

SAVING TiO₂ IN SEMI-GLOSS EMULSION PAINTS WITH SUPREME™

Semi-gloss emulsion paints require relatively high levels of TiO₂ pigment to obtain adequate opacity. Most extenders contribute little to the opacity of these paints because they are formulated well below critical pigment volume concentration (CPVC). **Supreme** ultrafine kaolin is an exception. **Supreme** improves the "spacing" of TiO₂ particles to optimise their light scattering efficiency and enables a significant saving to be made in the amount of TiO₂ in the paint.

This report demonstrates that replacing an ultrafine calcium carbonate (CaCO₃) extender by Supreme allows a saving of over 10% in the TiO₂ content of the paint, without loss in opacity or other properties.

The reduction in TiO₂ level and lower specific gravity result in a considerable cost saving, of about 0.04 Euro/litre of paint or about 8% of the pigmentation cost.

INTRODUCTION

Semi-gloss emulsion paints are formulated well below the CPVC. Under these conditions there is no "dry hiding effect" from the pigment and extenders, and relatively high levels of TiO₂ pigment

are required to obtain adequate opacity in these paints. Ultrafine kaolins, such as Supreme, can be used as extenders in semi-gloss paints to improve the "spacing" of TiO₂ particles, thereby increasing their light scattering efficiency. The spacing

effect is due to the fine particle size and platy (lamellar) particle shape of the kaolin. Ultrafine calcium carbonates are also used as extenders in semi-gloss paints but, due to their nodular particle shape, they are much less effective as spacers for TiO₂.

In this report, Supreme ultrafine kaolin from IMERYS is compared against an ultrafine CaCO₃ extender. Its superior opacifying and its ability to save TiO₂ are demonstrated.

TABLE 1: FORMULATIONS FOR SEMI-GLOSS EMULSION PAINTS

Paint	1	2	3	4	5
Kronos 2063 TiO ₂	17.0	17.0	16.0	15.0	14.0
Ultrafine CaCO ₃	10.0	-	-	-	-
Supreme	-	10.0	10.0	10.0	10.0
Dispex G40 dispersant	0.4	0.4	0.4	0.4	0.4
Potassium hydroxide	0.3	0.3	0.3	0.3	0.3
Foamaster NDW defoamer	0.2	0.2	0.2	0.20	0.2
Acticide BX(N) biocide	0.1	0.1	0.1	0.1	0.1
Vinamul 3697 latex	40.0	40.0	40.0	40.0	40.0
Acrysol RM5 thickener	4.0	4.0	4.0	4.0	4.0
Water	28.0	28.0	29.0	30.0	31.0
	100.0	100.0	100.0	100.0	100.0
PVC %	28.9	29.3	28.7	28.0	27.3
Specific gravity, g/cm ³	1.282	1.280	1.267	1.255	1.244
Solids, weight %	50.7	50.7	49.7	48.7	47.7
Solids, volume %	34.8	34.9	34.3	33.7	33.0

EXPERIMENTAL

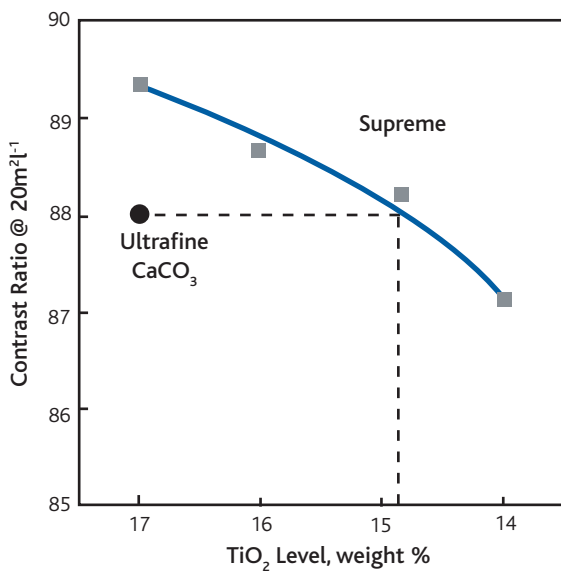
Formulation details for all these paints are given in Table 1.

The semi-gloss emulsion paint formulation used in this work was solvent-free, with Vinamul 3697 vinylacetate-ethylene-acrylate terpolymer as the latex binder. The formulation contained a starting level of 17 wt% of TiO₂ and 10 wt% extender. Supreme ultrafine china clay (d₅₀ 0.4µm) and an ultrafine calcium carbonate (d₅₀ 0.8µm) were compared as the extenders in this formulation (see Paints 1 and 2 in Table 1).

A series of additional paints was prepared with TiO₂ contents reduced in stages from the original 17 wt% to 14 wt% (Paints 3, 4 and 5 in Table 1). These paints all contained 10 wt% Supreme as the extender. As the TiO₂ level was reduced it was replaced by an equal weight of water.

Reducing the level of TiO₂ in the formulations gives a significant reduction in the specific gravity of the paint. The effect of these TiO₂ reductions on the opacity of the paint is shown in Figure 1.

FIGURE 1: OPACITY OF SEMI-GLOSS



As shown in Figure 1, Supreme gives significantly higher opacity than the ultrafine CaCO₃. In the paints containing 17 wt% TiO₂ the opacity was about 1.5 units higher with Supreme. Reducing the TiO₂ level with Supreme as the extender caused a loss in opacity, but a significant reduction in TiO₂ level was possible before the opacity dropped below that of the paint with the ultrafine CaCO₃. For the same opacity, only 15% of TiO₂ was required in the Supreme paint, compared with 17% TiO₂ in the paint containing the Ultrafine CaCO₃. The other properties of the paints with equal opacity are given in Table 2.

The other dry film properties with Supreme and the ultrafine CaCO₃ are identical.

The only properties that are different are specific gravity and cost. The cost of paint 4 with Supreme is 0.04 Euro/litre less than paint 1.

TABLE 2: PROPERTIES OF SEMI-GLOSS PAINTS HAVING EQUAL OPACITY

Paint:	1	4
TiO ₂ level, wt%	17.0	15.0
Extender type	Ultrafine CaCO ₃	Supreme
Contrast Ratio at 20 m ² /l, %	88.0	88.1
Light scattering coeff. S, cm ² /g	1030	1050
Colour L*	95.7	95.6
a*	-0.4	-0.4
b*	+2.5	+2.6
Gilsonite stain resistance, %	98	99
DIN Scrub resistance, cycles	>20000	>20000
% Gloss after 7 days at		
20°	9	8
60°	44	45
85°	86	87
Increase in 85° gloss on burnishing, %	6	5
Specific gravity, g/cm ³	1.282	1.244
*Pigmentation cost, Euro/litre of paint	0.46	0.42

CONCLUSIONS

- Using Supreme ultrafine kaolin instead of an ultrafine calcium carbonate as the extender in semi-gloss emulsion paints can result in improved opacity. This is due to the ultrafine size and platy shape of the clay particles, giving better spacing of TiO₂ particles.
- To take advantage of the improved opacity with Supreme, the TiO₂ content of the semi-gloss paint can be reduced by nearly 12%.
- This reduction in TiO₂ level and lower specific gravity can give significant cost savings of about 0.04 Euro/litre of paint, which is an 8% saving in pigmentation cost.

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