Additives for the Manufacturing, Surface Treatment and Processing of Pigments, Fillers and Flame retardants

Create more value and give more function to tailor made pigments, fillers and flame retardants. Evonik additives meet your demands with focusing on high value end applications like

- · Functional fillers for automotive compounds
- Special MDH and ATH grades for HFFR compounds
- · Increase filler loading for heat conductive compounds
- · Easy to disperse pigments for plastic colorizing
- Avoid pigment bleeding

TEGOMER® DA 640 (30% active)

- Dispersing of fillers as well as of inorganic/organic pigments in water-based slurries, strong viscosity drop
- Flocculation of inorganic pigments or fillers (use of ppm), can be used instead of polyacrylic amides/acids
- Works even in high electrolyte surroundings

TEGOMER® DA 646 (100% active)

- Dispersing of organic pigments/carbon black in water-based slurries and organic solvents
- Strong viscosity drop
- High color strength development for organic pigments/ carbon black

TEGOMER® DA 850 (40% active)

- Excellent rheological properties even after long-term storage of pigment paste
- Reduces particle size in precipitation steps and improves color strength
- · Less water uptake than polyacrylic acids or polyphosphates
- Prevents settlement of high density fillers/pigments

TEGOPREN[®] 6875 (100% active)/ TEGOPREN[®] 6875-45 (45% emulsion)

- Alkyl modified siloxane to be used for surface treatment of inorganic fillers and all kind of pigments in plastic formulations
- Easy to handle and easy to implement into the production process

TEGOPREN[®] 6879 (100% active)/ TEGOPREN[®] 6879-50 (50% emulsion)

- Bi-functional siloxane with high surface interaction
- Results in super-hydrophobic surfaces
- · Also usable for carbonates and sulfates

TEGOPREN[®] 5885 (100% active)/no emulsion available

- Hydrophobic, non-ionic polyether siloxane based wetting and dispersing agent
- It is a highly efficient dispersing agent, especially recommended for fine or nano scaled fillers, such as organo clays

BENEFITS

The use of Evonik's organo modified siloxane technology (OMS) and polymeric organic dispersants offers several advantages:

- No VOC and no migration
- · Faster filtration in water-based production processes, which saves drying time and energy
- · Less agglomeration of pigment or filler, even in dry stage
- · Easy dispersing with higher filling levels in a variety of polymers
- · Less specks and higher color strength in finished plastic parts
- Hydrophobic surface improves the weatherability and water repellence
- · Less fiber breaks and reduced FPV for pigments in masterbatches for fibres and films
- Improved UL 94, reduced burning time, CTI increase and enhancement of LOI for flame retardants
- · Improves mechanical and surface properties of plastic parts

TEGOMER® DA GRADES AS DISPERSANTS AND FLOCCULANTS FOR WET MILLING AND PRECIPITATION PROCESSES

TEGOMER® dispersants and flocculent

Due to their special chemical nature TEGOMER® DA additives:

- · Work as flocculants when used in very small dosages
- Interact with the pigment or filler surface and form a stable layer on it
- Will compatibilize the pigment/filler to the polymer matrix
- Are compatible with polyolefin and technical polymers
- Reduce the viscosity of the slurry enabling higher loadings during wet grinding stage



TEGOMER® DA in Pigment Manufacturing Processes

- Increased pigment content in the filter cake and less drying capacity needed
- · Fine particle size does not reduce retention in filtration
- Fine particle size results in higher color strength in the final masterbatches or colorants



Control

with TEGOMER® DA 850



with TEGOMER[®] DA 640



Filter cake with high water content





Filter cake turned liquid with TEGOMER® to remove additional water – Less drying capacity needed



Filter cake with low water content



High retention of pigment without discoloration (fine pigment particles) in cycled water

TEGOMER® DA for filler production by wet milling

Wet milled CaCO_3 slurries used for paper coating with high gloss

- Left bottle:
- Middle bottle:

TEGOMER® DA 850 used, stable dispersion for transport which results in high gloss paper coating

• **Right bottle:** Dispersant used but still settlement and coarser particle





TEGOMER® DA for wet milled MDH

Using TEGOMER® DA 850 results in significant viscosity reduction enabling wet milling or a MDH filter cake with 55% solid content.





TEGOPREN® 6875/TEGOPREN® 6875-45 and TEGOPREN® 6879/TEGOPREN® 6879-50 for the post-treatment of titanium dioxide

During the production of TiO_2 our additives can be added either in the TiO_2 slurry (wet stage) or during milling (dry stage), illustrated in the processing picture right. It can be added during the regular production. Therefore, no extra investment is needed. TEGOPREN[®] an inert OMS based liquid, which allow easy handling.



TEGOPREN® grades allow the same hydrophobization as silicone oils but does not create disadvantages in the final application, like VOC or migration which results in fish eyes, sealing or printing issues or loss of mechanical properties. Furthermore, a higher bulk density and better storage properties on pallets can be achieved with OMS technology. On the right side is illustrated as a simple test to visualize the effect of the surface treatment: TEGOPREN® grades hydrophobize the oxidic surface so effectively that even the high density material as TiO₂ floats on water.



Uncoated TiO₂ hydrophilic



TEGOPREN° 6875 treated TiO_2 hydrophobic, swims on water

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TEGOPREN® 6875/TEGOPREN® 6875-45 and TEGOPREN® 6879/TEGOPREN® 6879-50 for the post treatment of organic pigments

Not only inorganic pigments but also organic pigments can be treated by TEGOPREN[®] grades and are turned from a hydrophilic character to a hydrophobic pigment. Furthermore, this pigment is more compatible to the polymer matrix, what is essential especially for masterbatch applications.



