

## WorléePUD – Polyurethane dispersions for particularly stressed paint coatings

Polyurethane dispersions have been established in various coatings applications for many years and are an indispensable part of modern coatings formulations. The polymeric structure of polyurethanes permits a large number of variations, which means that a wide variety of property profiles can be tailor-made. Users of these coating systems are particularly impressed by their mechanical properties.

## Polyurethane dispersions for high-quality coating applications

Polyurethane dispersions provide coating formulators with a wide range of possible applications in high-quality coating systems. The main components of the polyurethane dispersion, polydiol and diisocyanate, can be combined according to a kind of modular system. Tailor-made properties can be produced by numerous variations of individual components in terms of type and structure (cf. Fig. 1).

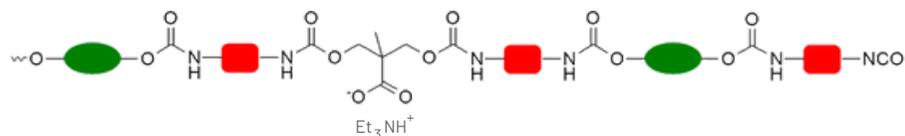


Figure 1: Structure of a polymer chain of diol and diisocyanate

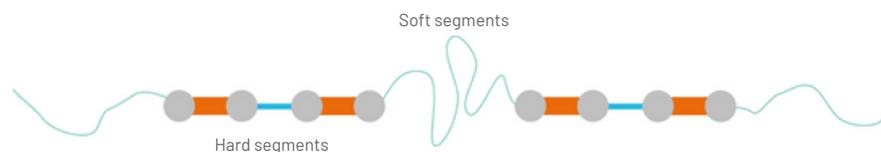


Figure 2: Structure of a polymer chain with hard and soft segments

Due to the special structural composition of the polymer chain into soft and hard segments, the polymer film generates special properties that no other class of binder exhibits.

The hard segments, consisting of RNCO units, are integrated into the matrix of the soft segments, consisting of polydiol chains, resulting in excellent mechanical property profiles.

On the one hand, polyurethane dispersions can exhibit an extremely high level of hardness without making the polymer film brittle. On the other hand, this class of binders also offers an extremely high level of flexibility without making the film appear too soft or even tacky. Good chemical resistance can be produced by the specific selection of polydiol chains.

These durable, resistant coatings are used especially in high-quality paint applications, such as parquet and furniture coatings, which are exposed to high mechanical stresses due to abrasion and scratching. The varnish layer, protecting for the wood surface, must be extremely tough and elastic to prevent breakage due to cracking.

Polyurethane dispersions can also be made highly flexible, for example for plastic applications, to give the coating film a very high flexural strength. At the same time, the polymer retains a high level of resistance so that the protective function is guaranteed.



## WorléePUD VP 1011 – a hard polyurethane dispersion for highly stressed systems

WorléePUD VP 1011 is highly resistant to scratches and abrasions and is thus resistant to strong mechanical stresses. In addition having a very good resistance to household chemicals, such as alcohol and cleaning agents, for one-component coatings, the film is also characterised by having a very good water resistance. Use in flooring, for example as a parquet coating, is conceivable.

It can also be used in high-quality furniture coatings, where fast drying and high blocking resistance are also required.

Appearance	Fine-particle polymer dispersion
Chemical characterisation	Polyurethane dispersion
Delivery form	Approx. 30% in water
Bio-based share	Approx. 48% (calculated on solids)

Table 1: Technical data WorléePUD VP 1011

Pos.	Product	%	Function
1	WorléePUD VP 1011	86.00	Binder
2	Dowanol DPnB	4.80	Co-solvent
3	WorléeAdd 6223	0.50	Defoamer
4	KahlPowder 2811P7	5.00	Matting agent
5	WorléeAdd 3410	0.20	Substrate wetting agent
6	Water	3.50	Solvent
Total		100.00	

Table 2: Example guide formulation 2.9988 - 51, 1K PUD wood coating with very good mechanical properties



## WorléePUD VP 1021 - a polyurethane dispersion for highly flexible applications

WorléePUD VP 1021 can be used to produce very elastic coating films with an elongation break point of 250%. In addition to interesting haptic properties, the film is also characterised by very good water resistance.

