



Surface Additives

Fine preparations of Polymethylurea for the modification of friction, scratch resistance and haptics

 **Deuteron**[®]
ADDITIVES TO YOUR SUCCESS



Surface additives by Deuteron

Functional and haptic surface modification

Modern coatings often contain a variety of surface modification additives. Such modifications include slip reduction, mechanical resistance, blocking resistance, gloss retention or matting. Most surface additives serve as multi-purpose materials and typically influence several of the mentioned properties. Silica, waxes or other polymers are the most common particle-based additives for such applications. Apart from the improved performance using such particles can also impart negative properties to a coating film. Waxes and silica for example can lower the inter-coat adhesion, add haze and reduce the chemical resistance. The addition of surface additives usually means looking for the best compromise between positive and negative properties.

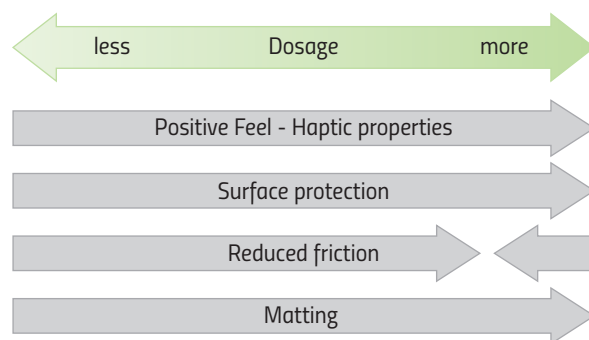
Our innovative surface additives are a helpful, additional tool for coating formulators to improve their formulations with minimal negative impact on the final performance. These products can be used on its own or in combination with other materials to specifically boost certain properties in a controlled way.

Special advantages:

- Reduced coefficient of friction
- Improved scratch and abrasion resistance
- Alternative to waxes and PTFE
- Excellent re-coat ability
- Suitable for "fine matting"
- Improved anti-blocking
- Improved sanding ability

Deuteron's polymethylurea (PMU) materials offer a unique performance profile and are well-established alternatives to other surface modification additives. PMU is a highly crosslinked polymer within the group of duromeric plastics – there is no melting point and the polymer does not soften when exposed to heat. High heat resistivity and comparably high hardness (compared to other polymers) make PMU a perfect additive to achieve significant surface improvements.

Properties depending on dosage

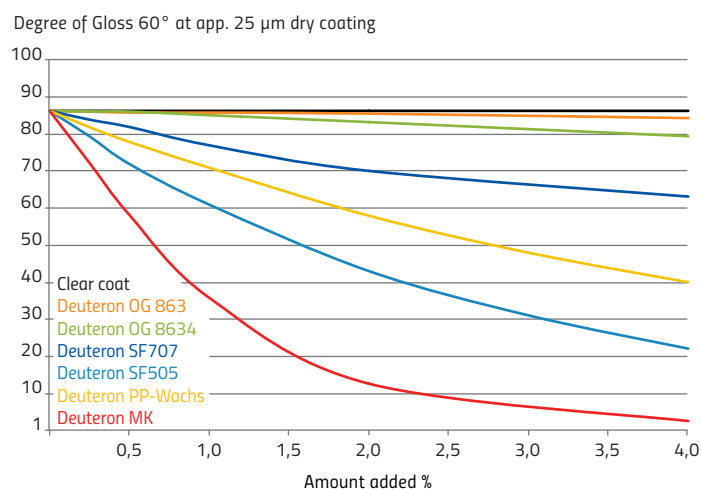


Polymethylurea is highly compatible in almost all common coating systems ranging from water-based to solvent-based and 100% systems. The polymer is easily dispersed and wetted without any need for additional dispersing additives or high shear forces. In addition, the refractive index is close to many standard resins and therefore causes low haze.

