



Enhancing Titanium Dioxide

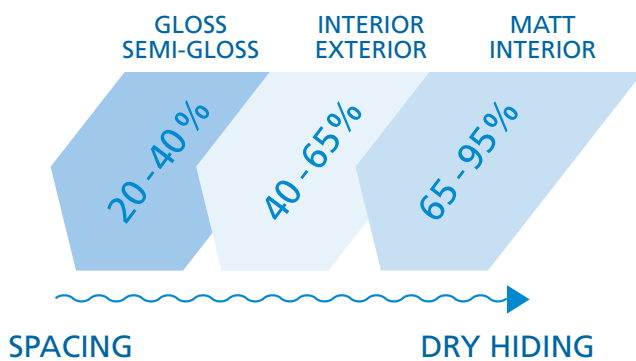
WITH CALCIUM CARBONATE



THINKING OF TOMORROW

Unique Portfolio of Titanium Dioxide Performance Enhancers

OPACIFYING CALCIUM CARBONATE FILLERS HELP TO DEVELOP THE FULL POTENTIAL AND PERFORMANCE OF YOUR TITANIUM DIOXIDE IN A WIDE RANGE OF WATER BASED AND SOLVENT BASED PAINT FORMULATIONS.



By dry hiding
By spacing

Dry Hiding & Opacity

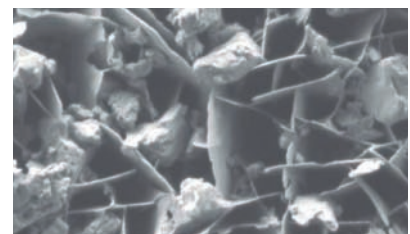
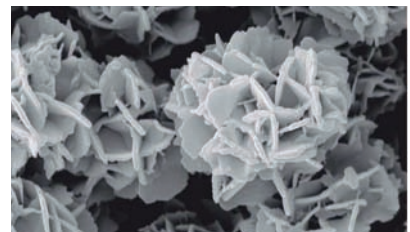
Dry hiding and opacity are determined by the result of a series of complex interactions. These properties are significantly influenced by the amount of titanium dioxide, extender type, size, and volume, pigment volume concentration, spreading rate, and porosity. Each of these factors have a direct impact on light absorption, scattering, and reflectance, which are also contributors to the hiding power.

Entrapped air in a paint film also contributes to dry hiding and opacity. This is possible in formulations that do not contain titanium dioxide, due to the interfaces between filler particles

and air providing sufficient difference of refractive indices; this effect is called dry hiding. This type of dry hiding is typically observed in paints with pigment volume concentration (PVC) above the critical pigment volume concentration (CPVC). These formulations typically result in poor wet hiding, since the air voids in the paint film are filled with water.

Omyabrite® 1300 modified calcium carbonate provides excellent dry hiding and opacity over a wide PVC range in matt emulsion paints due to its porous structure. Omyabrite® 1300 is a unique opacifying filler produced with patented Omya MCC technology based on natural ground calcium

carbonate. Omyabrite® 1300 provides an opportunity for significant reduction of the TiO₂ content in a broad PVC range of emulsion paints without compromising dry hiding and opacity.



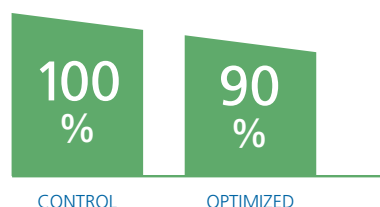
Omyabrite® 1300

The following starting paint formulation is an example of the potential for TiO₂ reduction. High quality dead matt interior emulsion paint, pvc = 65%; Significant reduction of TiO₂, and replacement of PCC provides the ability to lower total formula raw material cost, and also results in a lower carbon foot print.

RAW MATERIAL	CONTROL		OPTIMIZED	
	PARTS BY WEIGHT			
Water + Additives		27	27	
Titanium dioxide		19	15	
Omyacarb® 1		7	14	
Omyacarb® 10		13	10	
PCC		10	-	
Modified Alumino-Silicate		3	3	
Omyabrite® 1300		-	10	
Styrene acrylic dispersion 50%		21	21	
TOTAL		100	100	
PVC	%	65	65	
Density solid	g/ml	2.33	2.29	
Density liquid	g/ml	1.58	1.57	
Volume solids per litre	ml/l	420.6	425.2	
Solids content by weight	%	63.1	63.1	

		CONTROL		OPTIMIZED	
LIGHTNESS/OPACITY/SHEEN (GAP 150 µm)					
Ry at C2°	DIN 53140	%	91.7	91.6	
Ry over black at C2°	DIN 53140	%	89.4	89.1	
Yellowness Index	DIN 6167		3	3.2	
Contrast ratio	ISO 2814	%	97.5	97.3	
Gloss 85°	ISO 2813		1	1.1	
Contrast at 7.5 m²/l acc. EN 13300					
Contrast ratio at 7.5 m ² /l	EN 13300	%	98.7	98.5	
Contrast ratio class at 7.5 m ² /l	EN 13300	Class	2	2	
Mechanical properties acc. ISO 11998					
Loss of thickness, 200 cycles	ISO 11998	µm	4.5	4.6	
Wet scrub resistance Class	ISO 11998	Class	1	1	

