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</tbody>
</table>
**annex 1 : Humidity absorption of the cross sections**

Object: Ink application on the surface of the product, on the cross sections.

Execution date: 02.11.2012

Product: Soleo, Careo, Vertigo, Diameo

Outcome: After a week in an ink bath, there is no trace of any ink penetration between the composite wood layer and the aluminum.

The product can be worked like an aluminum profile without taking any particular precaution.

**annex 2 : Delamination resistance in tropical conditions (humidity and temperature variation)**

Object: Delamination resistance of the composite wood layer after exposure to a temperature of 70 Celsius degrees and a humidity rate of 95% during 30 days.

Execution date: 22.02.2013

Product: Soleo, Careo, Vertigo, Diameo

Outcome: No delamination or fissure occurred. The adhesion of the composite wood layer on the aluminum is perfect.

The product can be used in tropical climates conditions without any particular precaution.

**annex 3 : Aging due to sun rays exposure**

Object: Accelerated aging test through the Sunshine Weather-ometer® procedure

Execution date: 17.12.2012

Product: Soleo, Careo, Vertigo, Diameo

Outcome: A delta E of 2.61 after 1000 hours and of 2.53 after 5000 hours for a wood aluminum hybrid profile in the rosewood color. Color variation is tiny.

Profile’s color remains perfectly constant in the time.

**annex 4 : Aging due to UV light, humidity and temperature variations exposure**

Object: UV light resistance test with alternating humidity rates (water projection) and extreme temperatures (from 80 to -50 Celsius degrees).

Execution date: 28.03.2013

Product: Soleo, Careo, Vertigo, Diameo

Outcome: No delamination or fissure occurred. The adhesion of the composite wood layer on the aluminum is perfect. Color stays stable.

The product can be used in any kind of climate, even harshest ones (extreme temperatures, high humidity, very strong sunning).

**annex 5 : Resistance of bended profiles to humidity**

Object: Resistance of a bended profile to humid atmospheres which contains sulfur dioxide through the DIN EN ISO 3231 standard

Date d’obtention: 02.07.2013

Organisme: Institut für Oberflächentechnik GmbH, Germany

Product: Bended Soleo. Radius 500 mm

Outcome: No perceptible change after 24 cycles.

Bended profiles can perfectly be used in humid climates.

**annex 6 : Color stability**

Object: Samples of different colors are exposed to UV light through the JIS K5400(K5600) standard.

Execution date: 15.01.2013

Product: Soleo, Careo, Vertigo, Diameo

Outcome: Depending on the color and the number of hours, the delta E vary from 0,9 to 10,6.

Profile’s color remains perfectly constant in the time. Dark colors are even more stable than light colors.
**annex 7: Resistance of bended profiles to bad weather**

Object | Color and shine change due to meteo and solar radiations exposure through the DIN EN ISO 11341 standard.
---|---
Date d’obtention | 02.07.2013
Organisme | Institut für Oberflächentechnik GmbH, Germany
Product | Bended Soleo. Radius 500 mm
Outcome | No color or shine variation after 1 000 hours of test. Color before the test: ΔE = 39,7 and after the test: ΔE = 37,8. Shine before the test: G = 1,35 and after the test: G = 1,40.

Profile’s color remains perfectly constant in the time. Bended profiles can perfectly be used in high sunlight regions.

**annex 8: Termites resistance**

Object | Termites resistance through the JIS-K-1571-2010 standard.
---|---
Execution date | 17.12.2012
Product | Soleo, Careo, Vertigo, Diameo
Outcome | Little 0.5% loss of weight against 36% for Japanese cedar; Termites death rate of at least 47.6% against 23.5% for Japanese cedar.

The product shows an excellent resistance to termites.