Gloss level

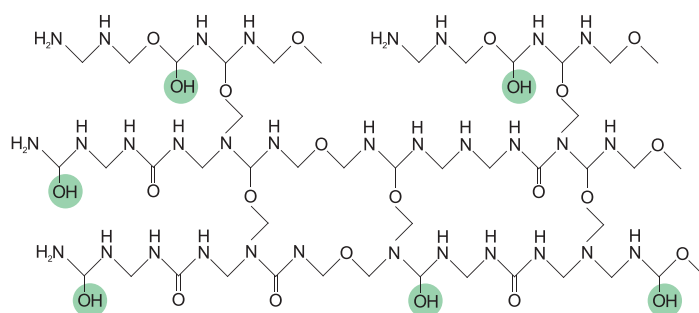
When compared to other surface additives such as waxes, Deuteron's fine PMU preparations have a small influence on the gloss and film transparency. The overall influence is closely linked to the particle size: smaller particles less likely influence the gloss, transparency, DOI (distinctness of image), haze and sheen. Typical dosage levels of our fine PMU products vary greatly depending on the desired effects, film thickness and resin matrix. Low dosages start to reduce a system's coefficient of friction. An increased dosage has a significant impact on the mechanical resistivity against scratches and abrasion. Very high dosages ultimately lead to relatively strong matting effects with high durability and pleasant and smooth appearance.

When used as a fine matting agent the right balance between particle size and film thickness is an important factor. Best results are usually achieved when using our coarser product grades.



Formulation

Working with PMU based preparations is relatively easy. Compared to other solid particles PMU materials can be dispersed and incorporated using only low shear forces. It is not necessary to use any dispersing additives for proper incorporation. Wetting and particle embedding in the resin matrix are usually excellent and lead to the high resistivity and stability of the additives. Additional crosslinking of the free hydroxyl groups leads to even more durable films. Another benefit of the PMU chemistry is the excellent re-coatability and adhesion of the polymer.



Dosage

The dosage of our surface additives depends on the needed effects, the coating system and the application details. Specifically, the film thickness is an important influencing factor. The dosage significantly influences the effect's strength. Lower dosages between 0,5% and 1% active content (~1.5% – 3% of the liquid preparations) lead to slip reduction and surface protection. Increasing the dosage typically increases the mechanical protection but does not further influence the slip. The addition of 1.5% – 3% active content (~4% – 10% of the liquid preparations) leads to a very smooth matting effect.

In high solid systems and 100% active coatings the typical addition levels can be significantly higher - up to a maximum of ~30% - 50% in extreme cases.

Coefficient of friction and mechanical resistivity

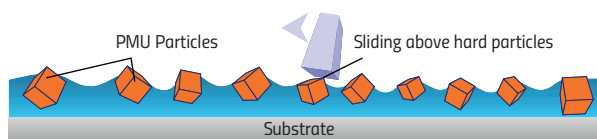
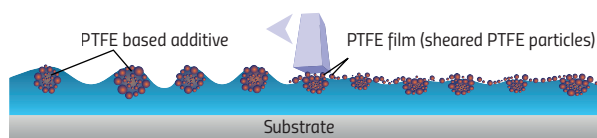
Coefficient of friction (COF) describes the force (dynamic or static) that is needed to slide an object across a surface. In certain applications the COF needs to be adjusted carefully to ensure proper processing of coated parts. Adjusting the COF is usually realized by using wax-based additives containing polyethylene with a lower melting point, carnauba wax or PTFE-based additives. Despite being an efficient way to lower the COF, waxes potentially have a negative influence on the re-coatability, intercoat-adhesion and print-acceptance of a coating. PMU-based additives show a similar performance without the wax-based additive's negative aspects.

For further details please refer to our **technical information "Alternatives to PTFE"**

Our PMU preparation's relatively small particles do not significantly influence the film's overall roughness. In addition, the particles are highly compatible with most binder systems and are therefore well-distributed and embedded in the coating matrix. Both leads to excellent smoothness and very little roughness – this leads to a low COF.

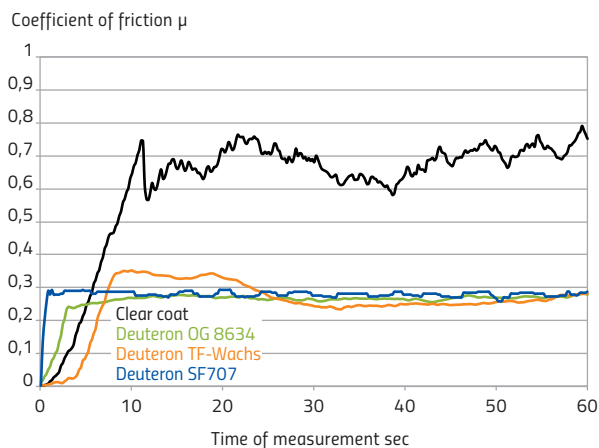
Another important factor for the reduction of the COF is the polymer's low COF. Friction always means contact between a moving object and another surface. The small protruding PMU particles reduce the contact surface between object and coating layer. In addition, the low COF of the particles makes it easier for a moving object to slide across the coating layer.

