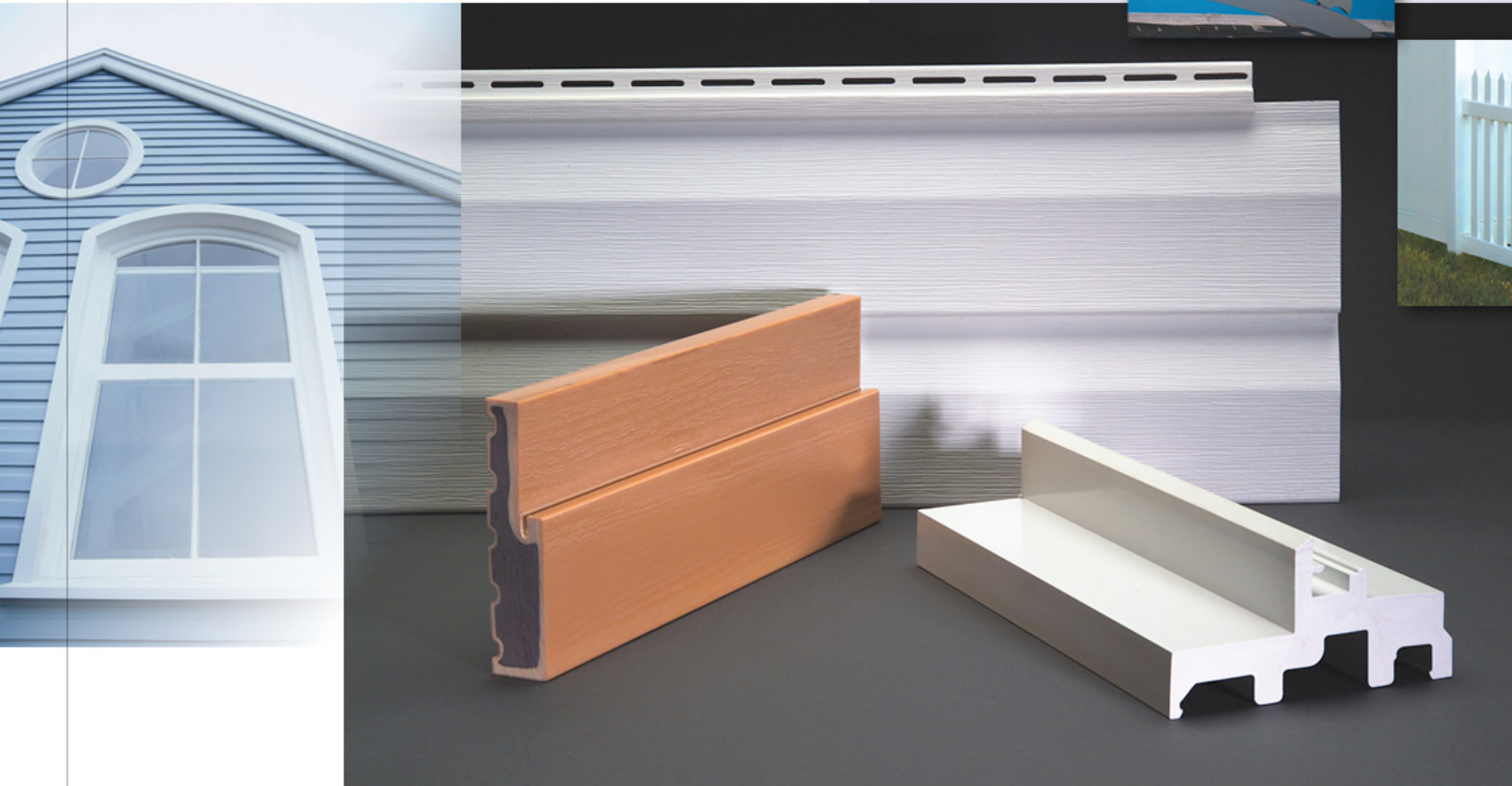
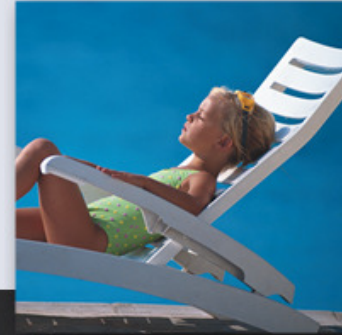


TIONA® 168

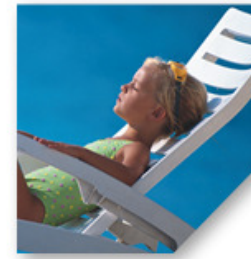
The Durable Alternative



CRISTAL  كريستال
Global العالمية

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Applications

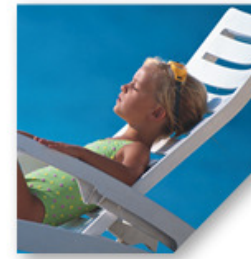
Specially designed for durable (exterior) PVC

- window and door profiles
- conservatories, glasshouses
- cladding
- shutters and boards
- rainwater goods
- roof membranes



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Features and Benefits

- Excellent durability: colour stability, retention of gloss during weathering
- Exceeds or matches the durability performances of competitive TiO₂ pigments recommended for PVC
- Since the launch of Tiona 168 in 1992 no claims have been made for pinking or discoloration
- Rigorous in-process and finished product testing to ensure consistent pigment quality

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The Durable Alternative

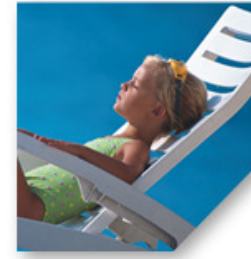


Features and Benefits

- Approved by numerous durable PVC profile producers across Europe
- Proven performance in a range of lead- and calcium/zinc-stabilised formulations
- Offered in 25 kg bags, 500 kg or 1,000 kg big bags and bulk
- Manufactured on Europe's single largest chloride process plant with expanded capacity of 150,000 MT since 1999

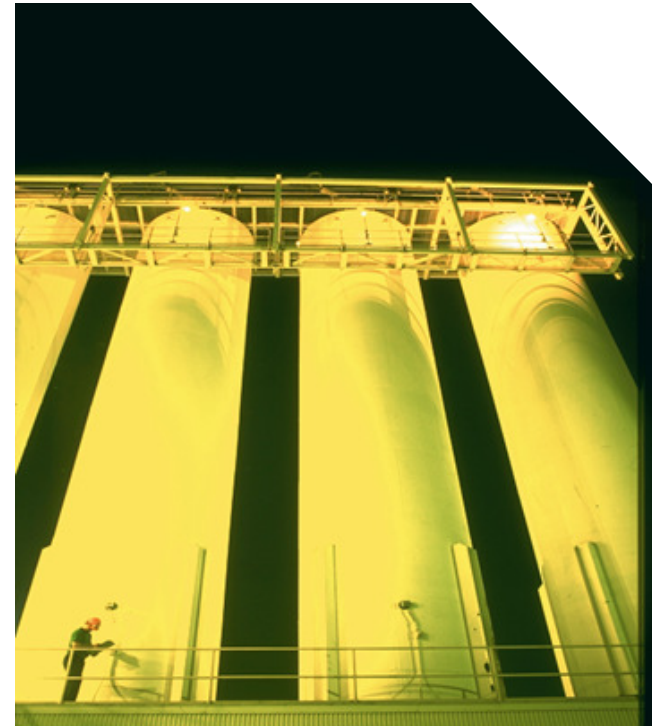
TIONA® 168

The Durable Alternative



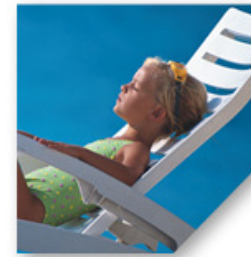
Bulk Flow

- Tiona 168 has good dry flow characteristics for easy conveying and mixing.
- Can be delivered by tanker into bulk silos.

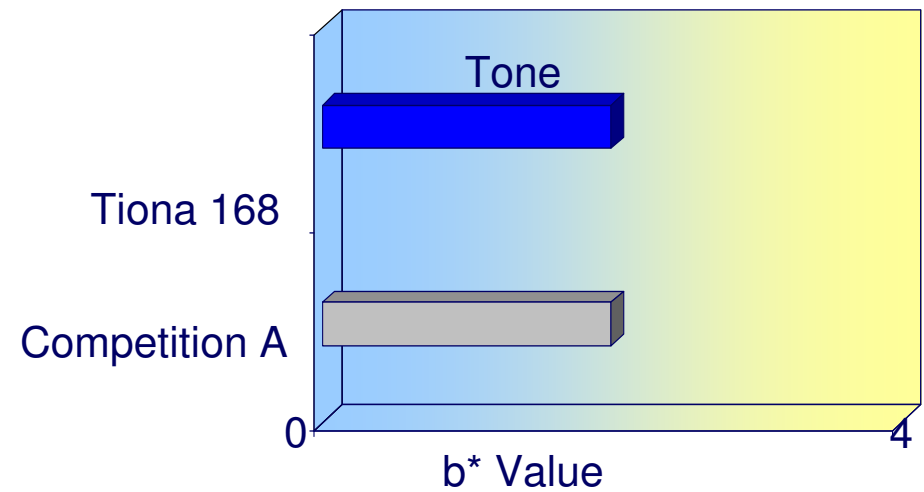
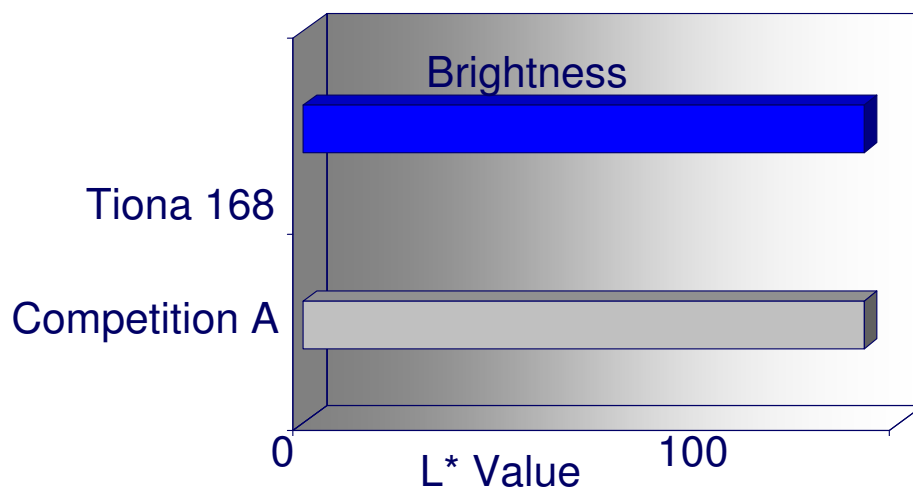


TIONA® 168

The Durable Alternative



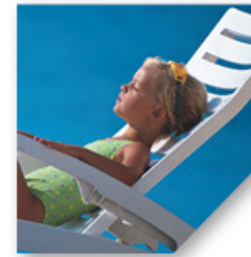
Optical Properties in PVC-U



- Tiona 168 closely matches the optical properties of other neutral tone TiO_2 pigments used in durable PVC
- Allows straight substitution with no reformulation of tinting system to achieve the desired colour match

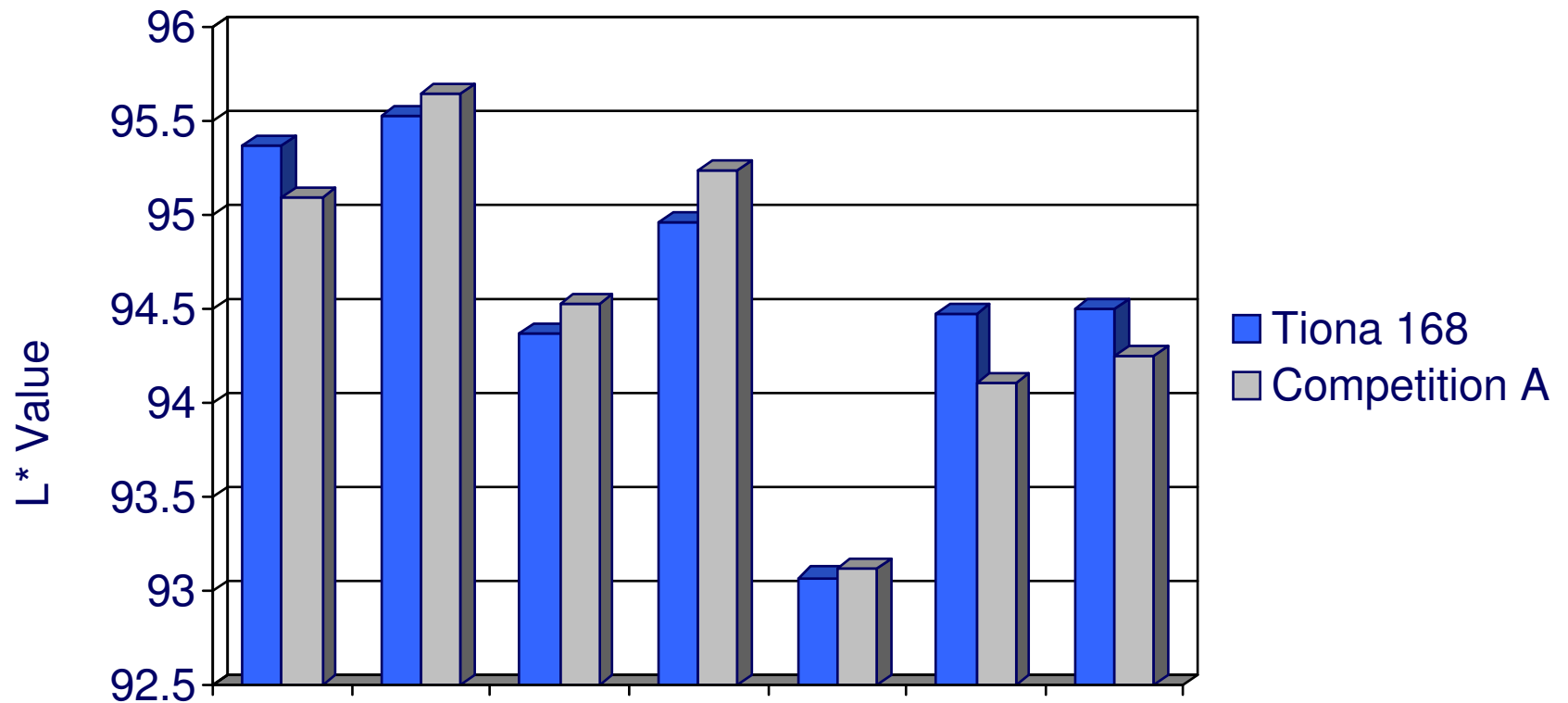
TIONA® 168

The Durable Alternative



Optical Properties

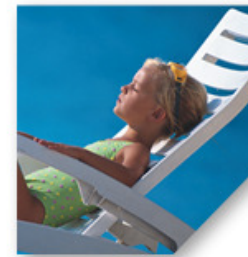
Brightness (L*-Value) of Commercial Profiles