<b>Appearance</b>	Fine-particle polymer dispersion
<b>Chemical characterisation</b>	Polyurethane dispersion
<b>Delivery form</b>	Approx. 30% in water
<b>Bio-based share</b>	Approx. 50% (calculated on solids)

Table 3: Technical data WorléePUD VP 1021



Pos.	Product	%	Function
1	WorléePUD VP 1021	80.00	Binder
2	WorléeAdd 6223	0.30	Defoamer
3	Dowanol DPnB	1.00	Co-solvent
4	WorléeAdd 3410	0.30	Substrate wetting agent
5	Carbon black paste concentrate*	10.00	Pigment paste
6	KahlPowder 2811P7	6.00	Matting agent
7	Tafigel PUR 61 (1:3 in water)	1.50	Thickener
8	WorléeAdd 3520	0.90	Surface additive
<b>Total</b>		<b>100.00</b>	

### \* Carbon black paste formulation:

Pos.	Product	%	Function
9	Water	67.80	Solvent
10	WorléeDisperse VP 8470 W	12.00	Dispersing agent
11	Monarch M 1000	20.00	Carbon black
12	WorléeAdd VP 6229	0.10	Defoamer
13	AMP 90	0.10	Neutralising agent
<b>Total</b>		<b>100.00</b>	

Table 4: Example guide formulation 2.9988 - 24, 1K PUD coating with very high flexibility

## WorléePUD – acrylate hybrid systems

A widely used method in the development of coating formulations is the combination of polyurethane and acrylate dispersions. By mixing them, positive properties of both binder classes can be combined in many cases. For example, hardness and blocking resistance can be increased by combining softer acrylates with harder polyurethane dispersions in order to create a more resistant coating film (cf. diagram 1).

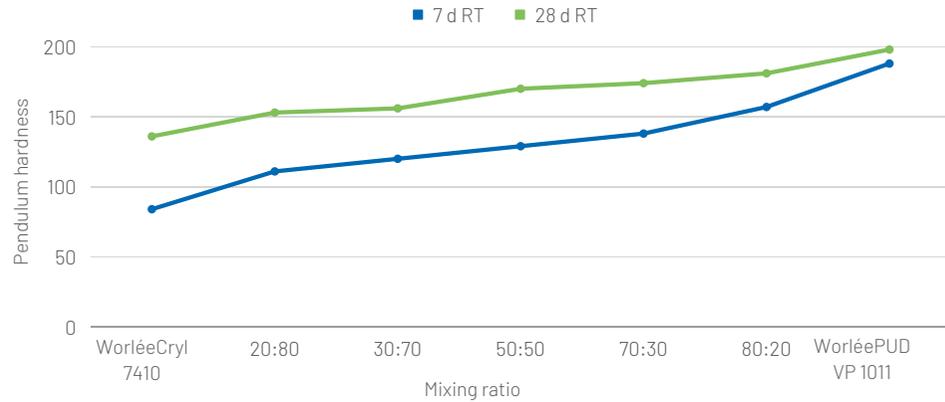


Diagram 1: Hardness development (pendulum hardness according to König in s) after mixing WorléeCryl 7410 with WorléePUD VP 1011 in different ratios

Conversely, even very brittle and hard acrylic coatings can be made more flexible by cleverly combining them with elastic polyurethane dispersions without negatively affecting the blocking resistance (cf. diagram 2).

