

ZEOCROS E110 TiO₂ EXTENSION FOR POWDER COATINGS



ZEOCROS E110

TiO₂ EXTENSION FOR POWDER COATINGS

Zeocros E110 is a novel synthetic aluminosilicate specifically designed for use as a TiO₂ extender for powder coatings. Cost savings can be achieved as Zeocros E110 has been shown to extend TiO₂ in powder formulations while retaining opacity, colour, stability, mechanical and aesthetic qualities of the original coating.

BENEFITS OF ZEOCROS E110:

Cost effectiveness:

Zeocros E110 can reduce the overall manufacturing costs of powder coatings.

Extension:

Zeocros E110 can be used to replace up to 25% TiO₂ in white and coloured formulations.

UV stability:

Zeocros E110 is not observed to affect UV stability in formulations tested.

Chemical stability:

Zeocros E110 is an inorganic aluminosilicate.

Overbake:

Zeocros E110 has been shown to reduce the negative discolouring effects of overbake in the formulations tested.

Colour balance:

Zeocros E110 allows further cost savings in coloured formulations through the use of less pigment.

Zeocros E110 is a synthetic aluminosilicate powder designed as a TiO₂ extender for powder coatings. Fine control of particle size, size distribution, purity and moisture give a product that has been shown to replace up to 25% of TiO₂ on a weight for weight basis. This performance is due to effective TiO₂ spacing by Zeocros E110 particles that have angular shape and a refractive index that is similar to the polymers used in powder formulations.

Zeocros E110 has proven effective in epoxy, hybrid and polyurethane systems, for both white and coloured formulations. The high extending power allows it to be used even in thin coatings, as often required by the OEM market, for example.

Zeocros E110 is a material of high purity with excellent whiteness, similar to TiO₂. Tests have shown that Zeocros E110 does not affect UV stability when compared with TiO₂ alone. Moreover, high temperature studies show that the use of Zeocros E110 can give better overbake performance than TiO₂ alone, reducing discolouration and gloss loss.

In coloured systems, the use of Zeocros E110 has been shown to increase tint strength which may permit further cost savings with minimal reformulation by making it possible to use less coloured pigments to achieve the same colour balance of the original formulation.

The oil adsorption of Zeocros E110 is approximately 40. While slight rheological modification may be observed, the material has been observed to reduce manufacturing time through reduction of the blending/extrusion processing time. The specific gravity of Zeocros E110 is 2.1g/mL and the Mohs hardness is 2 to 3.

Typical Zeocros E110 analysis

| | |
|-----------------------------------|-----------|
| Average particle size, microns | 1.5 - 2.4 |
| Loss on drying (800°C), % | <12 |
| Whiteness (Harrison) | Min 97 |
| +45 mm wet sieve, % | Max 0.5 |
| Bulk Density (Kg/m ³) | 400 - 600 |

TECHNICAL DATA – HYBRID (EPOXY-POLYESTER) SYSTEM

Hybrid formulations represent the largest sector for the powder coatings market where performance characteristics such as cost effectiveness, coating power, colour strength and mechanical durability are generally more important than UV stability and weathering resistance. The data in table 1 shows how effective Zeocros E110 can be in extending the hybrid system. In particular, Zeocros E110 is uniquely effective in extending thin coatings that are often required for important applications such as OEM.