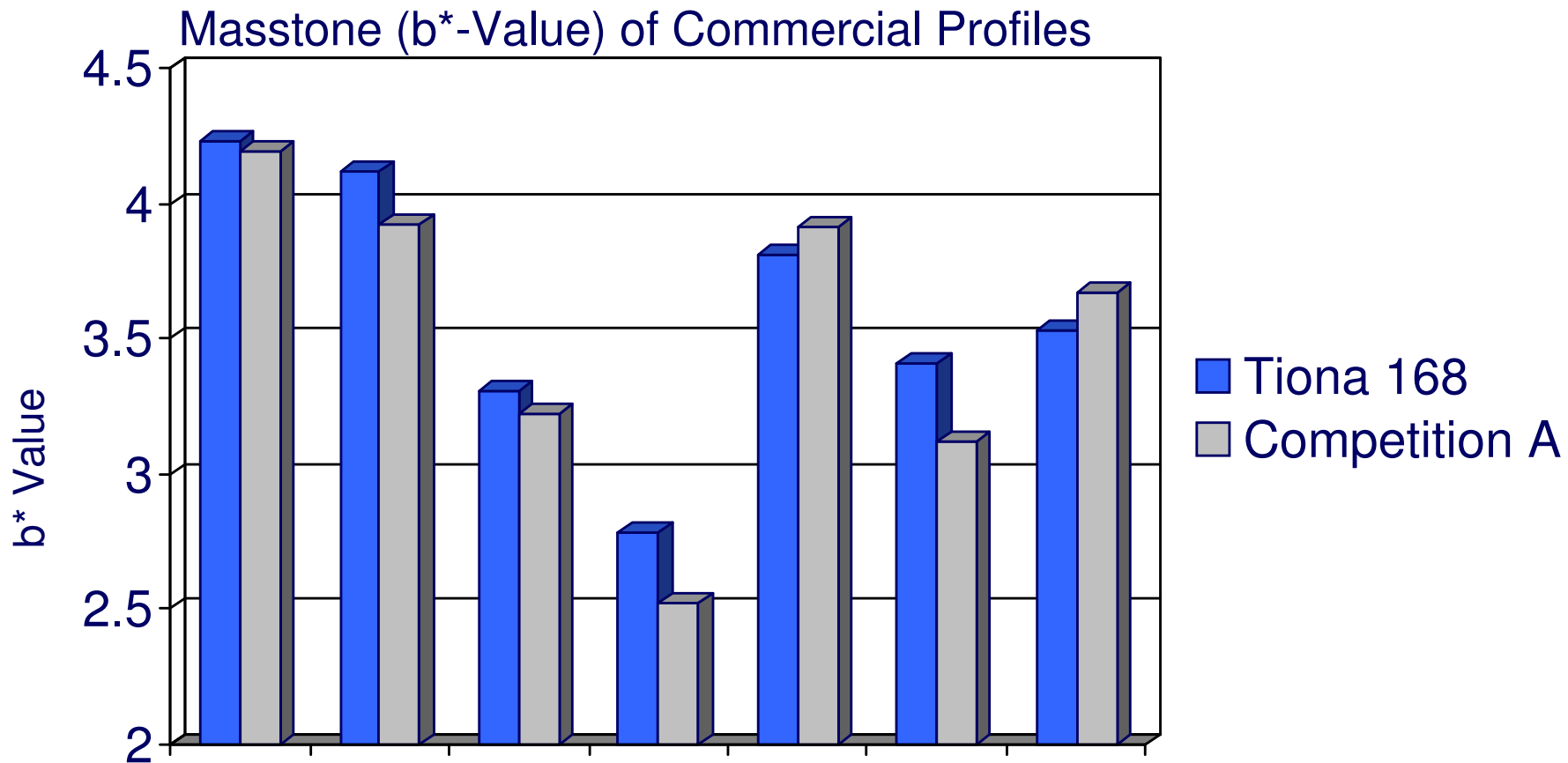
Comparisons of profiles made by different European companies

TIONA[®] 168

The Durable Alternative



Optical Properties



Comparisons of profiles made by different European companies

TIONA® 168

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Durability Performance

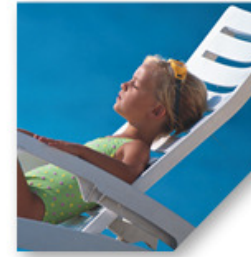
All Tiona 168 profiles with both Pb and Ca/Zn stabilisers have shown consistently good weathering resistance under all test conditions.....

- UK Nettleton weathering station (12 miles/20km from coast)
- South of France (Bandol)
- Western Australia
- Florida
- Arizona



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Durability Performance

PVC formulations containing Tiona 168 meet major industry and national standards including RAL, BS, CEN ...



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Accelerated Weathering Test Conditions

Xenotest 1200-LM

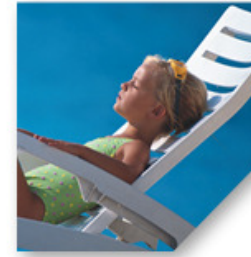
Conditions :

- Black standard temperature : $(60 \pm 3) \text{ }^\circ\text{C}$
- Energy (280 to 400 nm) : $(60 \pm 12) \text{ W/m}^2$
- Relative humidity : $(65 \pm 5) \%$
- Cycle :

Spray :	18 min
Dry :	102 min

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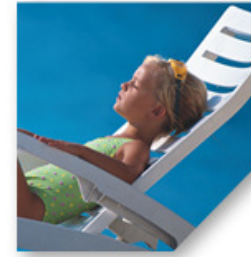


Pb-stabilised PVC Test Profile Formulation

	<u>phr</u>
PVC (K68)	100
Impact modifier	7
Coated CaCO ₃	5
Pb One-Pack (including blue/violet pigment and processing aid)	5.35
TiO ₂	4

TIONA® 168

The Durable Alternative

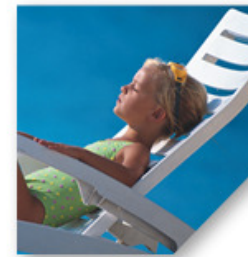


Ca/Zn-stabilised PVC Test Profile Formulation

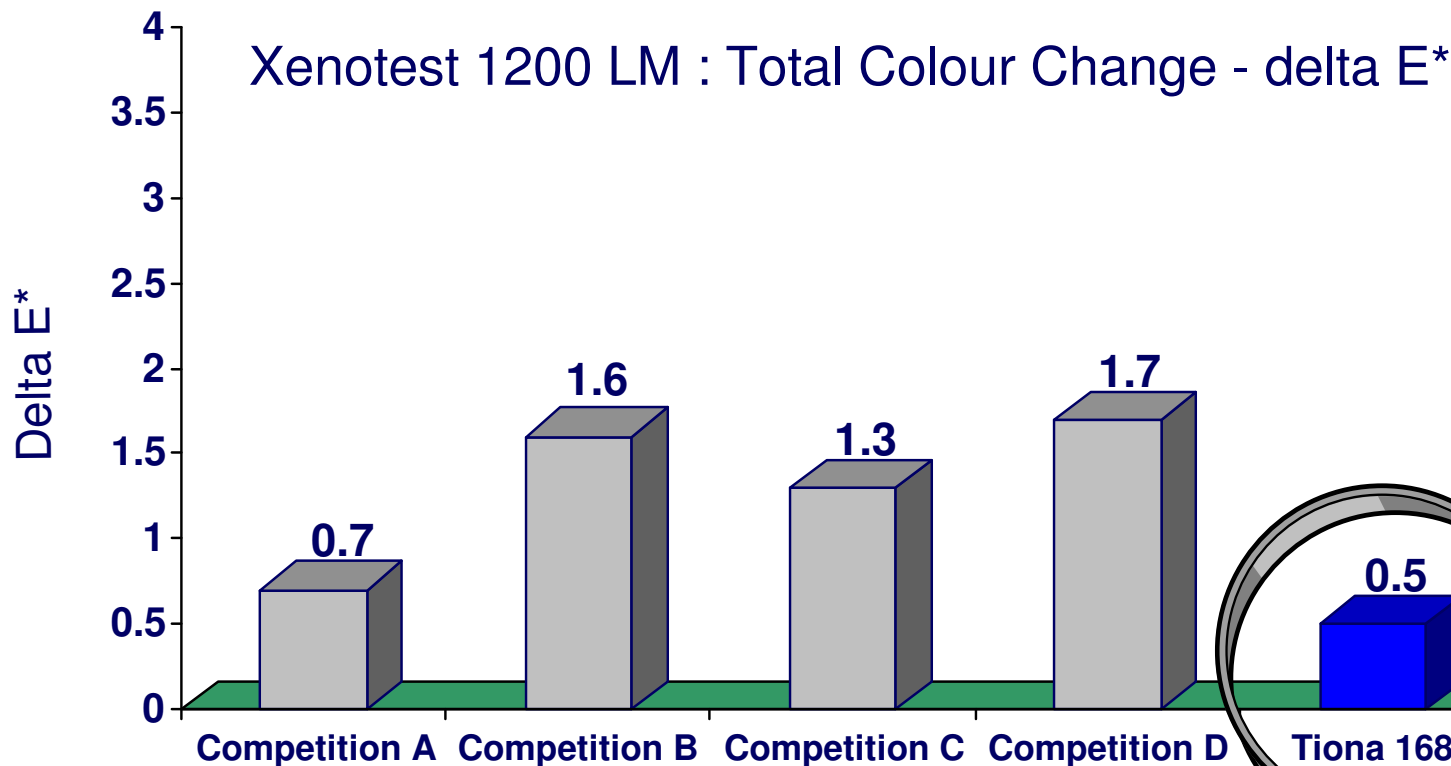
	<u>phr</u>
PVC (K68)	100
Impact modifier	7
Coated CaCO ₃	5
Ca/Zn One-Pack (including blue/violet pigment and processing aid)	4.5
TiO ₂	4

TIONA® 168

The Durable Alternative



Accelerated Weathering Performance

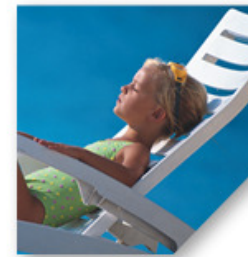


Least total colour change after exposure to industry standards

Pb-stabilised window profile Total irradiation = 8GJ.m^{-2}

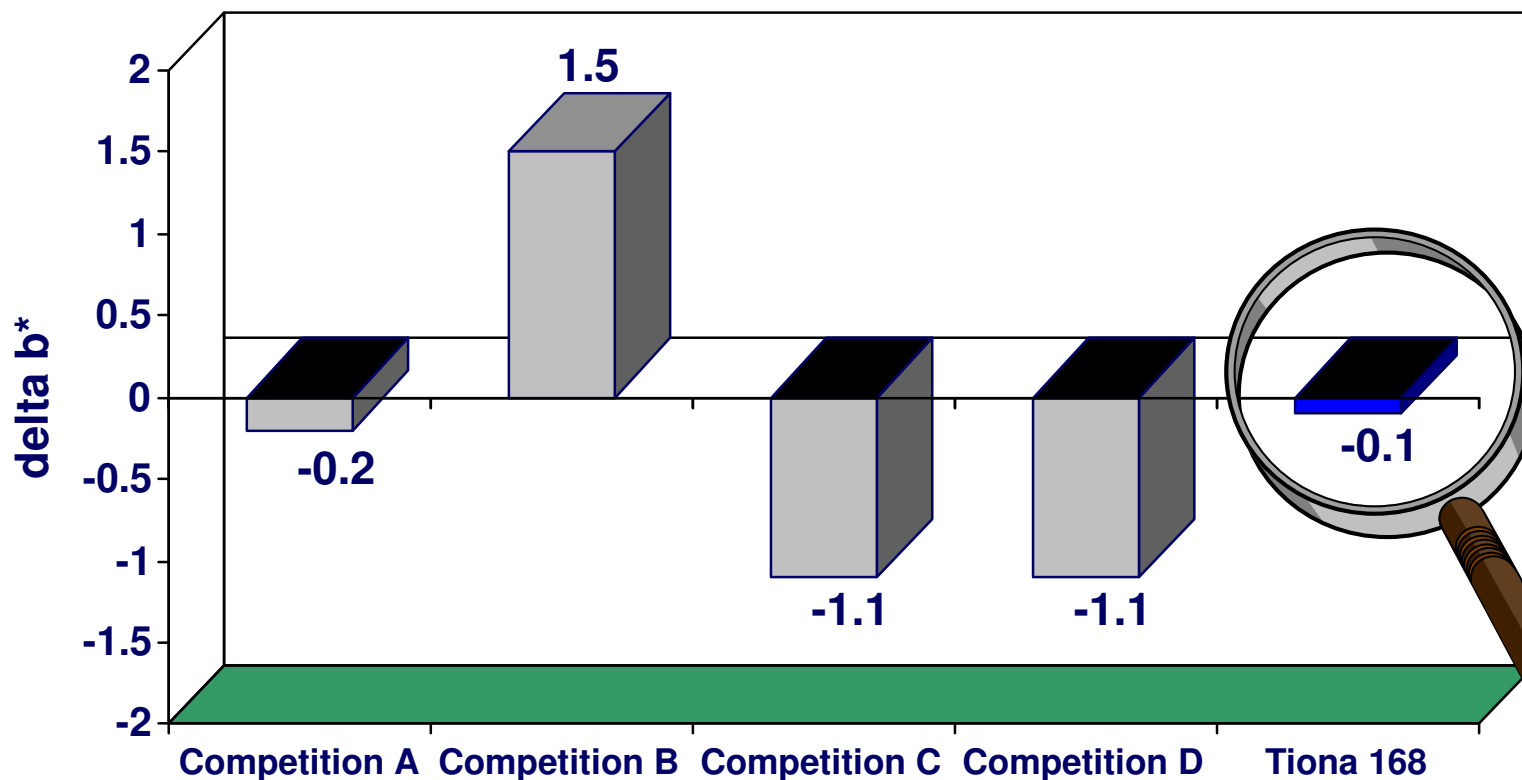
TIONA[®] 168

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Accelerated Weathering Performance