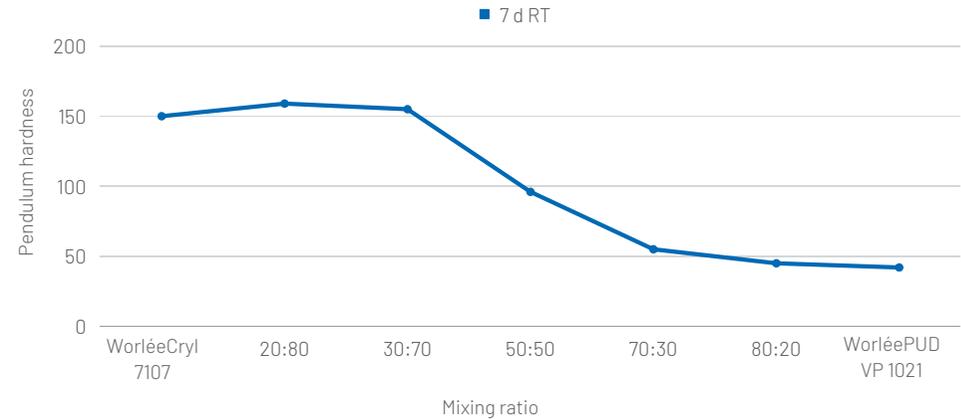


Diagram 2: Hardness development (pendulum hardness according to König in s) after blending WorléeCryl 7107 with WorléePUD VP 1021 in different ratios

## Worlée additive recommendation

In particular, the following additives can be used in formulations with the WorléePUD prototypes:

Appearance	Function	Property
WorléeAdd 6223	Defoamer	100% silicone compound. Prevents foaming during the production and processing of coatings.
WorléeAdd 3410	Substrate wetting agent	Highly effective silicone-based wetting additive. Improves substrate wetting and flow properties.
WorléeAdd 3520	Surface modification	High-molecular-weight silicone-containing surface additive. Improves smoothness, scratch and abrasion resistance.
WorléeDisperse 8400 W	Dispersing agent	High-performance polymeric dispersant. For universal use in direct grinds or pigment concentrates for all pigment types.
KahlPowder 2811P7	Matting agent	Micronised rice husk wax for matting paint surfaces. Also improves scratch resistance.

Table 5: Suitable additives



## Let's work together

Do you have any ideas for product developments? Feel free to contact us. We would be pleased to work on a joint project with you.

## Sustainable product development

The development of sustainable products has accompanied us for a very long time. Even without legal or societal pressure, it has always been our ambition to offer better and more durable products and solutions for a wide range of applications. Developing high-quality products in collaboration with our customers remains our primary focus.

Over the decades, we have gained a lot of experience in developing various resin technologies based on different raw materials to make products more sustainable from different perspectives. Sustainable product development must ultimately benefit the environment and society, but also take into account economic aspects.

The entire supply chain must benefit. Already part of our proven developments, we can take many of these different aspects into account and make resins and additives even more sustainable. For example, we can determine factors such as the proportion of renewable raw materials, the proportion of secondary raw materials, regionality and longevity, the hazard potential of our products, and the competition of our raw materials with the food industry.

Technologically, we are well positioned with our creative departments in research, development and application technology to continue to move towards sustainable products in collaboration with our customers and partners. Every new development is related to sustainability factors such as climate change and resource conservation.

## The corporate values that guide our actions

Since our founding in 1851, the principle of sustainability with its three core themes of economy, ecology and social issues has been at the heart of our corporate philosophy. As a family business, Worlée-Chemie is committed to social responsibility and fair dealings with business partners and employees. We are committed to forward-looking and prudent environmental protection as well as preventive and comprehensive occupational health and safety as a corporate goal.

We firmly believe that the natural resources of water, air and soil must be treated with care as part of our responsible actions. In this way, the ecosystem of which we are a part can be preserved as the basis of our living conditions for future generations. This also applies in particular to the economical and efficient use of energy and natural resources.

We stand by our responsibility for safety in production, storage and transport. We ensure that our products are handled conscientiously along the entire value chain.

Compliance with human rights due diligence is part of our company's self-image. Integrity, fairness, responsibility and a high degree of transparency are the basis for a trusting and long-term business relationship. We expect our suppliers to adhere to these principles in the wider supply chain and to recognise our Supplier Code of Conduct or provide an equivalent guideline.

### Additives

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