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Eastman Tetrashield™ IC3020 protective resin system

Prototype formulas for superior gloss retention

Eastman Tetrashield™ IC3020 protective resin system is a highly durable polyester designed to enhance coating performance and increase the application window for protective and maintenance coatings in industrial plants, equipment, and infrastructure. Tetrashield IC3020 can be used for both 2K topcoats and direct-to-metal (DTM) monolayer coating formulations. This technical tip covers a new prototype formula designed for high initial gloss with both limited short-term and long-term gloss loss.

Formulations

Formulations (see Table 1) maintained TiO_2 levels, and the pigment extender was reduced based on pigment volume concentration (PVC) in comparison to the original starting point formula. The standard workhorse formula uses Microdol™ Extra calcium magnesium carbonate as the pigment extender, while Cimbar XF barium sulfate was introduced in one of the new high-gloss formulas as the pigment extender. This pigment extender modification, in combination with the lower pigment-to-binder (P/B) ratio, gives exceptional gloss retention and demonstrates the capability of IC3020 formulations.

Formulations were prepared by grinding a mill base with a Dispermat high-speed mixer. The mill base was then let down by adding more resin, surface additives, and solvent. Cross-linker was added to the A component, starting the curing reaction. The formulations were sprayed in a humidity- and temperature-controlled environment (75°F, ~50% RH) at 35 seconds, Ford cup No. 4 viscosity using a conventional spray gun.

Table 1. IC3020 starting point formulations

| Compound | Wt% | | | Description | Supplier |
|----------------------------|--------------------|--------------------------------|----------------------------------|------------------------------|----------------|
| | Option 1: Original | Option 2: Reduced PVC (Cimbar) | Option 3: Reduced PVC (Microdol) | | |
| Mill base—Part A | | | | | |
| Tetrashield IC3020 | 11.83 | 8.35 | 8.35 | Polyester resin | Eastman |
| Zoldine® MS Plus | 0.71 | 0.71 | 0.71 | Moisture scavenger | Angus |
| DISPERBYK-164 | 0.55 | 0.55 | 0.55 | Wetting and dispersing agent | BYK |
| BYK-A 501 | 0.53 | 0.53 | 0.53 | Air release additive | BYK |
| Crayvallac® Ultra | 0.75 | 0.75 | 0.75 | Rheology modifier | Arkema |
| Ti-Pure™ R960 | 13.69 | 13.69 | 13.69 | Pigment | Chemours |
| Microcalc IT Extra | 3.53 | 1.77 | 1.77 | Pigment extender | Mondo Minerals |
| Vulcan® XC72R | 0.18 | 0.18 | 0.18 | Carbon black pigment | Cabot |
| Microdol™ Extra | 15.96 | 0.00 | 7.98 | Pigment extender | Omya |
| Cimbar XF | 0.00 | 12.32 | 0.00 | Pigment extender | Cimbar |
| MAK | 7.09 | 7.09 | 7.09 | Solvent | Eastman |
| Letdown—Part A | | | | | |
| Tetrashield IC3020 | 16.89 | 24.85 | 28.43 | Polyester resin | Eastman |
| BYK-306 | 0.05 | 0.05 | 0.05 | Surface additive | BYK |
| BYK-392 | 0.73 | 0.73 | 0.73 | Antipopping additive | BYK |
| Tinuvin® 292 | 0.37 | 0.37 | 0.37 | HALS | BASF |
| Tinuvin® 400 | 0.45 | 0.45 | 0.45 | UV absorber | BASF |
| 1% DBTDL in A100 | 1.90 | 2.16 | 2.38 | Catalyst solution | Various |
| Cross-linker—Part B | | | | | |
| Desmodur® N 3390 BA/SN | 15.39 | 17.49 | 19.18 | Cross-linker | Covestro |
| Thinner—Part B | | | | | |
| MAK | 9.40 | 7.96 | 6.81 | Solvent | Eastman |
| Total | 100.00 | 100.00 | 100.00 | | |

Table 2. IC3020 formula parameters

| Parameter | Value | | |
|------------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 |
| NCO:OH | 1.10 | 1.10 | 1.10 |
| Wt% solids | 72.00 | 72.00 | 72.00 |
| PVC | 0.24 | 0.16 | 0.15 |
| P/B | 0.89 | 0.66 | 0.51 |

Data

Initial gloss was recorded at 20° and 60° using a BYK Micro-Tri-Gloss Meter. Formulations underwent ASTM D7869 (xenon), UVA-340, and UVB-313 accelerated weathering exposure. Results are summarized in Table 3 and Figures 1–3.