Xenotest 1200 LM : Change In Yellowness - delta b*



**Tiona 168:
least change**

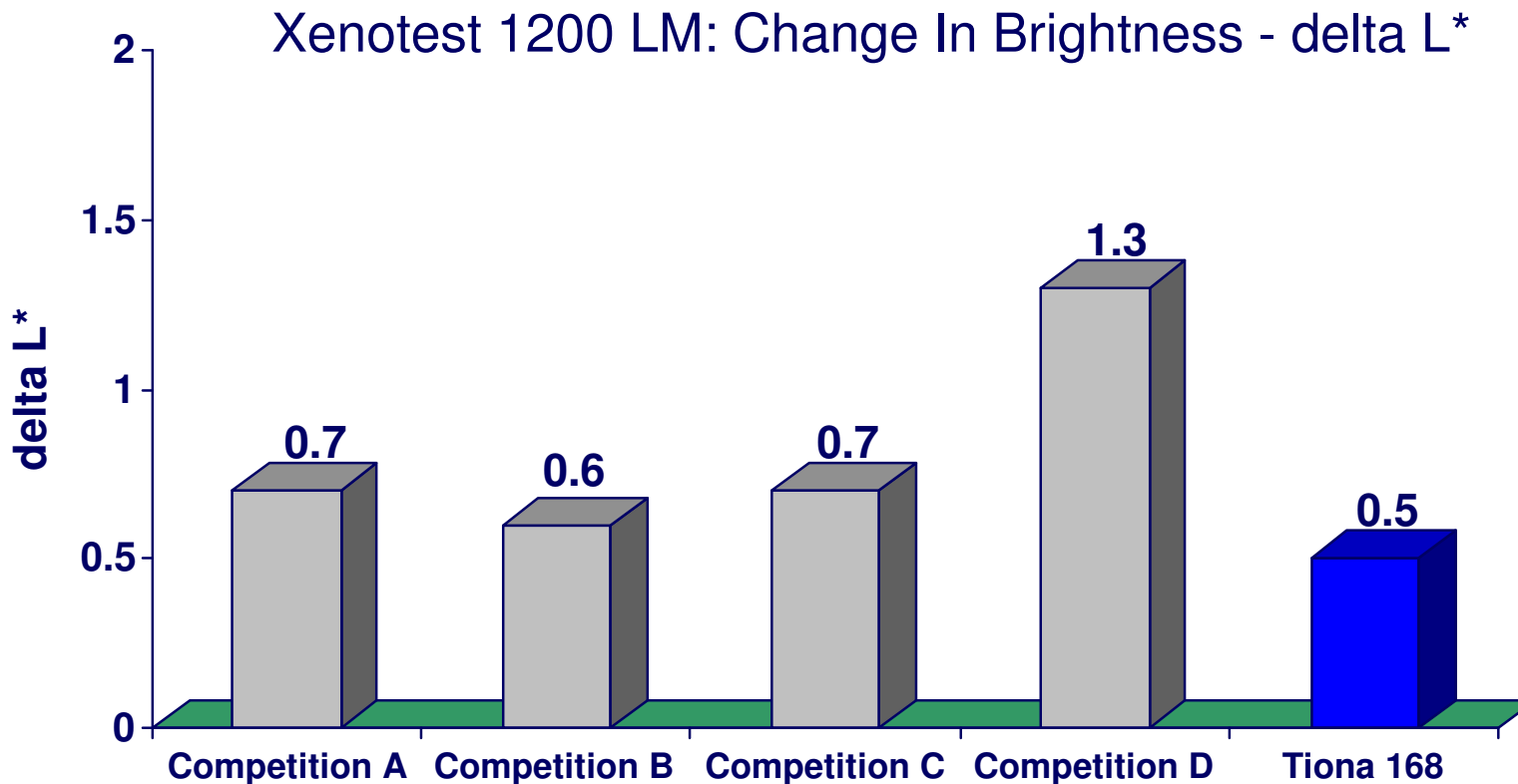
Pb-stabilised window profile Total irradiation = 8GJ.m^{-2}

TIONA® 168

The Durable Alternative



Accelerated Weathering Performance



Pb-stabilised window profile Total irradiation = 8GJ.m^{-2}

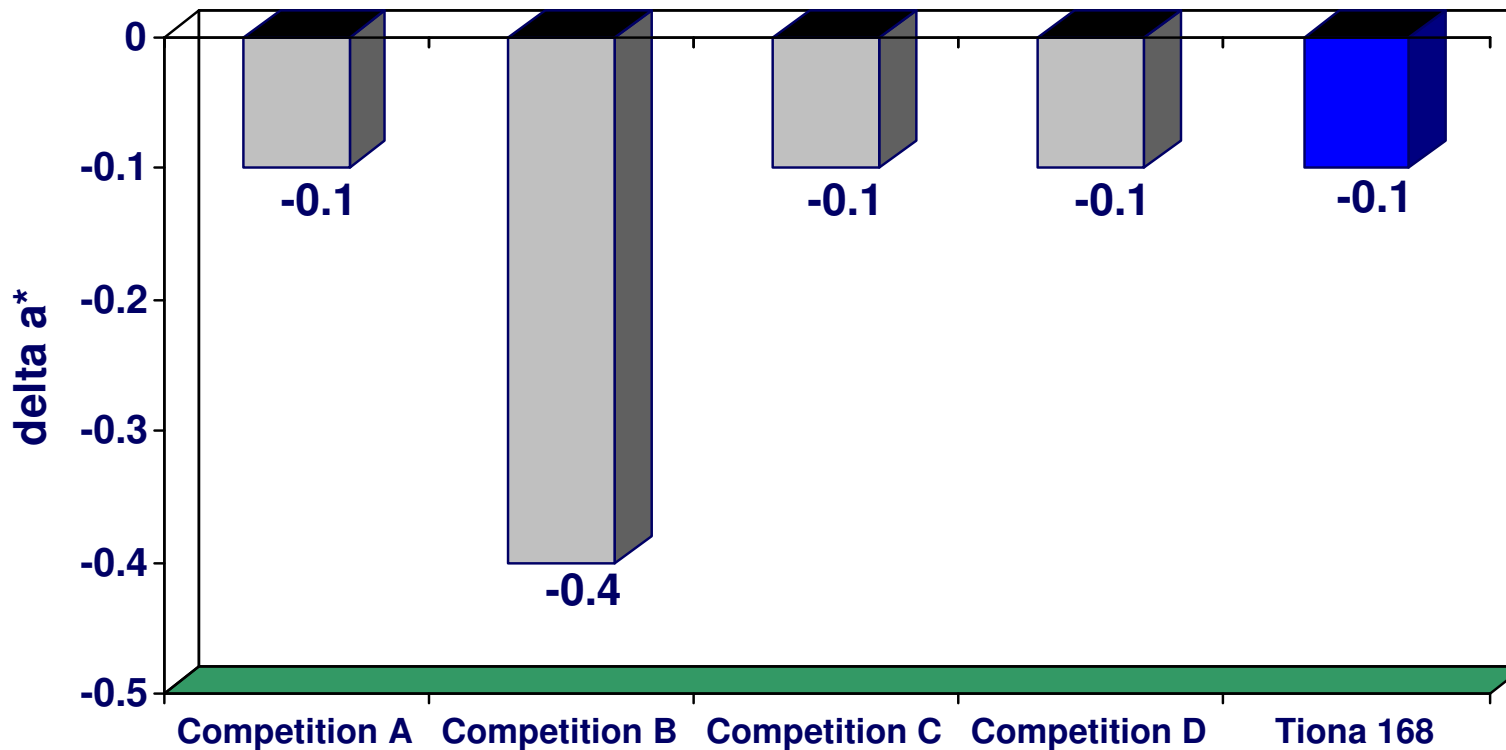
TIONA[®] 168

The Durable Alternative



Accelerated Weathering Performance

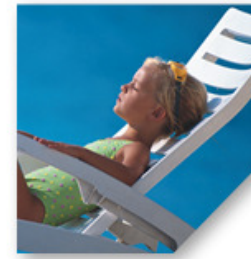
Xenotest 1200 LM : Change In Red-Green - delta a*



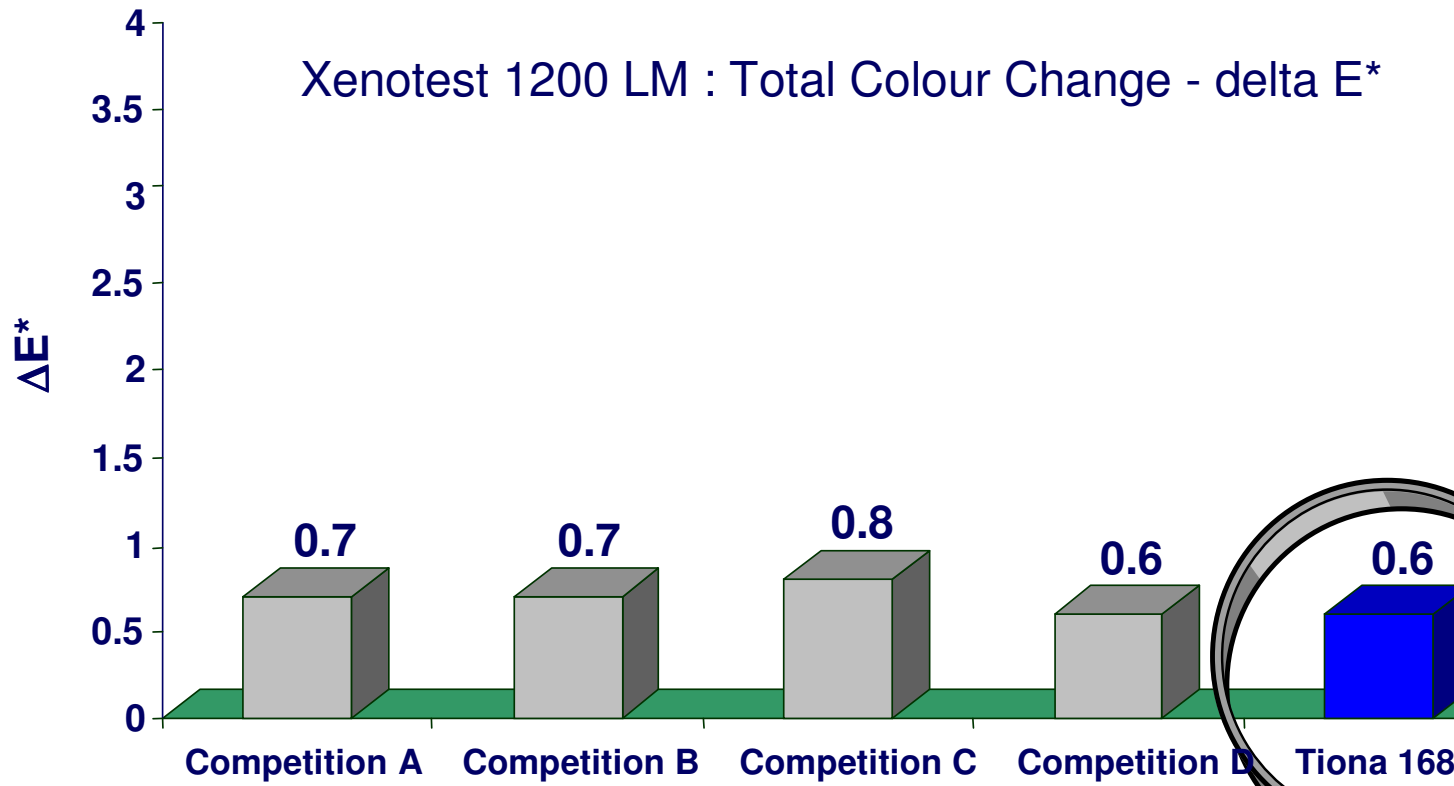
Pb-stabilised window profile Total irradiation = 8GJ.m^{-2}

TIONA® 168

The Durable Alternative



Accelerated Weathering Performance

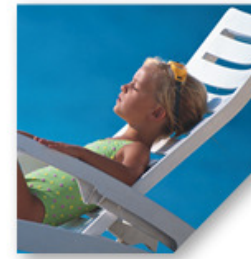


Least total colour change after exposure to industry standards

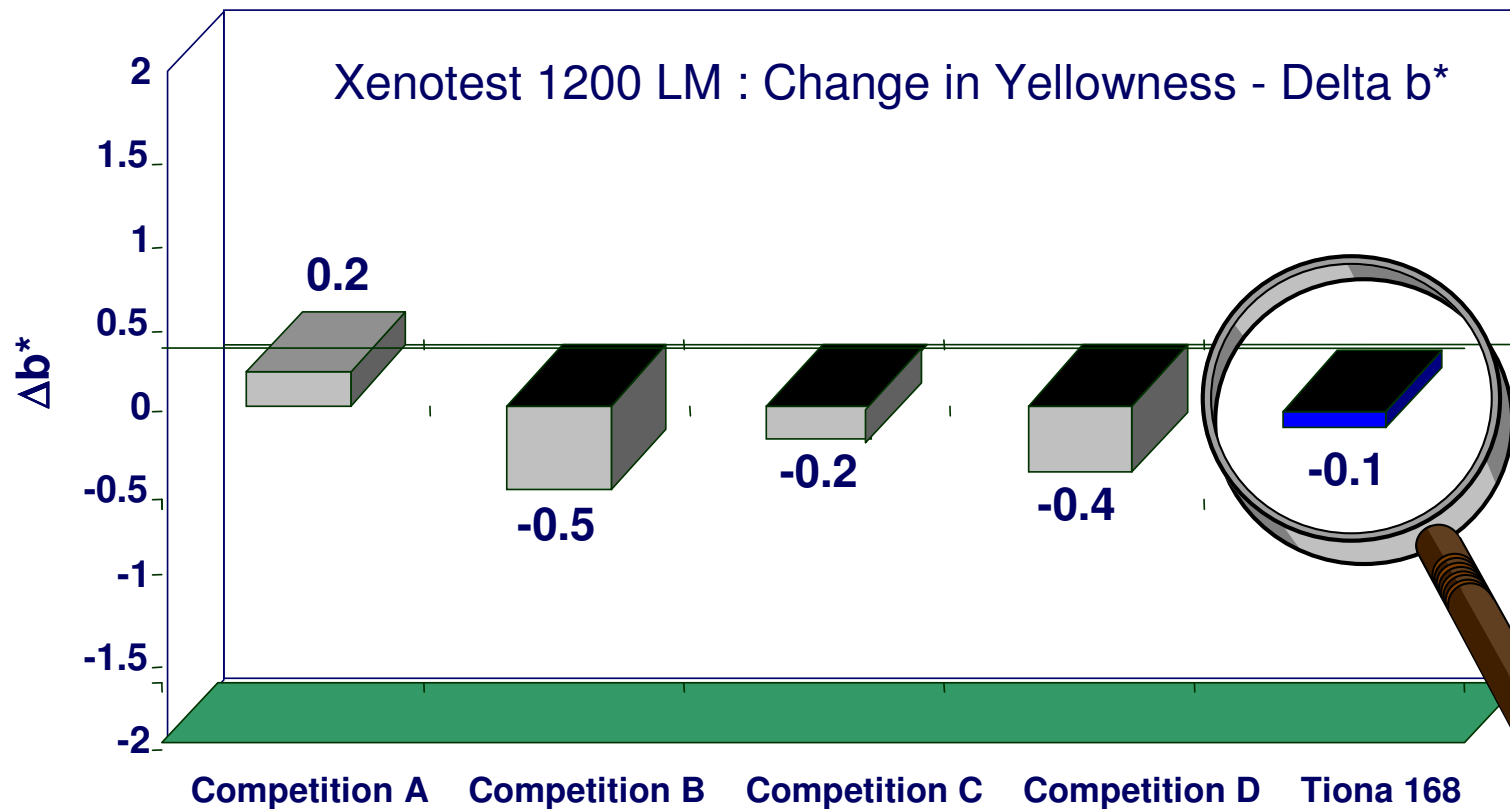
Ca/Zn stabilised window profile Total irradiation = 8GJ.m²

