



MINEX[®]

Functional Filler

Outdoor weathering studies of standard and low VOC acrylic paints formulated with functional fillers

Abstract

Test panels formulated with low oil absorption fillers in a pigment volume concentration ladder study (50 to 70% Pigment Volume Concentration (PVC)) in acrylic emulsion were evaluated after four years of South Florida exposure. In a subsequent study, test panels made with low VOC flat and eggshell exterior paints containing different functional fillers were evaluated after thirty and twenty-four months of South Florida exposure, respectively. MINEX[®] functional fillers provided the best overall performance in each of the three evaluations, with equal or better tint retention and chalk resistance under all test conditions.

Objective

Determine the effect of functional filler type on the outdoor weathering performance of standard and low VOC acrylic paint systems.

For more information about MINEX functional fillers,
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Materials and methods

In the PVC ladder acrylic emulsion study, a Rohm and Haas formulation based on Rhoplex Multilobe 200 latex was utilized. Fillers evaluated were MINEX 4 and 3 (nepheline syenite), Min-U-Sil 30 (silica), Hubercarb G-8 (calcium carbonate), SafSil CT-200 and CT-450 (volcanic ash), Vansil W-30 (wollastonite), and Nytal 3300 (talc). Volume solids were held constant and PVC was increased by reducing resin and compensating with water to balance. Test panels were painted with blue test paints formulated with the various fillers at 50, 55, 60, 65, and 70% PVC. Test paints in the low VOC flat resin study were all formulated below 50 g/L VOC at 50% PVC (i.e. 15.72 % PVCTipure 706, 2.47 % PVC Eagle Zinc, 8.04 % PVC Ice Cap K, 0.62 % PVC Attagel 50, and 23.15 % PVC test filler). Fillers evaluated were MINEX 4 and 3, Min-U-Sil 30 and 40, SafSil CT-200, Nytal 3300, UNISPAR® 40 (feldspar), IMSIL® 1240 (microcrystalline silica), Vansil W-30, and Nyad 400 (wollastonite). Test paints in the low VOC eggshell study were all formulated below 150 g/L VOC at 30% PVC (i.e. 18.0 % PVC Tipure R-746, and 12.0 % PVC test filler). Ultrafine fillers used in this evaluation were MINEX 10 and 12, Polygloss 90 (kaolin), IMSIL A-10, Min-U-Sil 10, Nytal 7700, Nyad 1250, Atomite (calcium carbonate), and Minspar 10 (feldspar).

Coatings were painted on freshly sanded beveled primed cedar panels. Unprimed panels were also evaluated in the PVC ladder study. The panels were cut to 3-foot length by 6-inch wide sections and were knot free. Where a primer was utilized, a 6-mil coat of commercial primer was applied to both sides of the panel and allowed to dry for 24-hours. All panels were done in duplicate. Test formulations were painted on the panels and were allowed to dry for one week before shipment to Florida. In the PVC ladder study, test paints were applied in two coats of about 6 mils each and allowed to dry for 24-hours between each coat. Panels were mounted in Florida at 45° southern exposure, and were evaluated for color change (tint retention) and chalking after various exposure intervals. Chalking was determined with ASTM method D4214. This test involves placing a clear piece of polyethylene tape on the panel with subsequent removal and comparison to a standard. Tint retention was evaluated on a visual basis and given a rating from 1 (worst) to 10 (best).

Results and conclusions

Part I: Acrylic emulsion PVC ladder study from 50 to 70% VOC

Primed systems gave much better tint retention and chalk resistance than the unprimed systems. In the primed test series, only MINEX 3, MINEX 4, Min-U-Sil 30 and Nytal 3300 maintained adequate performance up to 55% PVC for both tint retention and chalking. Hubercarb G-8, Vansil W-30, Safsil CT-450 and CT-200 were less consistent and would need to be formulated well below 55% PVC. Across the entire PVC range, MINEX 3 and Nytal 3300 gave the highest ratings for tint and chalk on primed panels.