TEGOPREN[®] 6875/TEGOPREN[®] 6875-45 and TEGOPREN[®] 6879/TEGOPREN[®] 6879-50 for filler treatment

Most fillers are produced by wet or dry milling. In both cases our additives can be applied quite easily at the end of the milling stage, in the tumbler or filtration step. The treatment will give better storage behavior in the silo. The filler is more compact, less dusty and has a reduced tendency of bridging and baking, which allows homogenous and therefore faster feeding in the compounding step and results in fewer variations of filler content.



SOME EXAMPLES

Treatment of ATH or MDH for HFFR compounds

The use of treated fillers in the production of cable compounds shows outstanding advantages:

- Improved dispersion of fillers
- Better hydrophobic properties
- Smooth and supple cable surfaces
- No influence on printability
- Better flame-retardant properties in the UL 94V
 and Cone Calorimeter measurement
 (addeed UDD) and best selected are the sight of the si
- (reduced HRR: see heat release graph on the right side)
- Increased LOI values
- Significant char formation



Treatment of organic flame retardants, e.g. APP for polyolefin-based flame retardant compounds

Treating an APP with TEGOPREN® for using it as flame retardant in a PP-based compound results in a better flame retardant properties on a constant level of FR content. A heat treatment over 1h at 110°C can further improve the performance and V-0 can even be reached at lower levels of FR content while total burning time (TBT) is even reduced.

		UL94V 1.5mm			
additive	FR [%]	class	твт	Dripp	
(30,0	V-2	37,2	1/5	
reference	27,5	V-2	47,7	2/5	
1.0%	30,0	V-0	14,3	0/5	
TEGOPREN® 6879	27,5	V-2	31,1	2/5	
1.0% TEGOPREN® 6879 (1h @110°C)	27,5	V-0	10,2	0/5	

Treated fillers in the production of automotive compounds

TEGOPREN® 6875 treatment will optimize the processing, which will lead to an extended tool life and reduced energy consumption. In this example the MFI could be increased more than 50% and 15% electricity has been saved.

PP/Talc compound with 40% treated Talc



Effect of talc treatment in TPO application

- No reduction of stiffness
- Better effect on impact resistance (notched charpy)
- Important reduction of CLTE (Coefficient of Linear Thermal Expansion)
- Reduced scratch visibility (Erichsen on grained surfaces K09 and K31)
- Improved hydrophobicity
- · Better dispersion and distribution of the talc



Large Mixer

Industrial Scale

Method of surface treatment Mixing Equipment in Pilot Plant at Evonik Essen

Three Henschel Mixer with different volume for surface treatment trials exist in the Pilot plant. The Henschel mixer allow to mix fluffy pigments, fillers and flame retardants with small amounts of viscous OMS additives. The high shear force guarantees a proper coating of the complete surface in a dry stage operation.



FML 10 Medium Mixer Pilot Plant Scale FML 4 Small Mixer Lab Scale

Improved/Increased Bulk Density

Advantages due to surface treatment of pigments, fillers and flame retardants:

- Increased bulk density
- Less dusty appearance
- No bridging in the feeder
- More robust processing



Untreated TiO2

 $\label{eq:treated_tion_2} Treated \ TiO_2 \\ with \ TEGOPREN^\circ$

Reduced Lacing

Advantages due to surface treatment of pigments, fillers and flame retardants:

- Higher loading possible
- Better dispersion
- No specks
- No lacing
- Higher color strength/better hiding power



CaCO3 without additive Agglomerates appear



No Agglomerates No Lacing CaCO₃ with TEGOPREN[®] treatment

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Comparison of different technologies for the surface modification of pigments and fillers

	TEGOPREN° 6875 TEGOPREN° 6875-45	TEGOPREN [®] 6879 TEGOPREN [®] 6879-50	Silicone oil	Silanes	Stearates
Handling in production	+	+	+	0	0
Hydrophilization	+	+	+	+	o
EC/FDA	-/+	+/+	+/+	o / o	+/+
Influence on end application (migration, sealing, printing)	+	+	_	+	_
Loading [%]	0.2 – 2.0	0.2 – 2.0	0.4 – 2.0	0.4 – 1.0	0.2 – 1.5

PICTURES OF DIFFERENT FILLERS



Titanium dioxide

Calcium carbonate grinded



Aluminium silicate

Recommendation for the Surface treatment of Fillers, Pigments and FR

		EVA	РР	PA	РВТ	PC	Ероху	UPES	Silicone
			:	:					
TiO ₂	•••••		TP 6875	• TP 6879					
Talc	•••••	TP 6875 ···	TP 6875			TP 6875	·····		
CaCo ₃	•••••	TP 6879 ··	TP 6879				E-Si 2330 . XP 21002	TP 6879 M-Si 2650	
Al ₂ O ₃	•••••		·····	TP 6879			E-Si 2550 XP 21002		TP 6879
Clay		TP 5885 TP 6875	TP 5885 TP 6875	XP 22015					
ATH		TP 6875 TP 6879						TP 6875 M-Si 2650	M-Si 2650 TP 6879
MDH		TP 6875 TP 6879	TP 6875 TP 6879	TP 6875 TP 6879					
мс	•••••			E-Si 2330 TP 6875	TP 6875 TP 6879				
MPP	•••••			XP 22015 TP 6879					
АРР	•••••		TP 6875 TP 6879						

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