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The Durable Alternative



Accelerated Weathering Performance

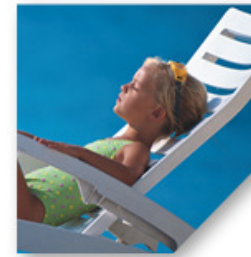


**Tiona 168:
least change**

Ca/Zn stabilised window profile Total irradiation = 8GJ.m^{-2}

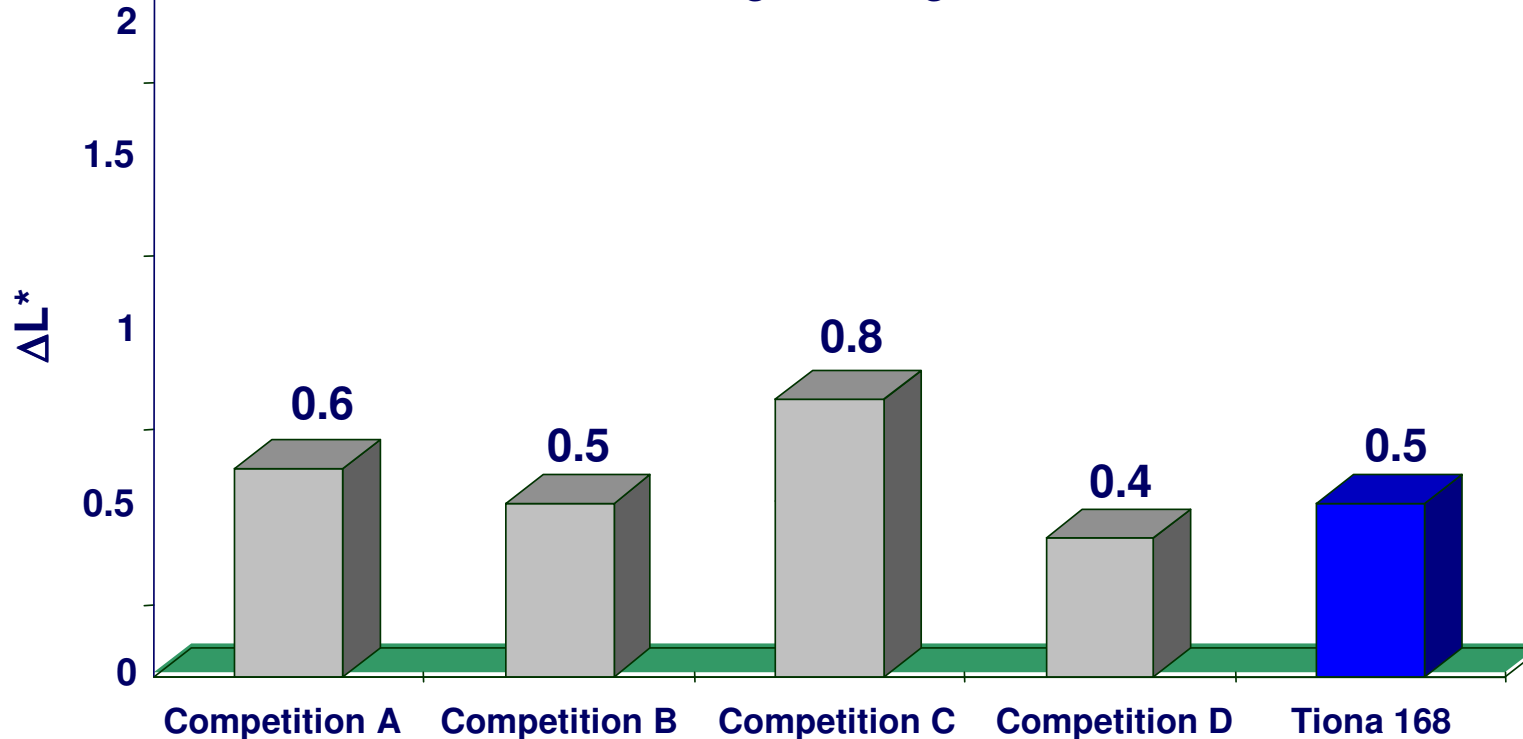
TIONA® 168

The Durable Alternative



Accelerated Weathering Performance

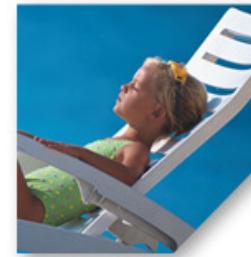
Xenotest 1200 LM: Change In Brightness - delta L*



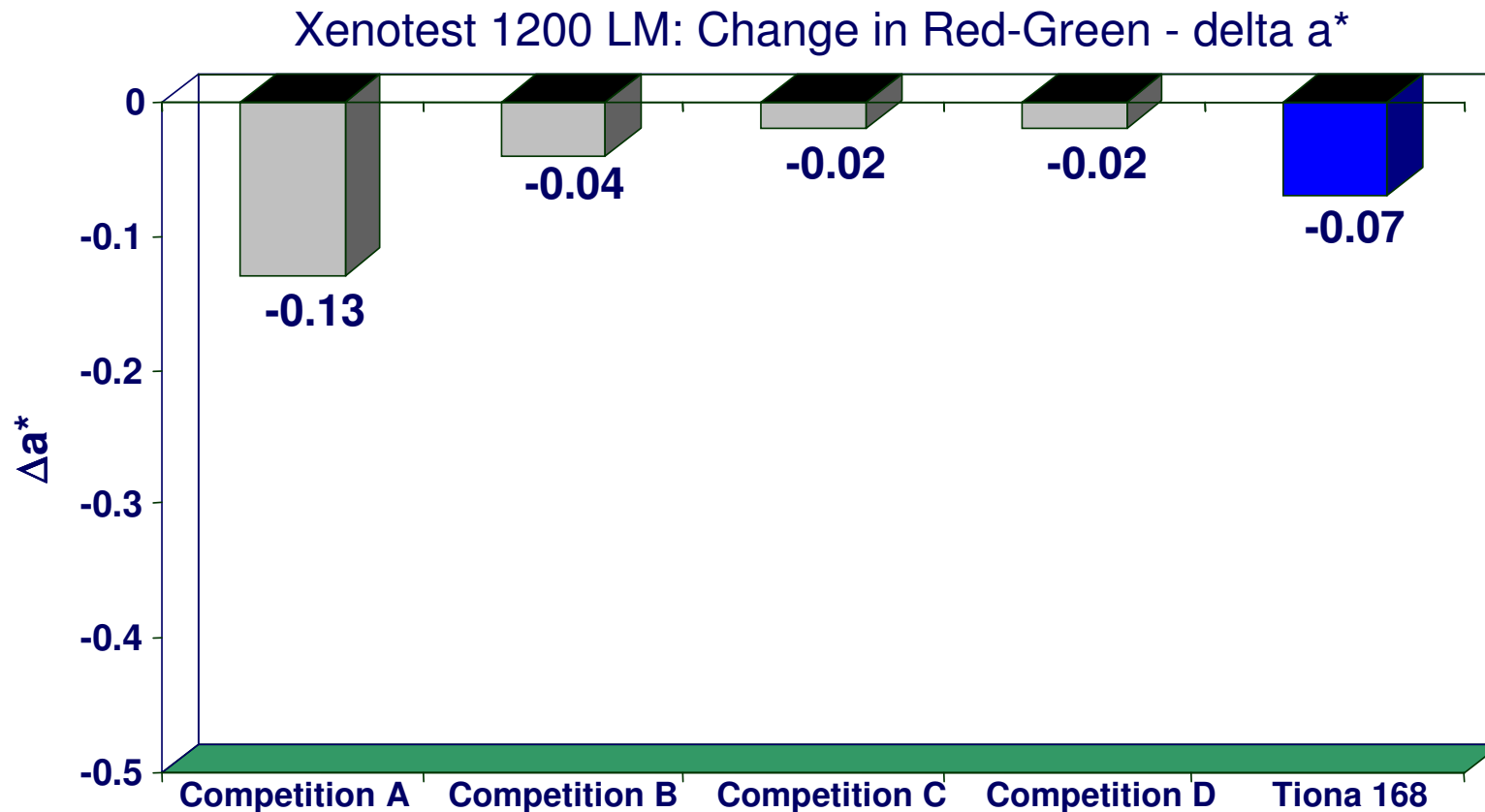
Ca/Zn stabilised window profile Total irradiation = 8GJ.m⁻²

TIONA[®] 168

The Durable Alternative



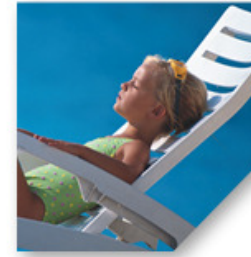
Accelerated Weathering Performance



Ca/Zn stabilised window profile Total irradiation = 8GJ.m⁻²

TIONA® 168

The Durable Alternative



Durability Performance

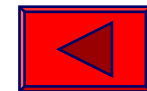
Commercial Pb- and Ca/Zn-stabilised PVC profiles containing Tiona 168 consistently demonstrate excellent durability when tested in various natural environments, including:

- Northern Europe : North-Facing, 90°
- Northern Europe : South-Facing, 45°
- Southern Europe : Bandol, South of France

Examples

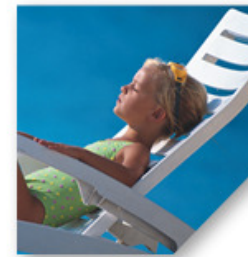
Examples

Examples

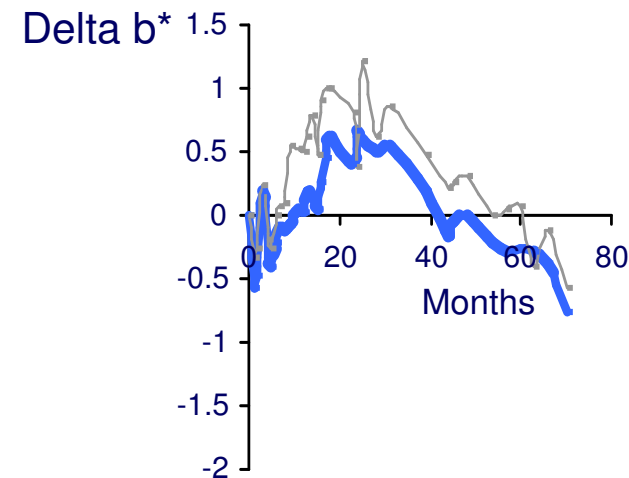
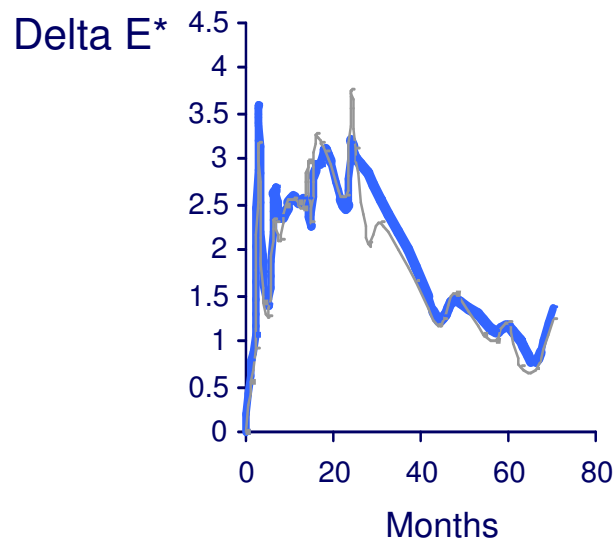


TIONA® 168

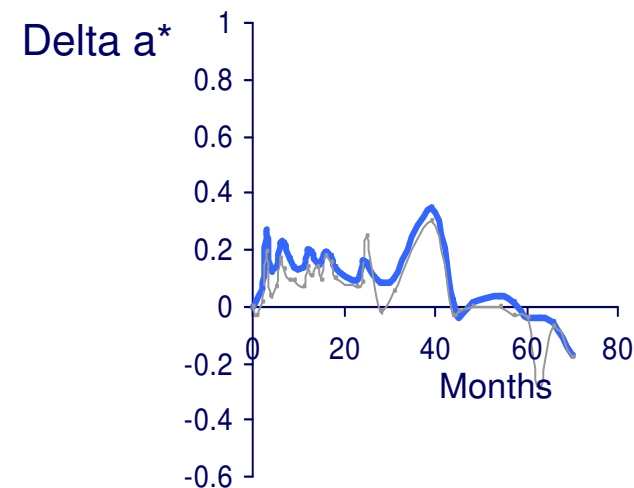
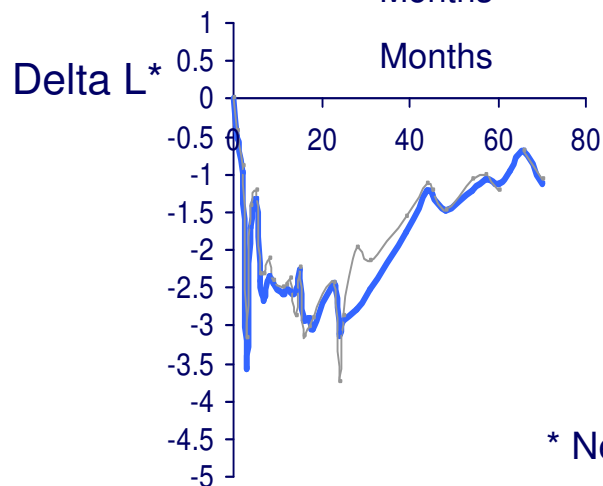
The Durable Alternative



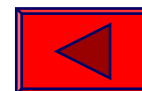
Commercially Produced Profile 1: Pb-Stabilised Northern Europe* Natural Weathering, 90° North-Facing: Colour Stability



— Tiona 168
— Competition A

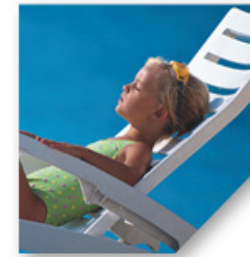


* Nettleton Weathering Station, UK

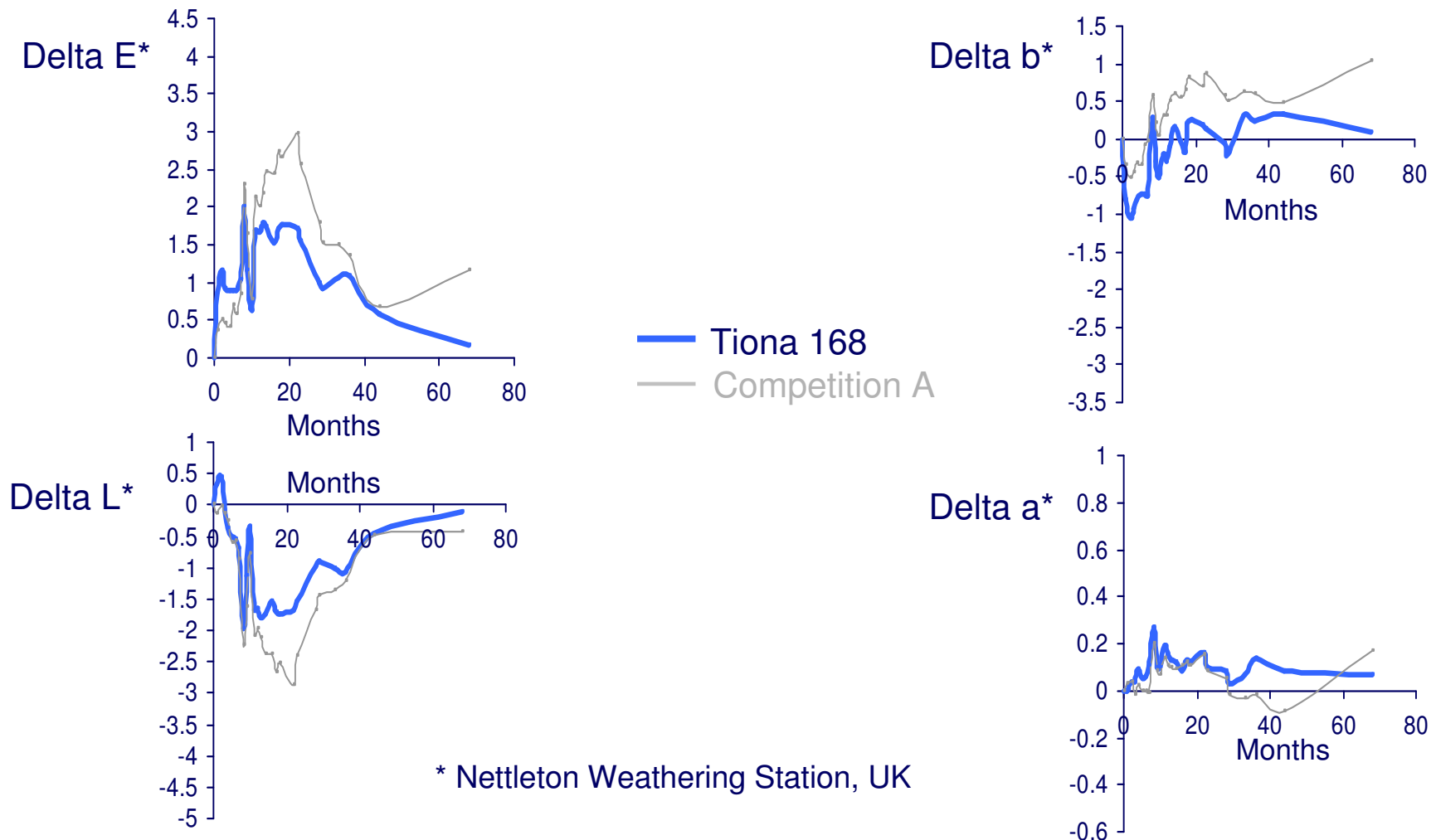


TIONA® 168

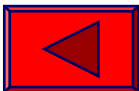
The Durable Alternative



Commercially Produced Profile 2 : Pb-Stabilised Northern Europe* Natural Weathering, 90° North-Facing: Colour Stability