A lower COF significantly increases the scratch resistance, a sharp object will more likely slide across the coating film rather than indent it. In addition, PMU particles are comparably hard (for a plastic) and will pass this hardness property on to the coating layer. The hard PMU particles need to be destroyed first before the coating will take any harm



Deuteron's OG and SF products immediately reach their final dynamic coefficient of friction. This behaviour distinguishes these additives from standard wax-based approaches. Waxes and PTFE based additives typically start with a higher COF and need a few seconds before a sliding layer based on sheared particles is formed.

The uniform distribution of hard and smooth PMU particles in a coatings surface leads to pleasant haptics. Even low addition levels significantly increase the surface slip and potentially reach the low COF levels of PTFE modified waxes.

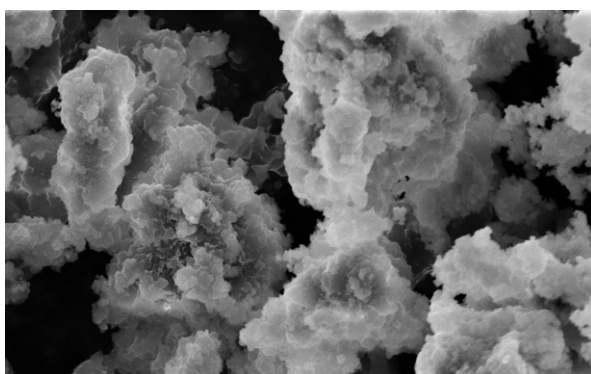


Deuteron's OG and SF products differ in their particle size distribution and particle morphology. The Deuteron OG products contain amorphous PMU particles whereas the Deuteron SF products are based on solid particles.

Deuteron OG Products

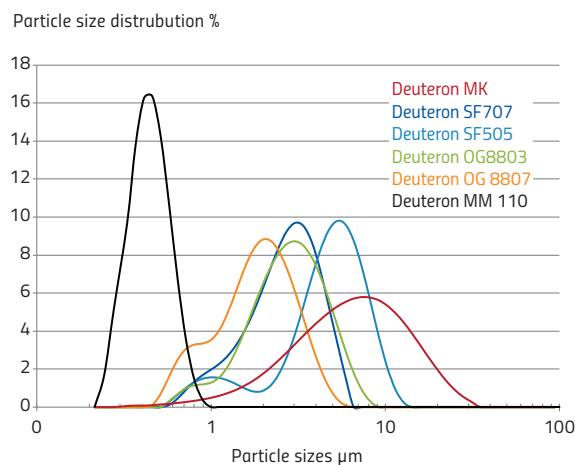
Deuteron OG products are fine, liquid preparations of our semi-compact PMU particle technology. The OG products are available in different solvents / reactive carrier. There are three different particle sizes (Dv90 range from 12 μm - <3.5 μm) available for each solvent / carrier.

Deuteron OG products are used in a wide range of applications ranging from surface protection and COF reduction (low addition level) to high performance low gloss applications (very high addition level).



SEM of semi-compact PMU particles used for the manufacture of Deuteron OG products.

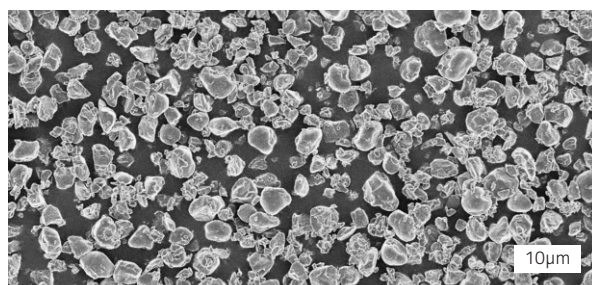
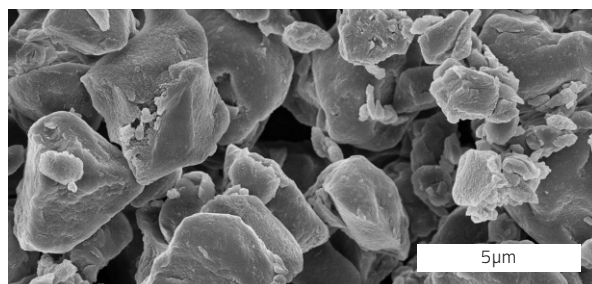
Comparison of the particle size distribution vs. Deuteron MK as reference.