Reduction of CO₂



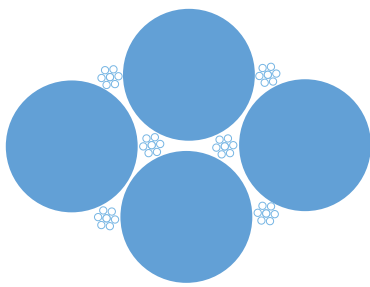
Natural Products
for Sustainability

Spacing of Titanium Dioxide

The extraordinary hiding power of titanium dioxide is due to its high refractive index; 2.7 for Rutile, and 2.55 for Anatase TiO_2 . In addition to refractive index, particle size is an important factor for the performance of TiO_2 . Ultrafine and sub-micron fillers based on natural ground calcium carbonate are able to prevent

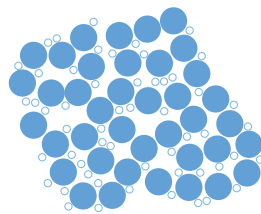
re-agglomeration, or crowding of TiO_2 particles in the paint film by spacing the TiO_2 particles.

Titanium dioxide spacing is most efficient in paint systems formulated below critical pigment concentration, and containing relatively high TiO_2 contents.



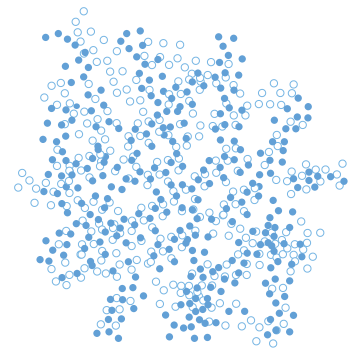
0.3µm TiO_2 -particle ○

5µm filler particle



0.3µm TiO_2 -particle ○

0.9µm filler particle ●



0.3µm TiO_2 -particle ○

< 0.5µm filler particle ●

Smaller particle size

Improved spacing effect

Omyacarb® Extra and Omyacoat®, are well known trade names of our range of ultrafine calcium carbonates. These products are the benchmark for ground calcium carbonate spacing fillers.

Each product is tailor made for a specific application;

Omyacarb Extra® provides excellent properties in both, emulsion based decorative paints and solvent based industrial coatings.

Omyacoat® 420 is a superior choice for water based and solvent based systems as a versatile opacifier with an outstanding price performance ratio.

Omyacoat® 420

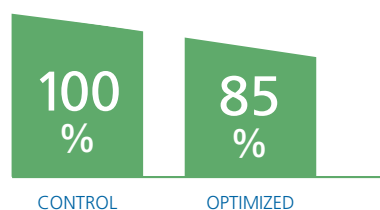
The use of Omyacoat® 420 allows a reduction of the titanium dioxide content, because of the opacifying effect provided by its ultra fine particles. In formulations above the critical pigment volume concentration up to 25% of the titanium dioxide can be reduced without compromising the dry opacity.

In general Omyacoat® 420 is suitable for matt / semi-matt paints. In formulation with a very low sheen of 2% (example hereafter) it is recommend combining Omyacoat® 420 with a coarser product to keep the low sheen level. The given example guides on the product selection. The reformulation was done at similar pigment volume concentration = 73% (pvc > cpvc). The paints were applied onto contrast cards by using a draw-down bar having 150 µm gap. After drying the optical properties have been measured.

	CONTROL		OPTIMIZED	
LIGHTNESS/OPACITY/SHEEN (GAP 150µm)				
Ry at C2°	DIN 53140	%	91.6	91.3
Ry over black at C2°	DIN 53140	%	88.8	88.7
Yellowness Index	DIN 6167		2.4	2.6
Contrast ratio	ISO 2814	%	96.9	97.2
Gloss 85°	ISO 2813		2.3	2.9
Contrast at 7.5 m²/l acc. EN 13300				
Contrast ratio at 7.5 m²/l	EN 13300	%	98.2	98.4
Contrast ratio class at 7.5 m²/l	EN 13300	Class	2	2
Mechanical properties acc. ISO 11998				
Loss of thickness, 200 cycles	ISO 11998	µm	6	7
Wet scrub resistance Class.	ISO 11998	Class	2	2

RAW MATERIAL	CONTROL		OPTIMIZED	
	PARTS BY WEIGHT			
Water + Additives		21.3	21.3	
Titanium dioxide		15	11	
Omyacarb® 5		39	-	
Omyacarb® 10		-	28	
Omyacoat® 420		-	15	
Talc		7.5	7.5	
Vinylacetate, VeoVa, acrylic acid ester		17.2	17.2	
TOTAL		100	100	
PVC	%	73	74	
Density solid	g/ml	2.43	2.39	
Density liquid	g/ml	1.74	1.72	
Volume solids per litre	ml/l	495.8	500.2	
Solids content by weight	%	71.4	71.4	

Reduction of CO₂



Omyacoat® 420 improves the efficiency and enables partial substitution of titanium dioxide. Recommended for formulation above critical pigment volume concentration with low emission. Very good dispersibility in water based matt to semi-matt paint systems.