* Nettleton Weathering Station, UK

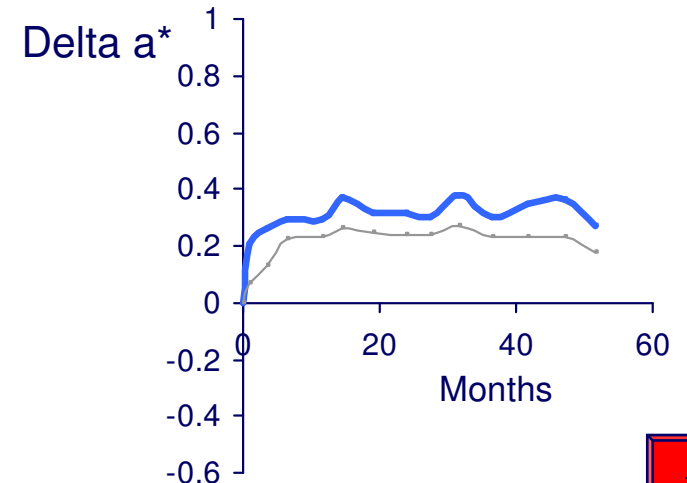
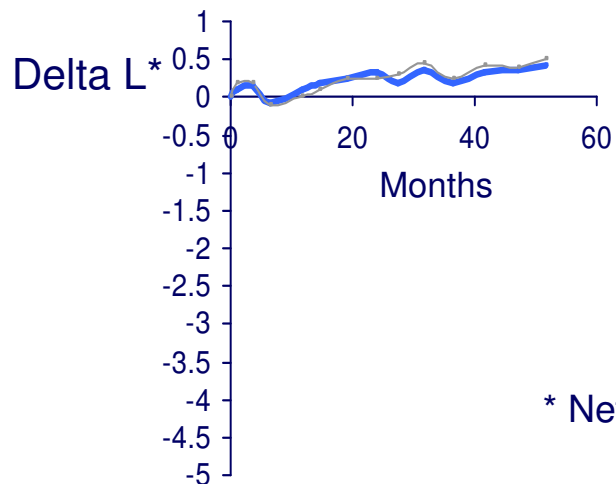
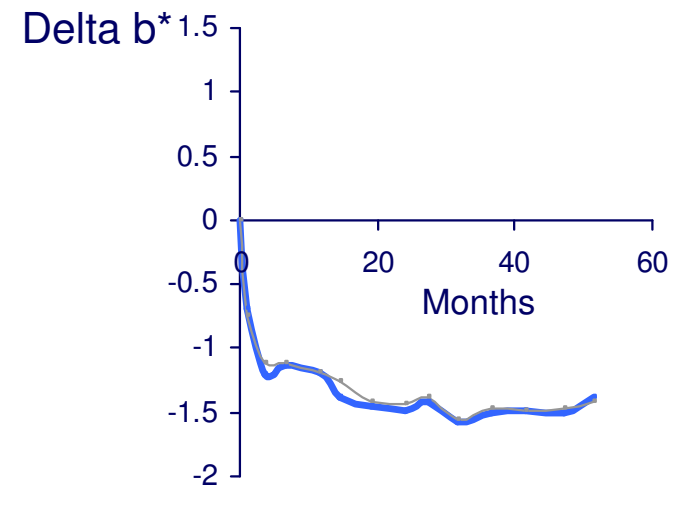
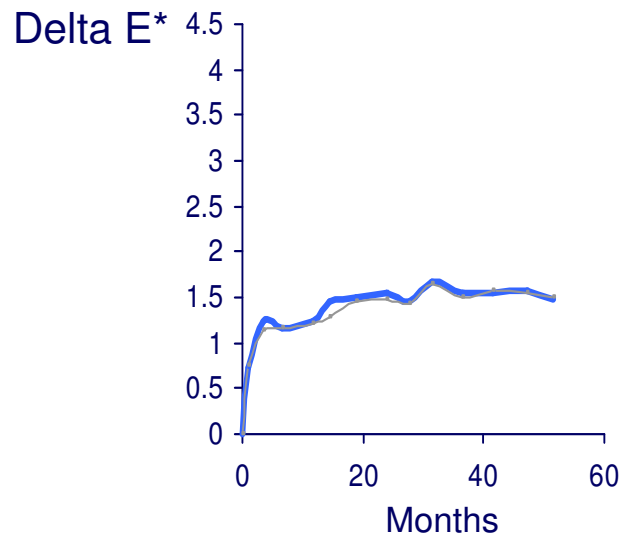


TIONA® 168

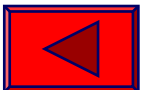
The Durable Alternative



Commercially Produced Profile 3 : Ca/Zn-Stabilised Northern Europe* Natural Weathering, 90° North-Facing: Colour Stability

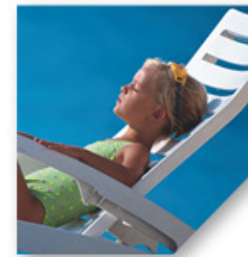


* Nettleton Weathering Station, UK

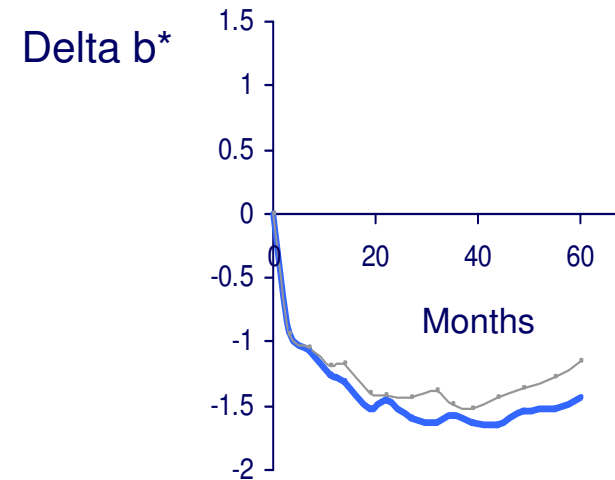
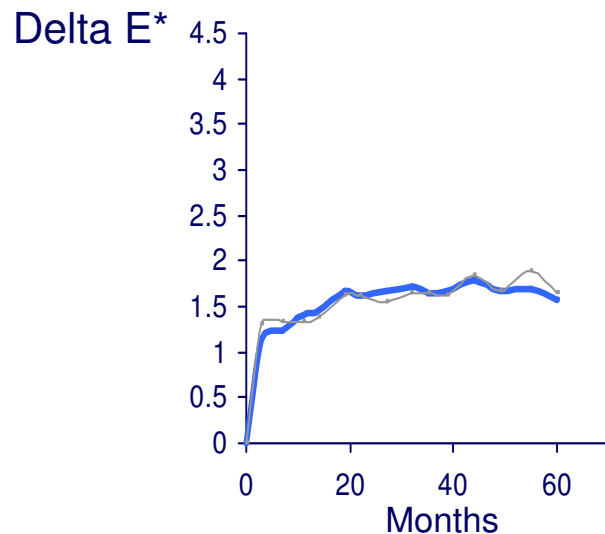


TIONA® 168

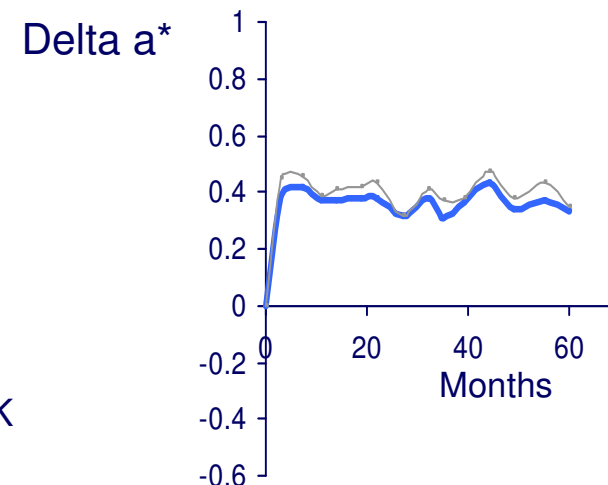
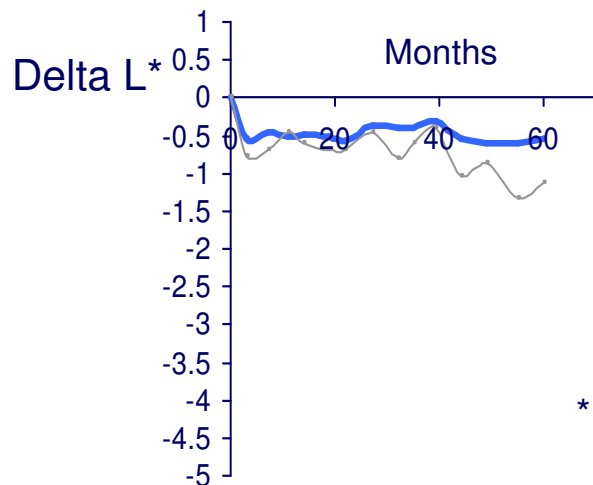
The Durable Alternative



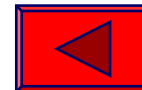
Commercially Produced Profile 4 : Ca/Zn-Stabilised Northern Europe* Natural Weathering, 90° North-Facing: Colour Stability



— Tiona 168
— Competition A

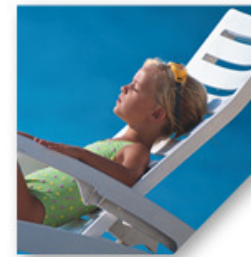


* Nettleton Weathering Station, UK

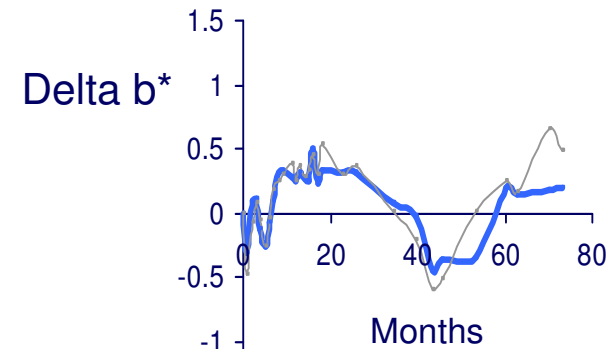
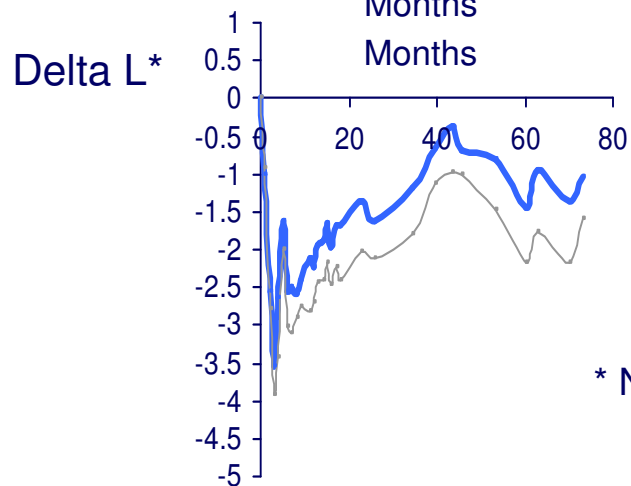
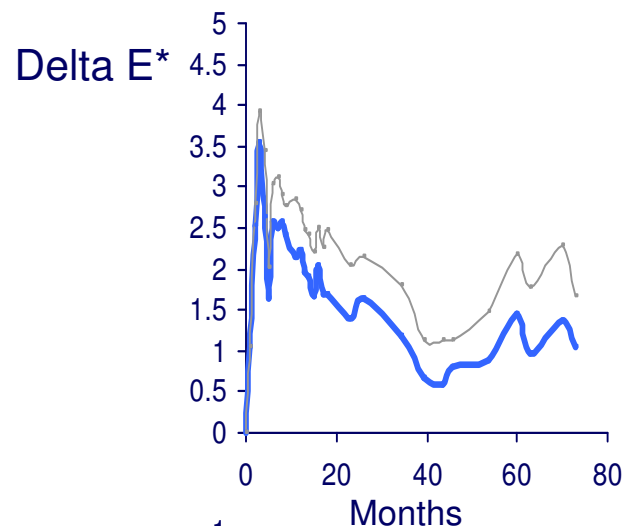


TIONA® 168

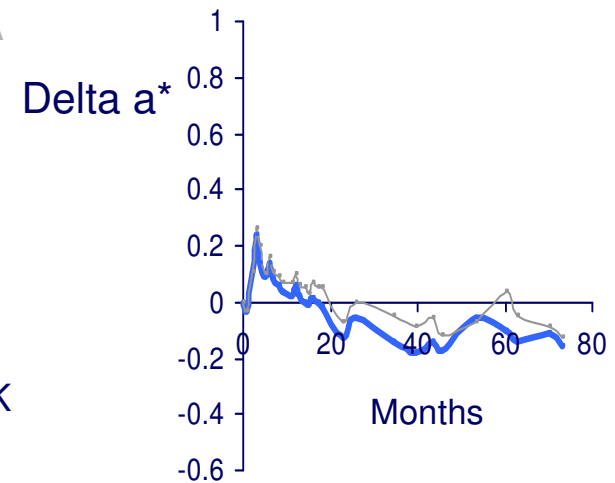
The Durable Alternative



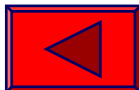
Commercially Produced Profile 1 : Pb-Stabilised Northern Europe* Natural Weathering, 45° South-Facing: Colour Stability