Table 1. Hybrid extension performance

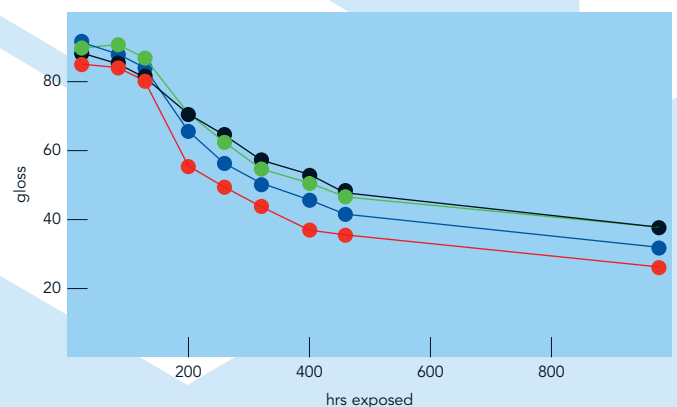
| | | Standard | 10% (w/w) Extension | 25% (w/w) Extension | 50% (w/w) Extension |
|------------------------|--------------------------|----------|---------------------|---------------------|---------------------|
| Formulation (% w/w) | Vantico Resin 6064 | 32.5 | 32.5 | 32.5 | 32.5 |
| | Cray Valley Resin 6877 | 32.5 | 32.5 | 32.5 | 32.5 |
| | Flow aid PV88 | 0.8 | 0.8 | 0.8 | 0.8 |
| | Benzoin | 0.4 | 0.4 | 0.4 | 0.4 |
| | Barytes AW10 | 3.8 | 3.8 | 3.8 | 3.8 |
| | Kronos 2310 | 30 | 27 | 22.5 | 15 |
| | Zeocros E110 | 0 | 3 | 7.5 | 15 |
| Gloss | Stoving at 10mins @180°C | 93 | 92 | 93 | 91 |
| Colour | ∂L* | (95.83) | -0.27 | -0.88 | -1.67 |
| | ∂a* | (-2.25) | 0.05 | 0.06 | -0.01 |
| | ∂b* | (1.57) | -0.2 | -0.6 | -0.8 |
| | ∂E | - | 0.34 | 0.97 | 1.85 |
| Contrast Ratio | 50 microns | 97 | 97 | 97 | 95 |
| | 90 microns | 99 | 99 | 99 | 97 |
| Impact: 40inch/lb | Category | Pass | Pass | Pass | Pass |
| Flow | Category | 2 | 2 | 2 | 3 |
| Cupping Test | Pass | 6mm | 6mm | 6mm | 6mm |

HYBRID UV STABILITY

Zeocros E110 did not affect the UV stability in hybrid systems tested as the rate of degradation is the same for formulation containing only TiO₂. The data in chart 1 shows this.

- No Zeocros
- 10% extension
- 25% extension
- 50% extension

Chart 1. UV stability of hybrid systems with and without Zeocros E110. (Equipment used is Q-Sun 1000 Xenon Lamp unit with daylight filter under conditions of irradiance at 0.8 W/m² at 420nm and temperature of 50°C)



TECHNICAL DATA – COMPARISON WITH LITHOPONE

In the formulations tested, Zeocros E110 is shown to be more efficient at extending TiO₂ in powder coatings than lithopone. The comparison in table 3 is with a high quality lithopone (A) and a lower quality material (B) – both commercial products. This increased performance is exemplified in thinner films where Zeocros E110 has been shown to be more effective than alternatives on a weight for weight basis.

Table 3. Zeocros E110 performance comparison with various lithopone products

| | | Standard | 10% E110 Extension | 25% E110 Extension | 50% E110 Extension | 10% Lithopone A Extension | 25% Lithopone A Extension | 10% Lithopone B Extension | 25% Lithopone B Extension | 90% TiO ₂ of Standard |
|---------------------|--------------------------|----------|--------------------|--------------------|--------------------|---------------------------|---------------------------|---------------------------|---------------------------|----------------------------------|
| Formulation (% w/w) | Vantico Resin 6064 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 |
| | Cray Valley Resin 6877 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 |
| | Flow Aid PV88 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | Benzoin | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | Barytes AW10 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 6.8 |
| | Kronos 2310 | 30 | 27 | 22.5 | 15 | 27 | 22.5 | 27 | 22.5 | 27 |
| | Zeocros E110 | - | 3 | 7.5 | 15 | - | - | - | - | - |
| | Lithopone A | - | - | - | - | 3 | 7.5 | - | - | - |
| | Lithopone B | - | - | - | - | - | - | 3 | 7.5 | - |
| Gloss | Stoving at 10mins @180°C | 93 | 92 | 93 | 91 | 93 | 92 | 88 | 93 | 94 |
| Colour | ∂L* | (95.83) | -0.27 | -0.88 | -1.67 | -0.37 | -0.92 | -1.3 | -1.52 | -0.87 |
| | ∂a* | (-2.25) | 0.05 | 0.06 | -0.01 | -0.01 | 0.11 | -0.04 | -0.04 | 0.02 |
| | ∂b* | (1.57) | -0.2 | -0.6 | -0.8 | -0.36 | -0.78 | -1.13 | -1.1 | -0.54 |
| | ∂E | - | 0.34 | 0.97 | 1.85 | 0.51 | 1.19 | 1.72 | 1.18 | 1.02 |
| Contrast Ratio | 50 microns | 97 | 97 | 97 | 95 | 96 | 96 | 96 | 95 | 96 |
| | 90 microns | 99 | 99 | 99 | 97 | 98 | 97 | 98 | 96 | 98 |
| Impact: 40inch/lb | Category | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass |
| Flow | Category | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 |
| Cupping Test | Pass | 6mm | 6mm | 6mm | 6mm | 6mm | 6mm | 6mm | 6mm | 6mm |

In terms of opacity and colour balance, Zeocros E110 outperforms lithopone on a weight for weight basis. While UV stability remains unaffected with the use of the extenders in table 3, the inherent chemical limitations of lithopone on weathering, such as discolouration, make the materials unsuitable for many polyester systems. In addition, the S.G of Zeocros E110 is 50% of that of lithopone.