Table 3. Initial gloss of prototype formulas

| Initial gloss | Option 1 | Option 2 | Option 3 |
|---------------|----------|----------|----------|
| 20° | 51.3 | 78.5 | 78.5 |
| 60° | 83.8 | 89.0 | 89.1 |

Figure 1. Xenon 60° gloss retention (ASTM D7869)

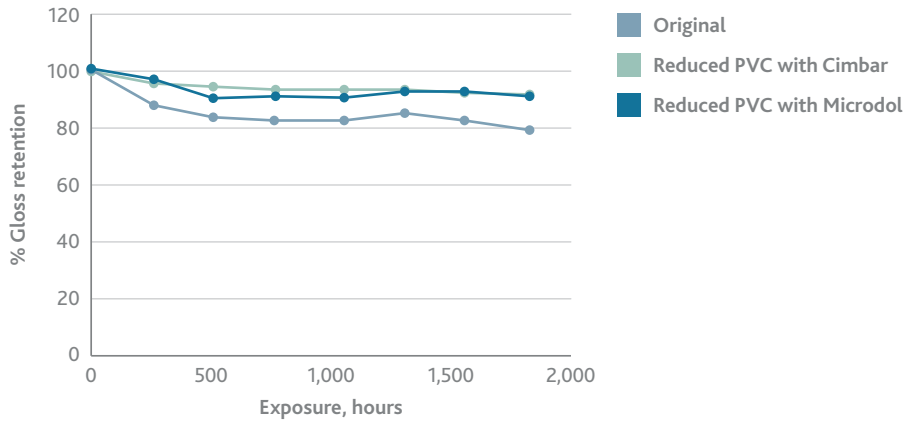


Figure 2. QUV 60° Gloss retention (UVA-340)

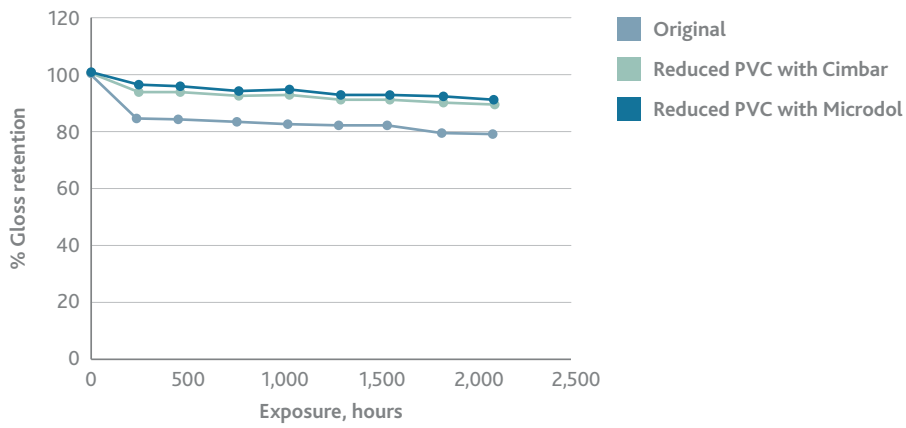
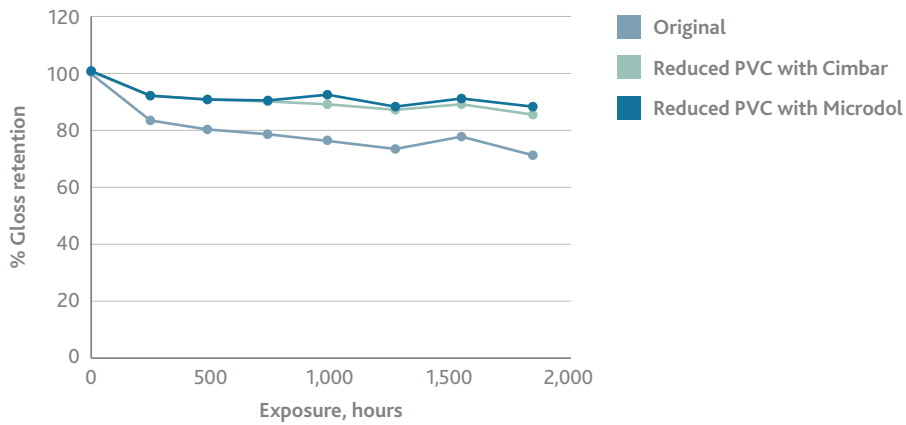


Figure 3. QUV 60° gloss retention (UVB-313)



Conclusion

Modifications were made to the Tetrashield IC3020 starting point formula used in industrial applications that included reduced PVC levels using Microdol Extra and Cimbar XF. After conducting accelerated weathering testing on the formulations, both initial gloss and gloss retention over time were improved over the existing formula. Modifications made to the existing formula resulted in similar accelerated weathering performance between the two different pigment extenders at reduced PVC levels, allowing the coating additional durability over an extended time period.



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