Omyacarb[®] Extra

RAW MATERIAL	PARTS BY WEIGHT			
	START	A	B	
Acrylic resin, OH-functional	25	25	25	
Butyl acetate	5	5	5	
Xylene	1	1	1	
Methoxy propyl acetate	2	2	2	
Wetting agent	0.3	0.3	0.3	
Defoamer, silicone based	0.5	0.5	0.5	
Titanium dioxide	30	25	20	
Omyacarb [®] Extra	0	5	10	
Acrylic resin, OH-functional	35	35	35	
Levelling agent, silicone based	0.2	0.2	0.2	
Xylene	1	1	1	
TOTAL	100	100	100	
Polyisocyanate, aliphatic	25	25	25	
TOTAL	125	125	125	
Pigment volume concentration	%	13.5	14.4	15.3
Density	g/ml	1.23	1.22	1.21
Solids content	%	68.1	68.1	68.1
VOC content	g/l	392	389	386

Omyacarb[®] Extra is designed to enhance the performance of TiO₂ in a wide range of gloss levels. Excellent dispersibility in both water and solvent based systems characterize its properties.

The performance of Omyacarb[®] Extra is assessed in a high gloss 2c polyurethane coating. The titanium dioxide content is reduced from 30% to 20% in two incremental steps and replaced by Omyacarb[®] Extra. The examination of gloss, haze and contrast ratio was done after the coatings were cross linked with hardener (according to table 1) and applied. After drying at ambient temperature the optical properties were measured at a dry film thickness of 60 µm. The data in figure 1 shows that up to 10% Omyacarb[®] Extra can be used without a significant influence on gloss or haze.

Omyacarb[®] Extra offers the optimization of the titanium dioxide content in a 2c polyurethane coating. It is possible to maintain the gloss and haze while reducing pigmentation costs.

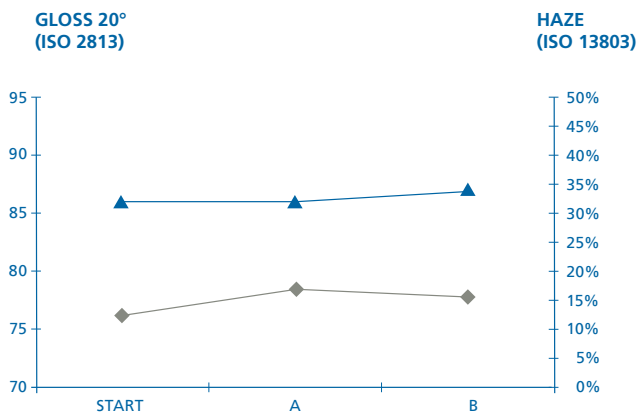


Fig. 1

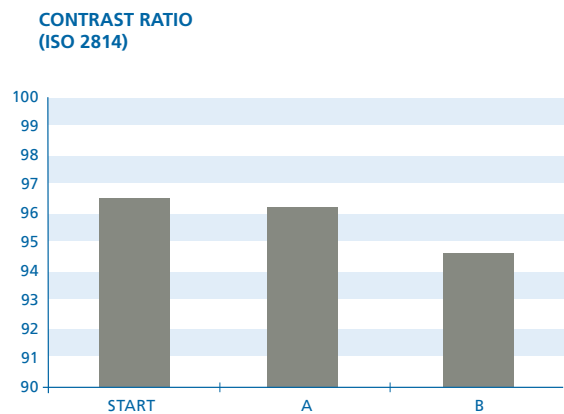


Fig. 2

Product Overview

Water Based

PRODUCT	PRODUCED IN	GLOSS	DECORATIVE		INDUSTRIAL
			SEMI-GLOSS	MATT	
Omyabrite® 1300	Various	-	-	++	+
Omyacoat® 420	Various	-	+	++	+
Omyacoat® 852 - FO	Förby, Finland	-	+	++	+
Omyacoat® 850 - OG	Orgon, France	-	+	++	-
Omyacarb® Extra	Various	++	++	+	+
Calcigloss®	Various	++	++	+	+
Omyacarb® UF	America	+	++	+	+
Omyaflow® 7	Various	+	++	+	+

Solvent Based

PRODUCT	PRODUCED IN	DECORATIVE	INDUSTRIAL
		Omyacoat® 420	Various
Omyacoat® 852 - FO	Förby, Finland	++	++
Omyacoat® 850 - OG	Orgon, France	++	++
Omyacarb® Extra	Various	++	++
Calcigloss®	Various	++	++
Omyacarb® UF	America	++	++

++ HIGHLY RECOMMENDED

+ RECOMMENDED



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