Table 4. **Characteristics of lithopone used for comparison**

| | Lithopone A | Lithopone B |
|----------------------|-------------|-------------|
| APS (microns) | 1 | 0.7 |
| ZnS (%) | 30 | 30 |
| BaSO ₄ | 70 | 70 |
| pH | 8 | 8.6 |
| Density (g/mL) | 4.3 | 4.3 |
| Mohs Hardness | 3 | 3 |
| Whiteness (Harrison) | 95 | 90 |

TECHNICAL DATA – COMPARISON WITH BARIUM SULPHATE

Barium sulphate is typically used as a filler for powder coatings however some high purity grades with small particle size are promoted as extenders. The data in table 5 shows that in the powder coating formulations tested Zeocros E110 is more efficient at extending TiO₂ than even powder coating quality BaSO₄.

Table 5. **Zeocros E110 comparison with barium sulphate**

| | | Standard | 10% E110 Extension | 25% E110 Extension | 50% E110 Extension | 10% Blanc Fixe | 25% Blanc Fixe | 90% TiO ₂ of Standard |
|----------------------------|--------------------------|----------|--------------------|--------------------|--------------------|----------------|----------------|----------------------------------|
| Formulation (% w/w) | Vantico Resin 6064 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 |
| | Cray Valley Resin 6877 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 | 32.5 |
| | Flow Aid PV88 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| | Benzoin | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | Barytes AW10 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 6.8 |
| | Kronos 2310 | 30 | 27 | 22.5 | 15 | 27 | 22.5 | 27 |
| | Zeocros E110 | - | 3 | 7.5 | 15 | - | - | - |
| | BaSO ₄ | - | - | - | - | 3 | 7.5 | - |
| Gloss | Stoving at 10mins @180°C | 93 | 92 | 93 | 91 | 93 | 93 | 94 |
| Colour | ∂L* | (95.83) | -0.27 | -0.88 | -1.67 | -1.17 | -1.51 | -0.87 |
| | ∂a* | (-2.25) | 0.05 | 0.06 | -0.01 | 0.01 | -0.05 | 0.02 |
| | ∂b* | (1.57) | -0.2 | -0.6 | -0.8 | -0.89 | -1.1 | -0.54 |
| | ∂E | - | 0.34 | 0.97 | 1.85 | 1.47 | 1.79 | 1.02 |
| Contrast Ratio | 50 microns | 97 | 97 | 97 | 95 | 96 | 94 | 96 |
| | 90 microns | 99 | 99 | 99 | 97 | 97 | 96 | 98 |
| Impact: 40inch/lb | Category | Pass | Pass | Pass | Pass | Pass | Pass | Pass |
| Flow | Category | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cupping Test | Pass | 6mm | 6mm | 6mm | 6mm | 6mm | 6mm | 6mm |

The test data in table 5 shows that Zeocros E110 is more efficient for TiO₂ extension than barium sulphate alone, both for opacity and colour balance - particular at thin film thickness. The characteristics of the barium sulphate used here are given in table 6.

Table 6. **Characteristics of barium sulphate used for comparison**

| | Barium Sulphate |
|----------------------|-----------------|
| APS (microns) | 1 |
| BaSO ₄ | 99 |
| pH | 7 |
| Density (g/mL) | 4.4 |
| Mohs Hardness | 3 |
| Whiteness (Harrison) | 96 |

EXTENSION FOR POLYURETHANE

Zeocros E110 has also been shown to extend polyurethane systems effectively. The extension power is identical to that shown previously for hybrid systems. The UV stability of polyurethanes remains unaffected by the use of Zeocros E110.

OVERBAKE PERFORMANCE

Zeocros E110 has been shown in tests not to affect overbake performance when compared to non-extended coatings. At higher loadings of Zeocros E110, the resistance of the coating to overbake can be slightly improved by comparison with systems containing TiO₂ only.