The particle size of Deuteron SF 707 is comparable to the coarsest Deuteron OG grades. (e.g. Deuteron OG 8803)

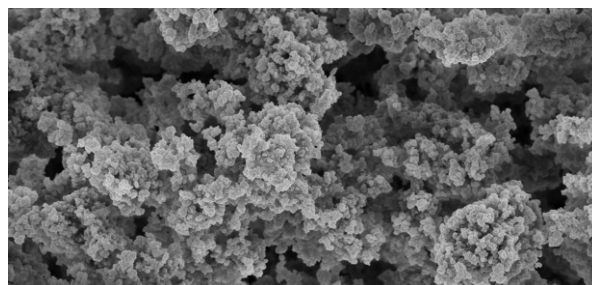
Deuteron SF Products

Deuteron SF 505 and Deuteron SF 707 are based on our compact PMU chemistry. Both products are finely ground versions of our Deuteron ST product range. The massive particles and comparably higher particles sizes allow for highest surface protection. The fine Deuteron SF 707 is more suitable for COF reduction whereas the coarse Deuteron SF 505 is most suitable for improved scratch and abrasion resistance as well as anti-blocking.



Deuteron MM 100 and MM 110

Extremely fine ground versions of our Deuteron MK matting agents designed for the use in UV inkjet printing. Both products are prepared in DPGDA and suitable wherever very fine particles are necessary.



SEM picture of Deuteron MK matting particles used for the ultra-fine MM 100 / MM 110 dispersions. Highly amorphous primary particle structure.



Surface additives by Deuteron

Functional and haptic surface modification

Properties at a glance

- No melting point (duromeric)
- Stable up to 200°C / short term stability above 300°C
- Outstanding mechanical resistance (scratches and abrasion)
- Improved smoothness and haptics
- Reduction of the coefficient of friction
- Alternative to wax additives (recoatable)
- Suitable for high gloss systems
- Improved metal marking and blocking resistance
- Control of metallic effect pigments (flop control)
- Crosslinking via OH groups possible
- Biodegradable
- Suitable for food contact applications

Technical Data

Deuteron	Particle size μm		Active content %	Solvent / Reactive Thinner	Delivery form	Systems
	d50	d99				
OG 861	3.5	12.0	32	ShellSol A 150 ND	Dispersion	Solvent based
OG 8612	2.3	7.0	32			
OG 8614	< 1.5	< 3.5	32			
OG 863	3.5	12.5	32	Isopropyl alkohol		Water and solvent based
OG 8632	2.3	7.0				
OG 8634	< 1.5	< 3.5				
OG 8670	3.5	12.5	22	Water		Water based
OG 8672	2.8	8.0				
OG 8674	< 2.0	< 5.0				
OG 8803	3.5	12.0	30	DPGDA		UV - radical curing
OG 8805	2.8	8.0				
OG 8807	< 2.5	< 7.0				
OG 8820	3.5	12.0	30	TMP(EO)3TA		
OG 8822	2.8	8.0				
OG 8824	< 2.5	< 7.0				
MM 100	0.6	< 1.2	17	DPGDA		
MM 110	0.6	< 1.2	25			
SF 707	4	12	100	-	Powder	All
SF 505	7	18				



Deuteron: First-class products for the coating industry

Deuteron successfully develops and sells innovative additives since 1977. Our product range consists of matting agents, anti-static additives, texturing additives, thickeners and UV initiators. In the course of our company history we have become an important partner of the national and international paint, lacquer and coating industry with sales agencies around the globe.

Visit us on the Internet

Our documents such as product datasheets, safety datasheets, regulatory information and brochures are available in the download area of our website without registration.

This leaflet intends to give technical advice without warranty and does not claim to be complete.