— Tiona 168
— Competition A



* Nettleton Weathering Station, UK

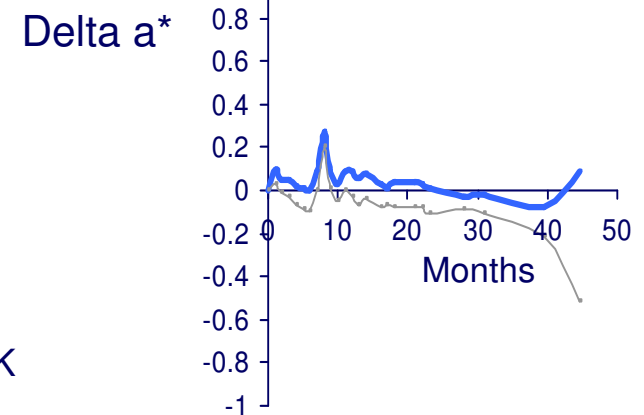
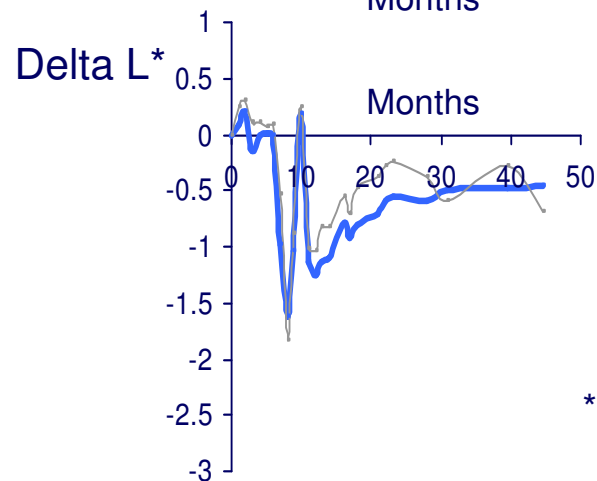
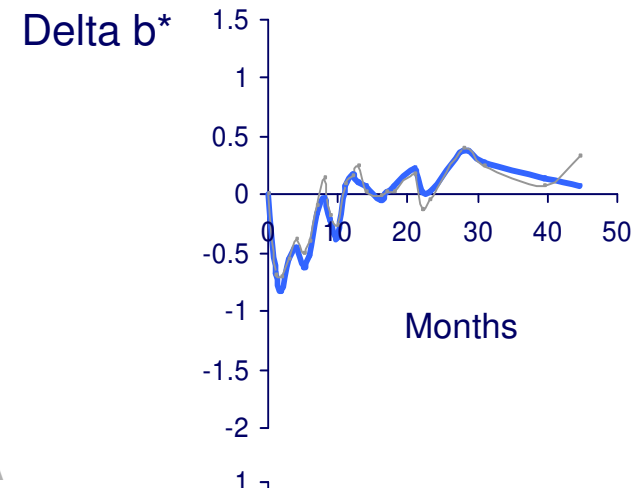
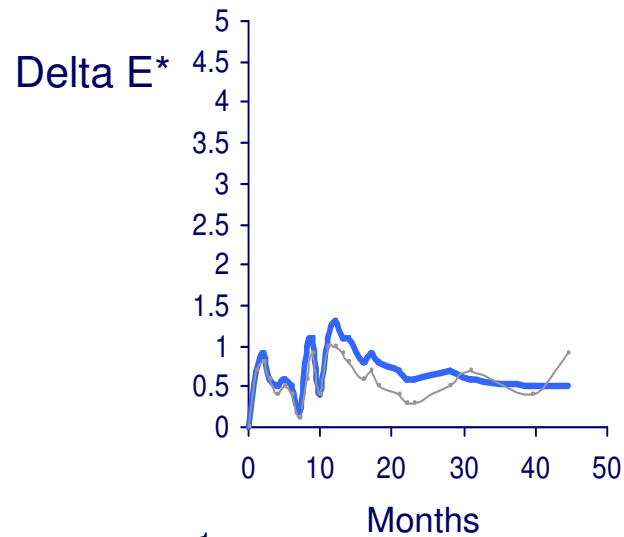


TIONA® 168

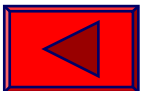
The Durable Alternative



Commercially Produced Profile 2 : Pb-Stabilised Northern Europe* Natural Weathering, 45° South-Facing: Colour Stability

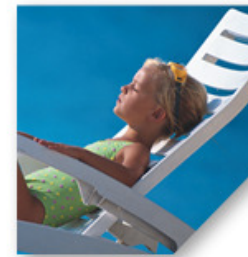


* Nettleton Weathering Station, UK

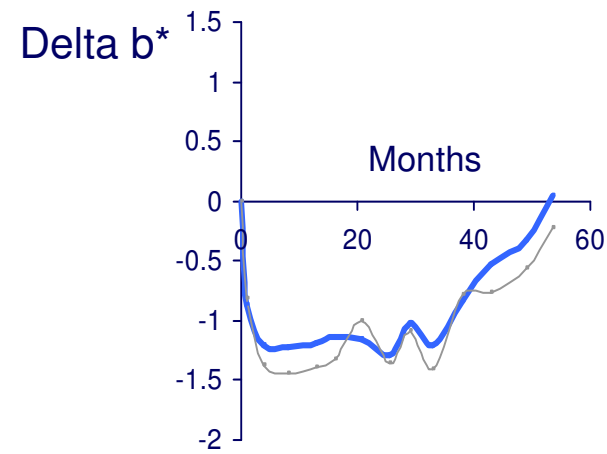
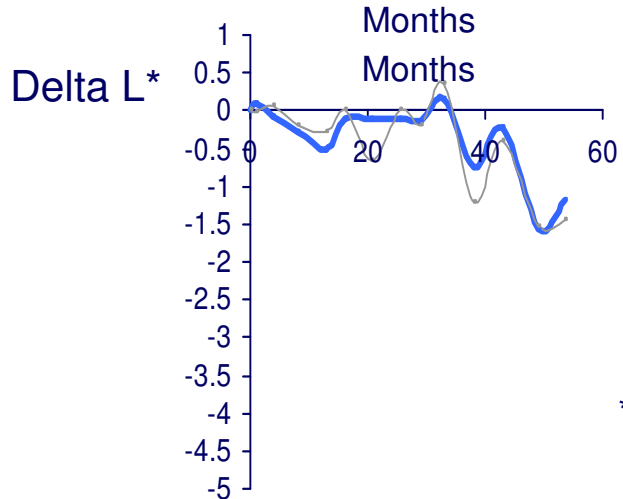
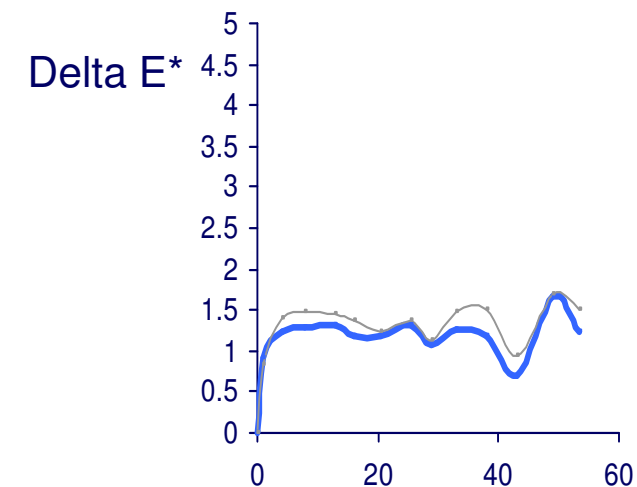


TIONA® 168

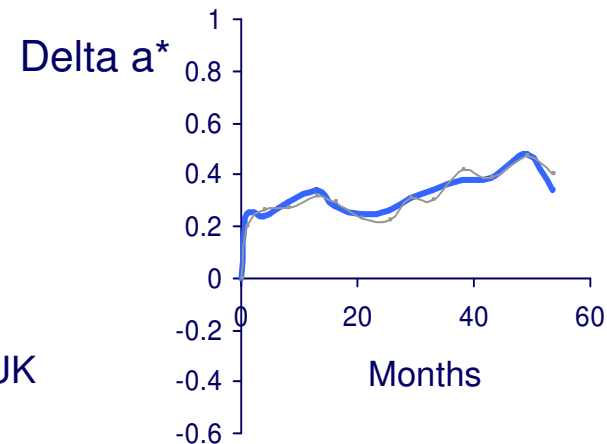
The Durable Alternative



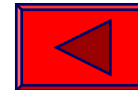
Commercially Produced Profile 3 : Ca/Zn-Stabilised Northern Europe* Natural Weathering, 45° South-Facing: Colour Stability



— Tiona 168
— Competition A

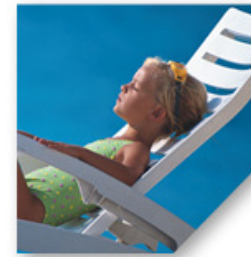


* Nettleton Weathering Station, UK

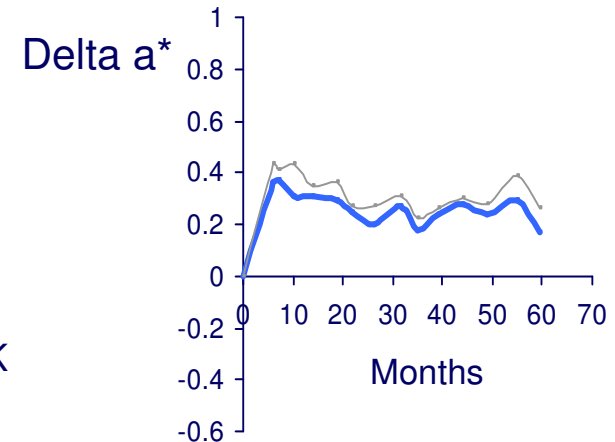
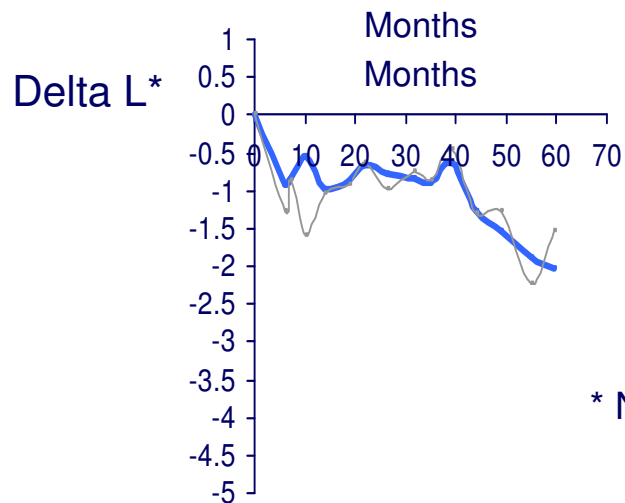
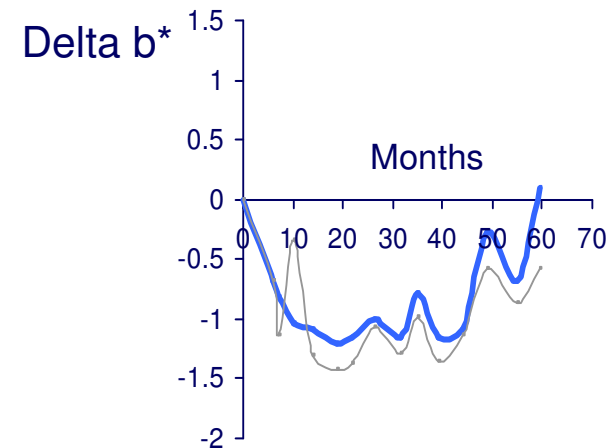
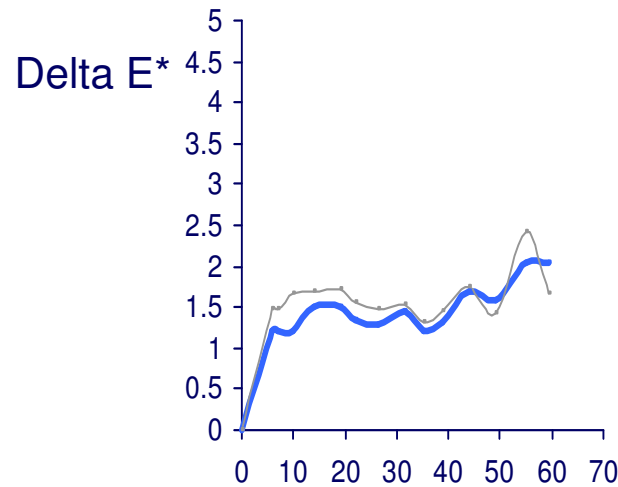


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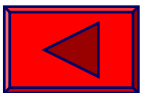
The Durable Alternative



Commercially Produced Profile 4 : Ca/Zn-Stabilised Northern Europe* Natural Weathering, 45° South-Facing: Colour Stability

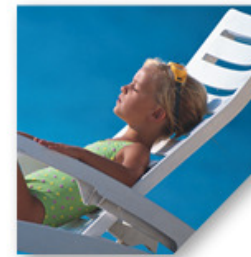


* Nettleton Weathering Station, UK

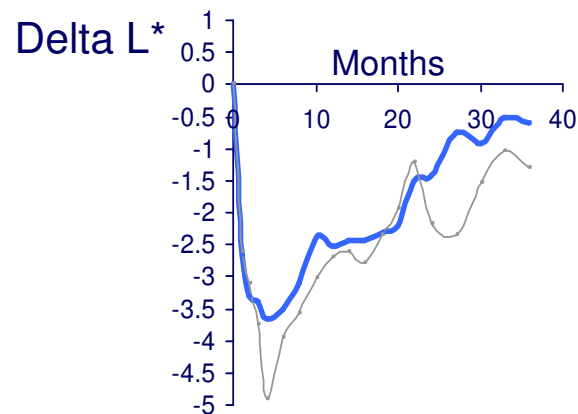
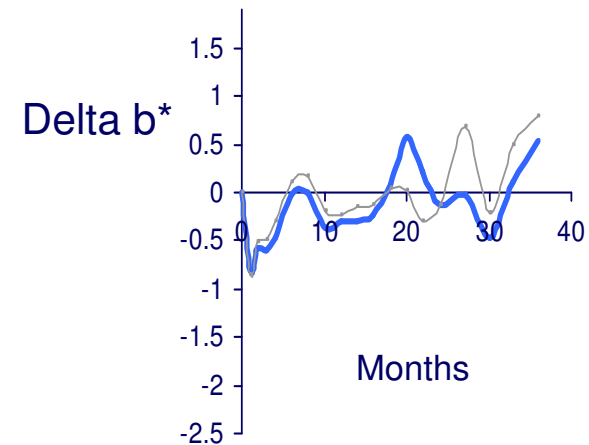
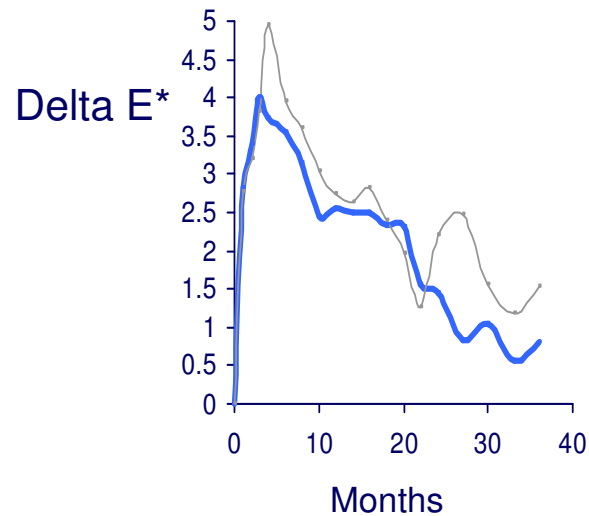