In the unprimed tests, only MINEX 3 was able to maintain adequate performance at and above 55% PVC for both tint retention and chalk retention. Nytal 3300 performance dropped off considerably when self-primed. Results indicate that the MINEX fillers are the best choice to maximize solids and PVC loading for lower cost without sacrificing quality. MINEX 3 is especially effective in primed or self-primed higher PVC formulas.

See Figures 1 thru 4.

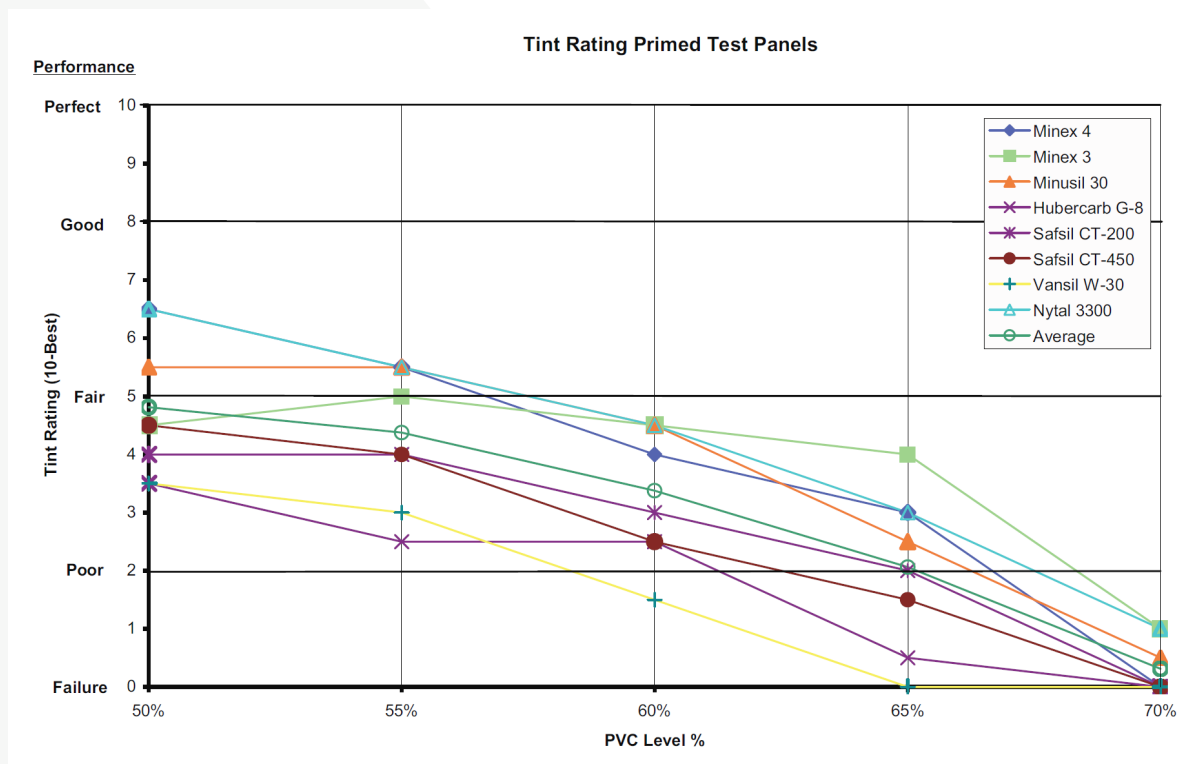


Figure 1. Tint retention vs. PVC level of primed test panels, 48 months exposure

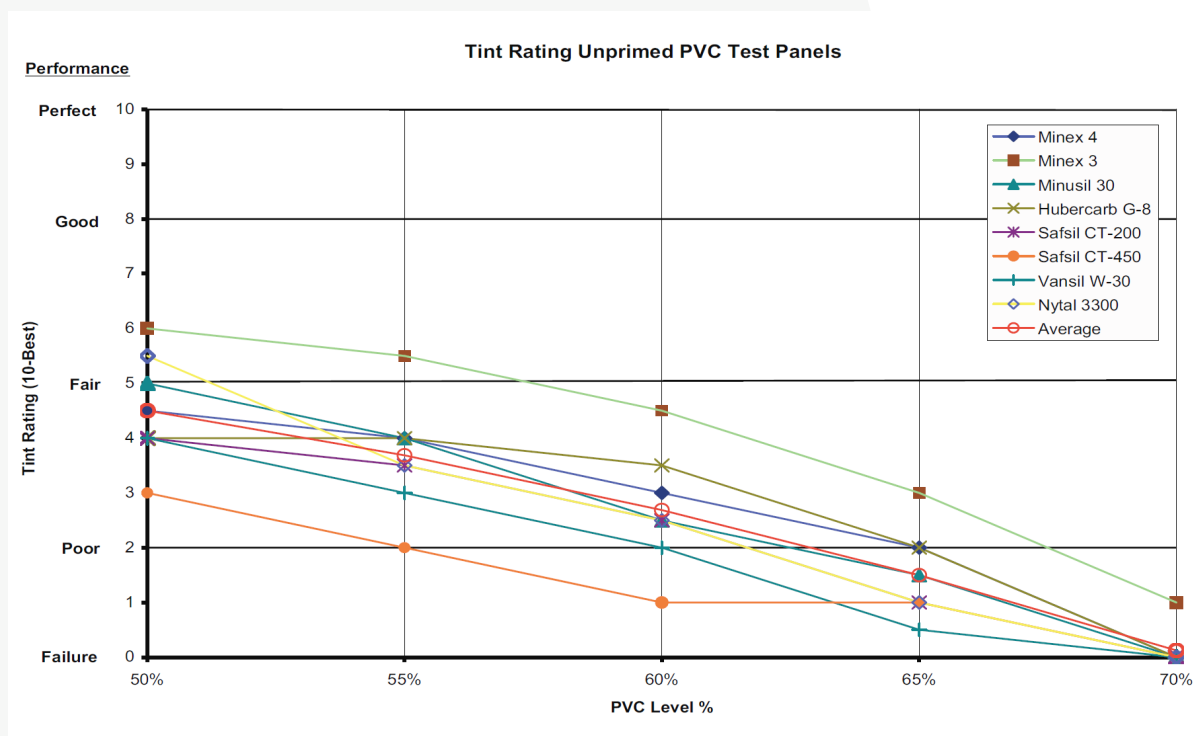


Figure 2. Tint retention vs. PVC level of unprimed test panels, 48 months exposure

