry
Bis-MPA	Crystals	2 hydroxyl, 1 carboxyl	835	134.4	N/A	N/A
Ymer™ N120	Waxy	2 hydroxyl	110	1,000	60 (50)	N/A

### Isocyanate monomers

	Appearance	Isocyanate type	Color, APHA	Hydrolysable chlorine, ppm	Total chlorine, ppm
IPDI (Isophorone Diisocyanate)	Liquid	Cycloaliphatic	≤ 30	< 200	< 400
HDI (Hexamethylene Diisocyanate)	Liquid	Aliphatic	≤ 15	< 350	< 1,000
Scuranate® T80 (Toluene Diisocyanate, 80% 2,4 TDI)	Liquid	Aromatic	≤ 15	< 70	< 300
Scuranate® T65 (Toluene Diisocyanate, 68% 2,4 TDI)	Liquid	Aromatic	≤ 25	<100	< 300

### Aliphatic polyisocyanates for waterborne PU formulations

	Viscosity, mPas (° C)	NCO, %	Solid content, %	APEO-free without nonyl phenol ethoxylate
<b>For mono-component (1K) thermosetting formulation</b>				
Easaqua™ WT 1000	3,200	9.4	63	
<b>For two-component (2K) coating formulations</b>				
Easaqua™ WT 2102	4,300	19.0	100	
Easaqua™ X M 501	1,100	21.6	100	•
Easaqua™ X M 502	3,600	18.3	100	•
Easaqua™ X D 401	1,050	15.8	85	•
Easaqua™ X D 803	200	12.2	69	•
<b>For two-component (2K) adhesives, leather, textile &amp; paper</b>				
Easaqua™ WAT	4,000	19.0	100	
Easaqua™ WAT-1	1,400	21.7	100	
Easaqua™ WAT-3	1,150	21.5	100	•
Easaqua™ WAT-4	4,000	18.6	100	•



## Your Winning Formula

The Perstorp Group, a trusted world leader in specialty chemicals, places focused innovation at your fingertips. Our culture of performance builds on over 125 years of experience and represents a complete chain of solutions in organic chemistry, process technology and application development.

Matched to your business needs, our versatile intermediates enhance the quality, performance and profitability of your products and processes. Present in the aerospace, marine, coatings, chemicals, plastics, engineering and construction industries, they can also be found in automotive, agricultural, food, packaging, textile, paper and electronics applications.

Our chemistry is backed by reliable business practices and a global commitment to responsiveness and flexibility. Capacity and delivery security are ensured through strategic production plants in Asia, Europe and North America, as well as sales offices in all major markets. Likewise, we combine product and application assistance with the very best in technical support.

As we look to the future, we strive for the development of safer products and sustainable processes that reduce environmental impact. This principle of innovation and responsibility applies not only to our own business, but also to our work with yours. In fulfilling it, we partner with you to create a winning formula that benefits your business – as well as the people it serves.

Discover your winning formula at [www.perstorp.com](http://www.perstorp.com)