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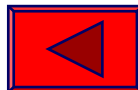
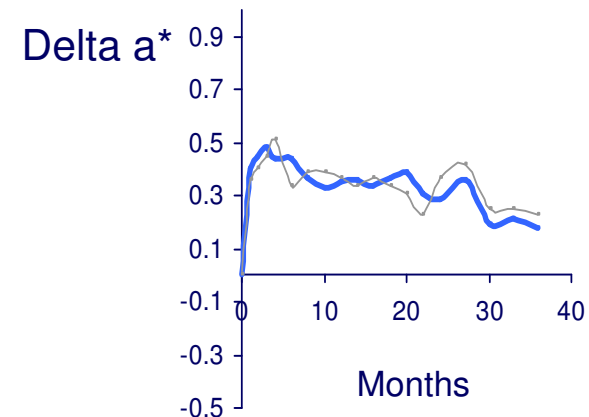
The Durable Alternative



Commercially Produced Profile 1 : Pb-Stabilised Bandol, S. France: Natural Weathering, 45° South-Facing: Colour Stability

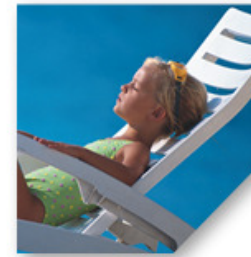


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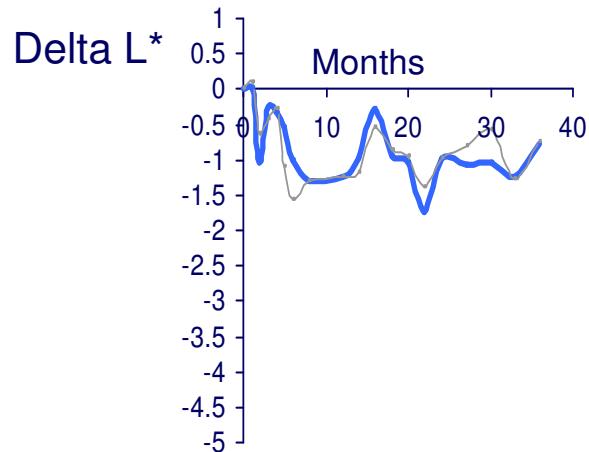
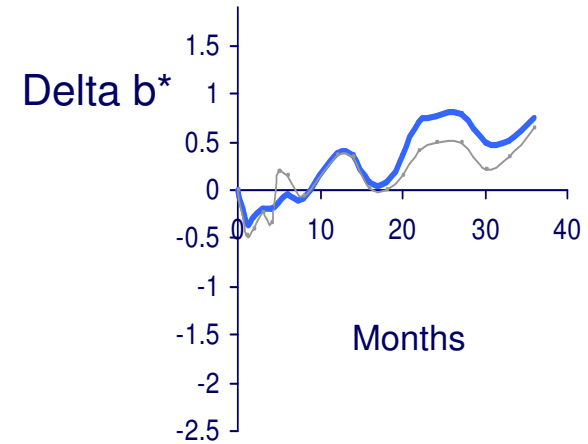
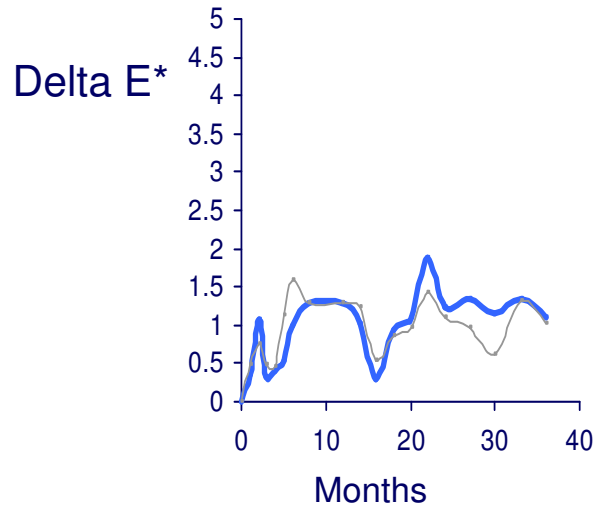


TIONA® 168

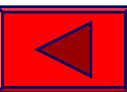
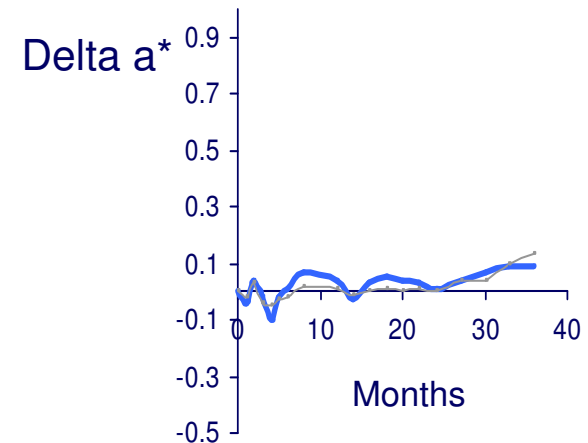
The Durable Alternative



Commercially Produced Profile 2 : Pb-Stabilised Bandol, S. France: Natural Weathering, 45° South-Facing: Colour Stability

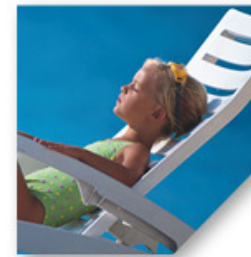


— Tiona 168
— Competition A

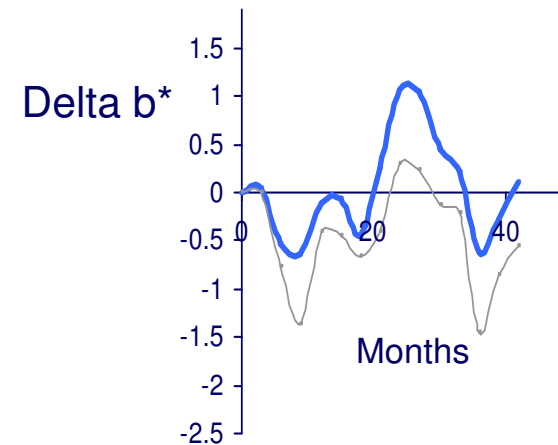
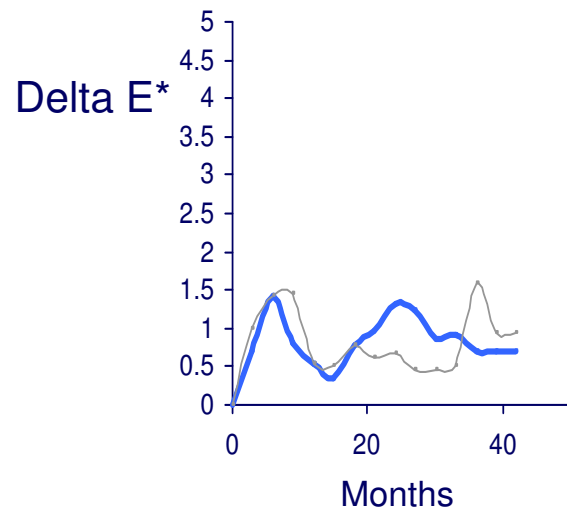


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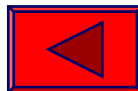
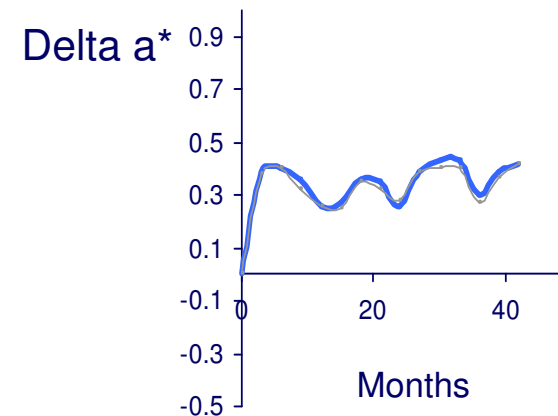
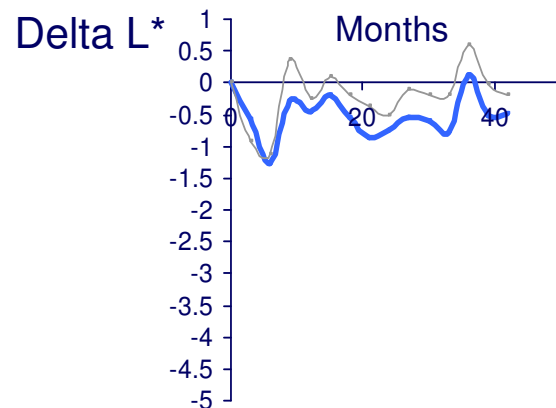
The Durable Alternative



Commercially Produced Profile 3 : Ca/Zn-Stabilised Bandol, S. France: Natural Weathering, 45° South-Facing: Colour Stability

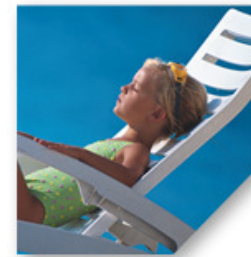


— Tiona 168
— Competition A

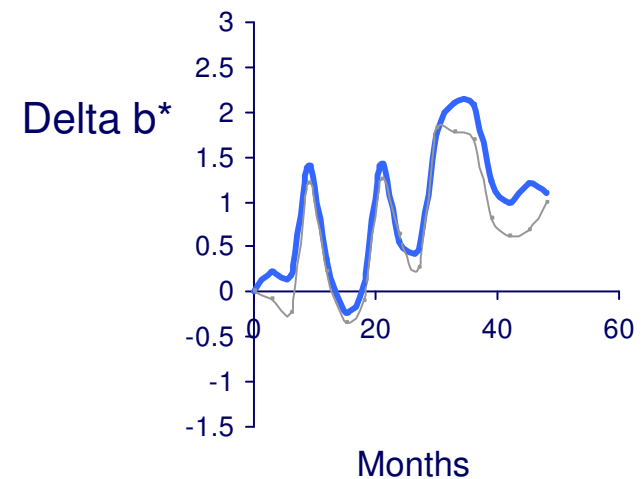
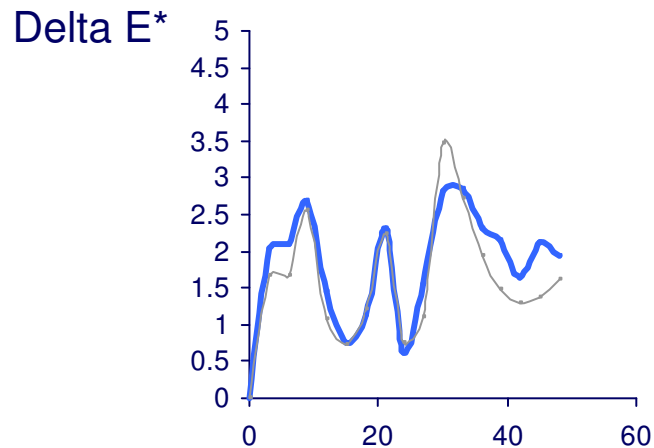


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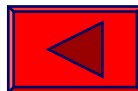
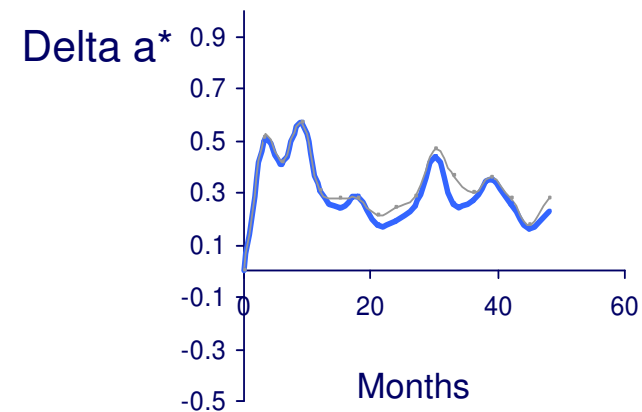
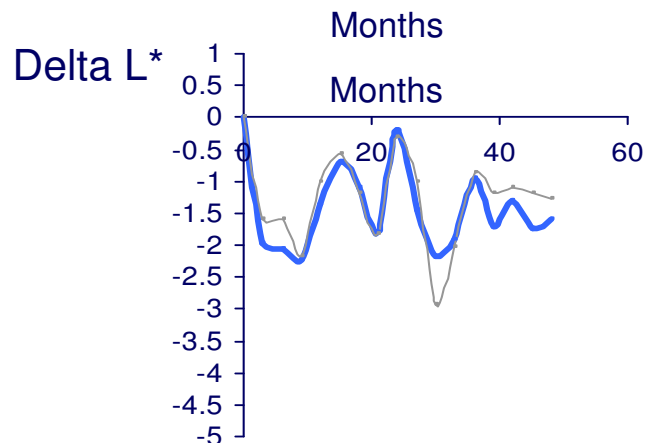
The Durable Alternative



Commercially Produced Profile 4 : Ca/Zn-Stabilised Bandol, S. France: Natural Weathering, 45° South-Facing: Colour Stability

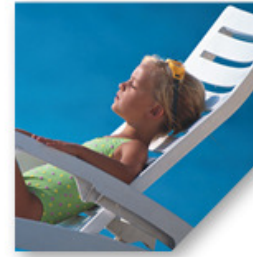


— Tiona 168
— Competition A



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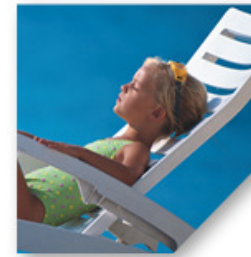