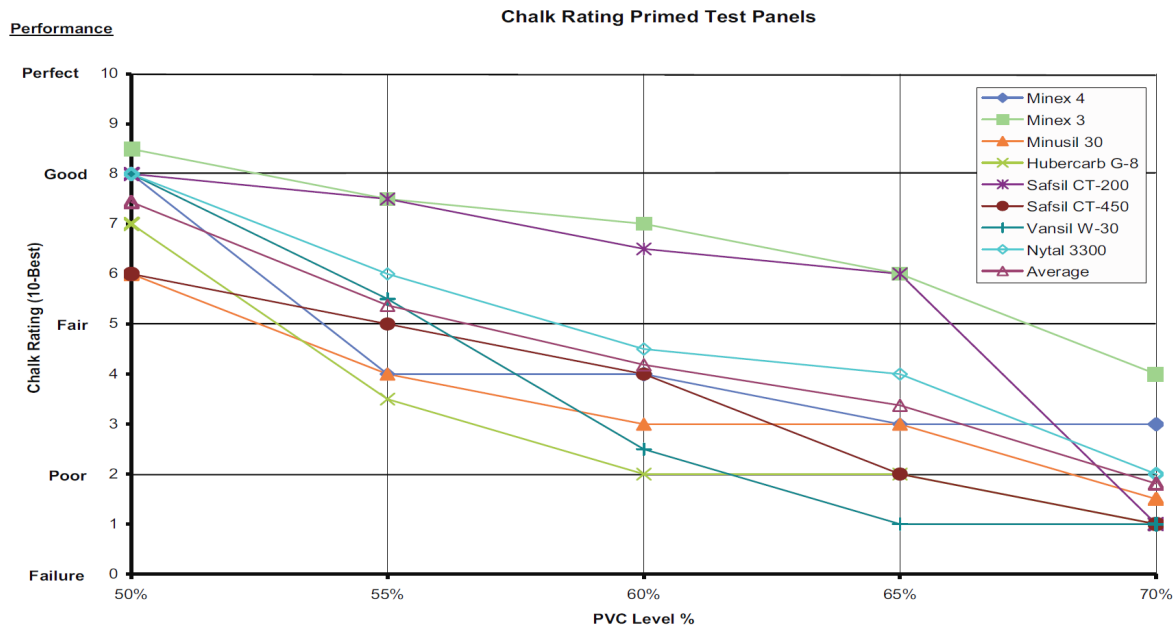


Figure 3. Chalk rating vs. PVC level of primed test panels, 48 months exposure

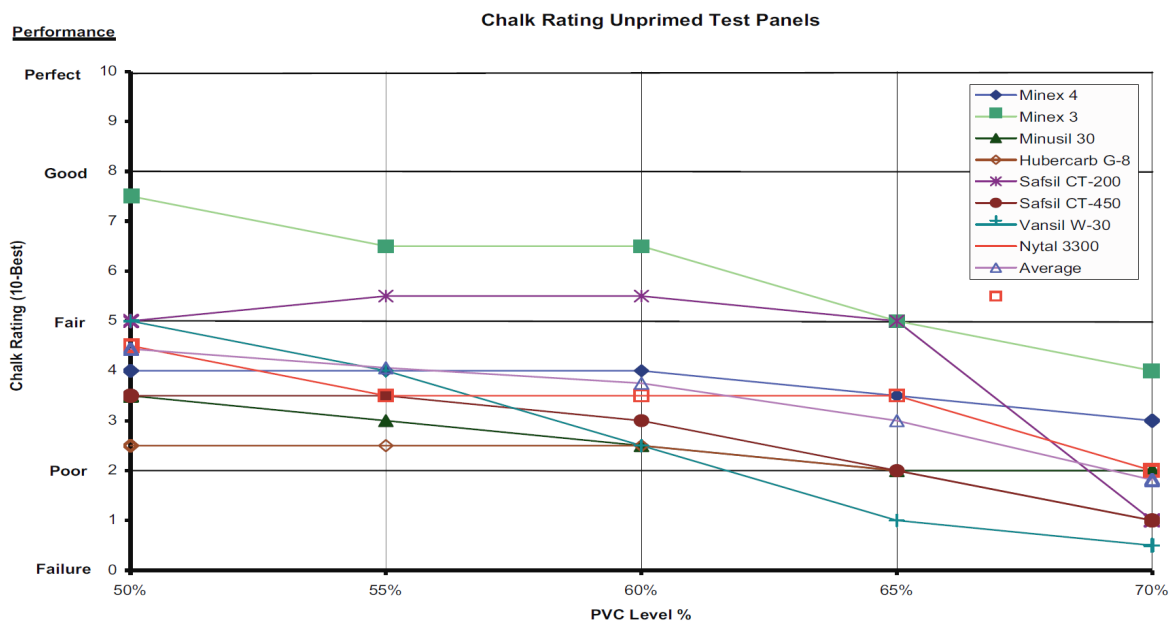


Figure 4. Chalk rating vs. PVC level of unprimed test panels, 48 months exposure

Part II: Low - VOC architectural flat study at 50% PVC

MINEX 3, MINEX 4 and Nyal 3300 all rated higher than other fillers tested for tint retention and chalk resistance. MINEX 3 showed superior tint retention and chalk resistance. Nyal 3300 and MINEX 4 equaled MINEX 3 in chalk resistance, but were lower in color retention. See Figures 5 and 6.