Table 7. **Overbake performance in a hybrid system at 220°C for 30 mins**

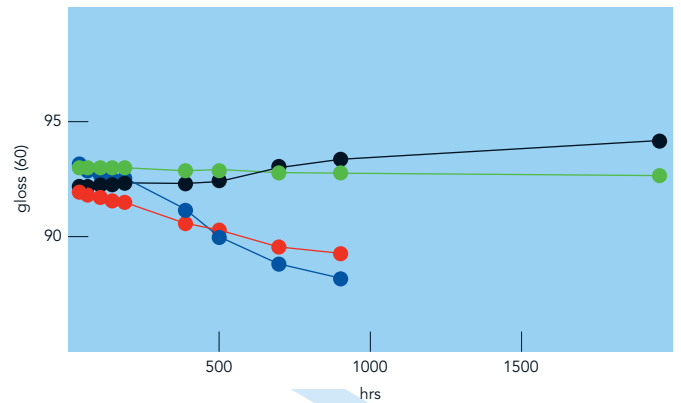
| | | Standard | 10% (w/w) Extension | 25% (w/w) Extension | 90% TiO ₂ of Standard |
|--------------------------------|---|----------|---------------------------|---------------------------|--|
| Formulation (% w/w) | This data is generated using the hybrid formulation given in Table 1. | | | | |
| Initial Colour | L* | (95.83) | -0.27 | -0.88 | -0.87 |
| | a* | (-2.25) | 0.05 | 0.06 | 0.02 |
| | b* | (1.57) | -0.2 | -0.6 | -0.54 |
| 220°C, 30 mins - Colour | ∂L* | 0.94 | 0.79 | 0.31 | 0.59 |
| | ∂a* | 0.07 | 0.08 | 0.09 | 0.2 |
| | ∂b* | 2.24 | 2.44 | 1.96 | 1.91 |
| | ∂E | 2.6 | 2.7 | 2.2 | 2.4 |

ACID AND ALKALI RESISTANCE

On hybrid systems (table 1) tested with 5% H₂SO₄ and 5% NaOH, Zeocros E110 is not observed to affect stability when compared with formulations containing TiO₂ only. Further data is available upon request.

Chart 5. Acid and alkali Gloss stability of the hybrid formulation given in Table 1

- Acid Std
- Acid 25% Zeocros
- Alkali Std
- Alkali 25% Zeocros



PACKAGING

Zeocros E110 is available in 25kg sacks on one metric tonne pallets.

SAFETY

Not classified as dangerous for supply/use under EC classifications, Material Safety Data Sheets providing Health and Safety information are available upon request.

TECHNICAL SERVICE

PQ Corporation offers a high standard of technical and analytical service to ensure optimum performance of its products. For assistance, contact us via e-mail: techsupport@pqcorp.com

For further information please contact:

PQ Corporation

Warrington, England, WA5 1AB
T: +44 (0)1925 416100 F: +44 (0)1925 416116

PQ Corporation

111 Ingalls Avenue, Joliet, IL 60435 USA
T: +1 815 727 3651 F: +1 815 727 5312

PQ Corporation

435 Orchard Road, #19-05 Wisma Atria, Singapore 238877
T: +65 6838 7290 F: +65 6736 1650

PQ Corporation

Av. Marques de São Vicente, 121, 6° andar sala 60101139-001 - São Paulo, SP Brazil
T: +55 (0)11 3613 9900 F: +55 (0)11 3613 9919

PQ Corporation

169 Tedstone Road, PO Box 14016, Wadeville 1422, Gauteng, South Africa
T: +27 (0)11 820 7111 F: +27 (0)11 827 6922

All information contained in this publication is believed to be accurate and is given in good faith. PQ Corporation would be very pleased to co-operate with organisations who wish to explore further any resulting possibilities. However, readers must satisfy themselves as to the suitability of such information for their own particular purpose. This applies equally to recommendations or suggestions made by PQ Corporation relating to the use of information from this publication or offered in response to specific enquiries or otherwise. No warranty is given as to the fitness of the information for any particular purpose and any implied warranty or condition (statutory or otherwise) is excluded except insofar as such exclusion is prevented by law. PQ Corporation accepts no liability for loss or damage (including liability for negligence or other tortious act or omission) other than that causing death or personal injury arising from reliance on the information provided. Freedom from patent, copyright or design protection must not be assumed.

ZEOCROS® is a registered trademark

June 2012 PQ109-2