PVC Pinking

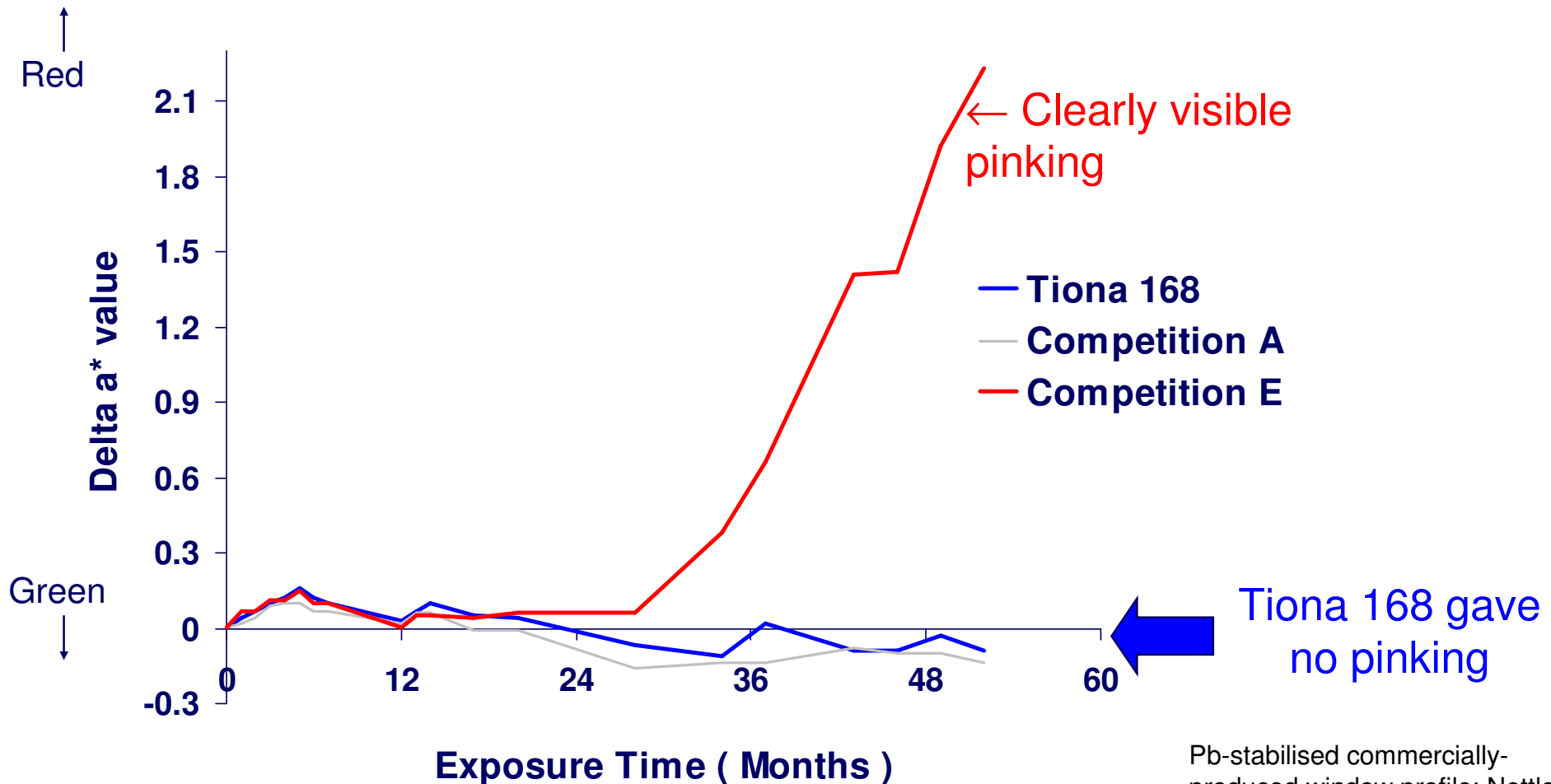
- May occur in Northern European climates, usually with lead-stabilised profiles when exposed to North-facing sunlight. More often seen during cool, wet summers
- Susceptible formulations tend to discolour within 18-36 months of installation

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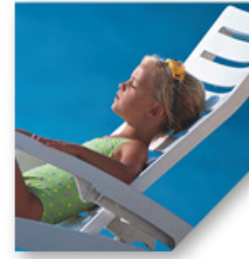
PVC Pinking Example



Pb-stabilised commercially-produced window profile: Nettleton Weathering Station, UK : 90° North-facing. Same formulation bar TiO₂ and same manufacturing conditions for all profiles

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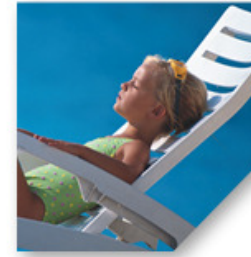


Pinking Resistance

Since the launch of Tiona 168 in 1992
no claims have been made for pinking
or discoloration

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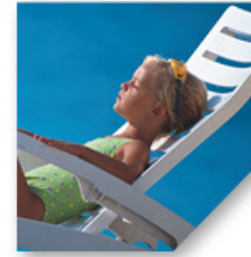


Technical Data

- *Datasheet*
- *Manufacturing Process*
- *Product Testing*

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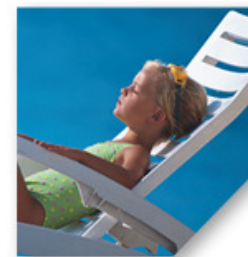
Technical Data Sheet

Typical Properties

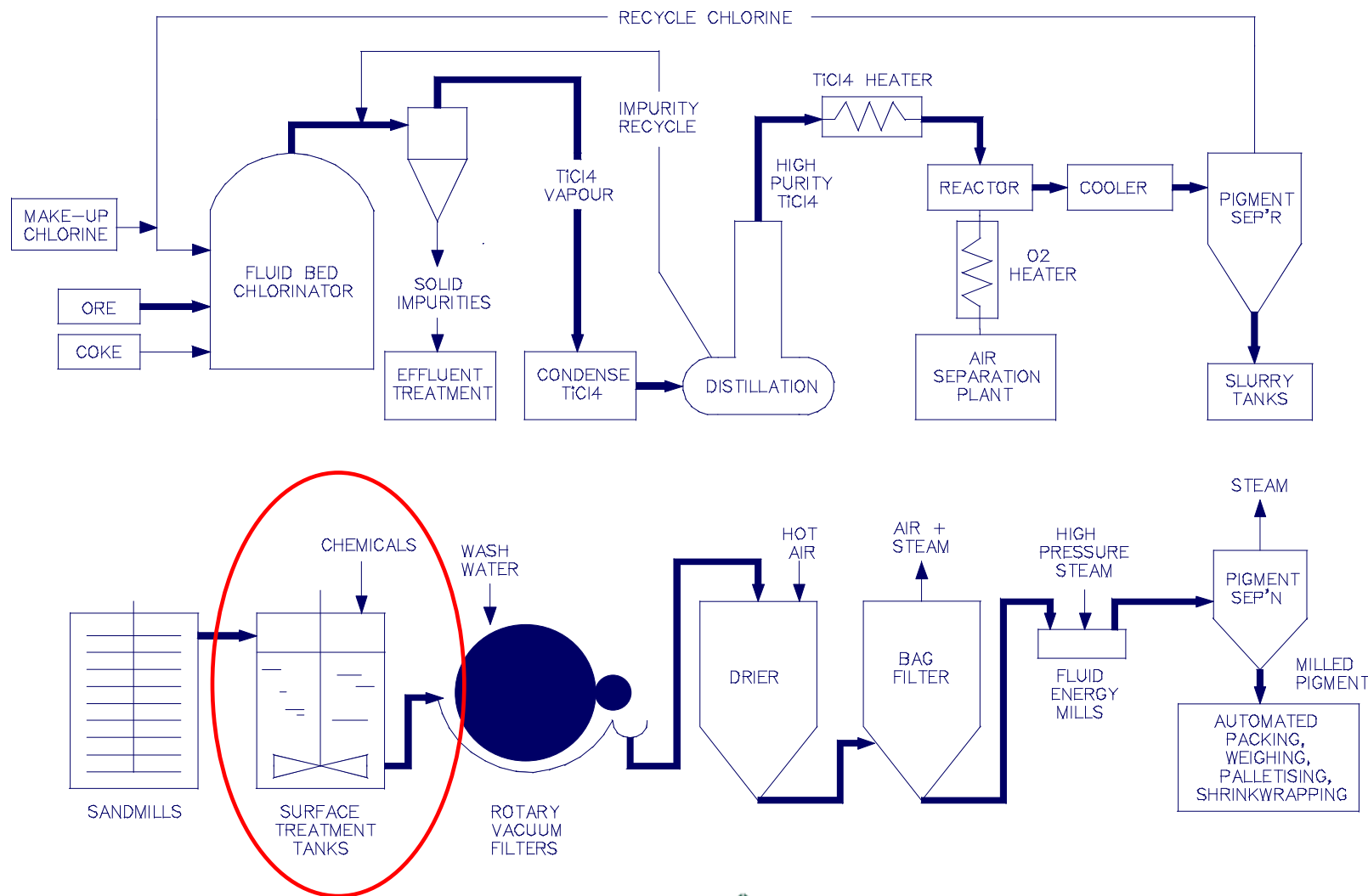
- *Crystal Form:* 100% Rutile
- *TiO₂ Content:* 94%
- *Surface treatment:* Al₂O₃, SiO₂, Organic (hydrophobic)
- *Oil Absorption:* 18g/100g TiO₂
- *Specific Gravity:* 4.1g/cm³
- *Loss at 105°C:* 0.4%

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Manufacturing Process

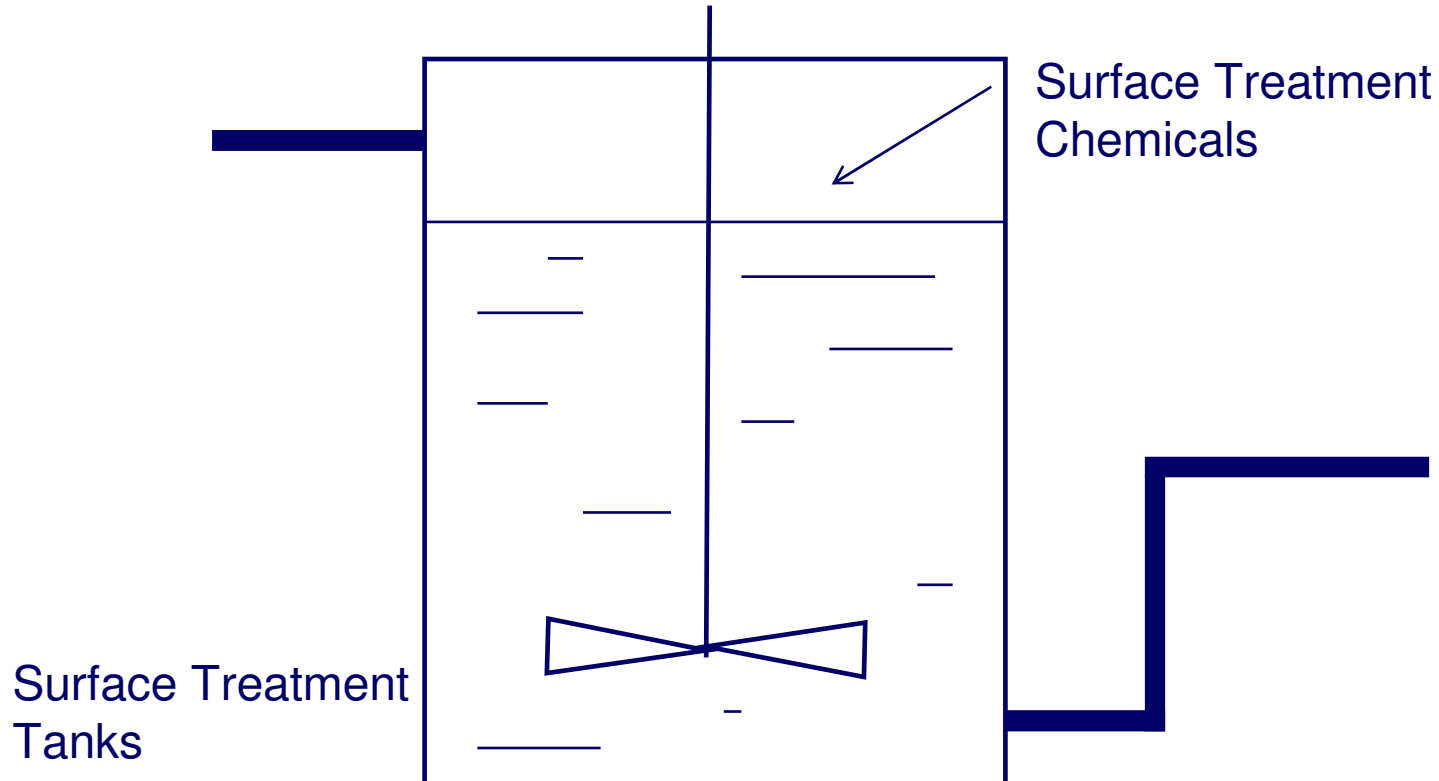


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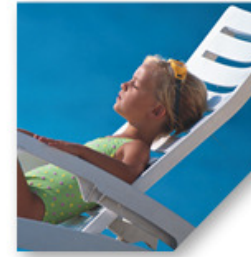


Strict control of surface treatment to ensure reliable, consistent durability performance



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Product Testing

Consistent long-term weathering performance achieved through :

- Sophisticated control of surface treatment using in-process and finished product testing
- Use of specialised photo-activity testing

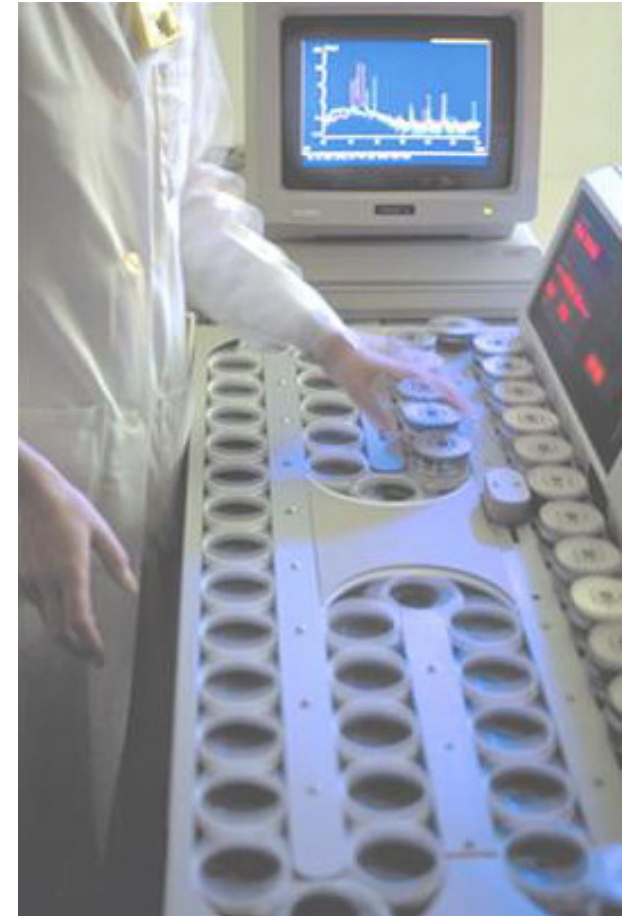
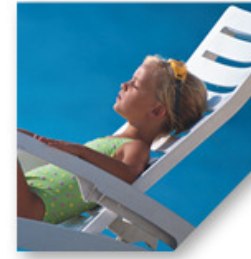


Image: X-ray fluorescence (XRF) analysis of surface treatment

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Offers

Excellent product performance, consistency and reliability backed-up by more than 16 years of product quality and performance data

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Design Concept

- Specifically designed for use in durable PVC applications
- A neutral tone chloride process pigment with high tinting strength and excellent opacity
- A surface treatment developed to ensure consistently good colour stability and weathering resistance



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