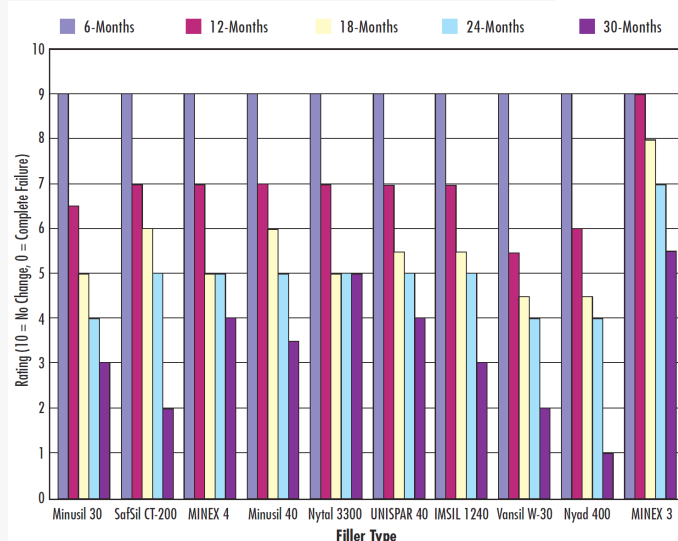


Figure 5. Tint Retention of Low VOC Flat

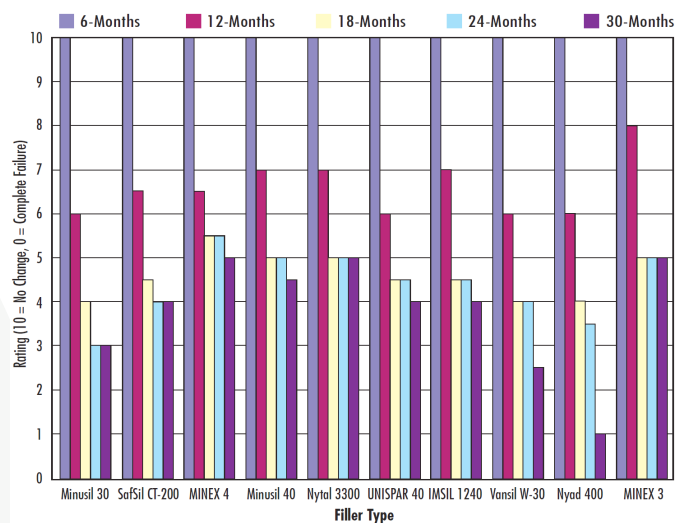


Figure 6. Chalk Rating of Low VOC Flat Formulations, 30 Months Exposure

Part III: Low - VOC architectural eggshell study at 30% PVC

MINEX 10 and MINEX 12, IMSIL A-10, Min-U-Sil 10, and Polyglass 90 all rated higher for chalk resistance than Nyal 7700 (talc), Atomite (calcium carbonate), Nyad 1250 and Minspar 10. MINEX 10 and MINEX 12 rated slightly higher for tint retention than all other ultrafine extenders. See Figure 7.

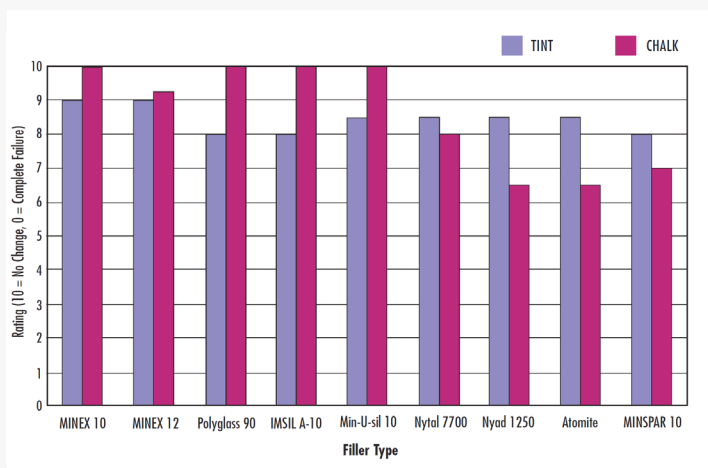


Figure 7. Tint and Chalk Rating of Low VOC Eggshell Formulations, 24 Months Exposure

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