**annex 9: Rot resistance**

Object | Rot resistance through the JIS-K-1571-2010 standard.
---|---
Execution date | 17.12.2012
Product | Soleo, Careo, Vertigo, Diameo
Outcome | After 12 weeks of Fomitopsis Palustris infection, minimal 0.5% weight loss against 27.6% for Japanese cedar. After 12 weeks of Trametes Versicolor infection, no weight loss against 33.4% for Japanese cedar.

The product is perfectly rot-proof.

**annex 10: Brinell hardness & wear**

Object | Measure of the puncture resistance (high hill shoe) and measure of the loss of weight caused by the wear due to pedestrian traffic.
---|---
Execution date | 10.03.2013
Product | Soleo, Careo, Vertigo, Diameo
Outcome | The Soleo profile do have a higher hardness than the teak and the weight loss due to wear is lower than the one of a composite wood product of the second generation, as commonly used for terraces.

The product is extremely wear resistant.

**annex 11: Delamination resistance**

Object | Resistance to the detachment of the composite wood layer from the aluminum one, following an incision through the JIS-K-5600-5-6 standard.
---|---
Execution date | 13.02.2013
Product | Soleo, Careo, Vertigo, Diameo
Outcome | No delamination on the incised parts. Presence of little scales at the intersection of the incisions.

The composite wood layer is perfectly joint to the aluminum.

**annex 12: Treatment and tags cleaning**

Object | Possibility to eliminate tags with a solvent-made or preventive solution in order to enable a water cleaning without damaging the surface of the product.
---|---
Execution date | 14.03.2014
Product | Soleo, Careo, Vertigo, Diameo
Outcome | The GraffiGuardR 2030 enable the elimination of the tag without causing any chemical damage to the surface of the product. This statement is valid for solvent-based paints as well as water-based paint.

Tags on the product can be removed without causing any damage to its surface.
Health – safety – environment

**annex 13 : Reflection factor**

<table>
<thead>
<tr>
<th>Object</th>
<th>Reflection test through the JIS-K-5602.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Execution date</td>
<td>03.06.2013</td>
</tr>
<tr>
<td>Product</td>
<td>Soleo, Careo, Vertigo, Diameo</td>
</tr>
<tr>
<td>Outcomes</td>
<td>The solar radiation is absorbed three times more by the composite wood than by the aluminum.</td>
</tr>
</tbody>
</table>

The absorption of the solar radiation and a very low reflection factor prevent any risk of glare for the neighborhood.

**annex 14 : Fire reaction**

<table>
<thead>
<tr>
<th>Object</th>
<th>Fire reaction test using a radiation located 30 mm away from the test tube during 20 minutes through the NF P 92-501 standard.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date d'obtention</td>
<td>16.04.2013</td>
</tr>
<tr>
<td>Organisme</td>
<td>Centre Scientifique et Technique du Bâtiment (CSTB), Département de Sécurité, Structures et Feu, France</td>
</tr>
<tr>
<td>Product</td>
<td>Soleo, Careo, Vertigo, Diameo</td>
</tr>
<tr>
<td>Outcome</td>
<td>M2 fire ranking awarded.</td>
</tr>
</tbody>
</table>

The product is combustible and hardly flammable.

**annex 17 : Absence of radioactivity**

<table>
<thead>
<tr>
<th>Object</th>
<th>Absence of radioactivity in the product.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date d'obtention</td>
<td>06.12.2012</td>
</tr>
<tr>
<td>Organisme</td>
<td>Unitika Environmental Technical Center Ltd., Japon</td>
</tr>
<tr>
<td>Product</td>
<td>Soleo, Careo, Vertigo, Diameo</td>
</tr>
<tr>
<td>Outcome</td>
<td>No detection of radioactivity</td>
</tr>
</tbody>
</table>

The product is not radioactive.

**annex 18 : Absence of toxic elements**

<table>
<thead>
<tr>
<th>Object</th>
<th>Presence of heavy metals and formaldehyde emission.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisme</td>
<td>Chemical Evaluation and Research Institute, Japon</td>
</tr>
<tr>
<td>Product</td>
<td>Soleo, Careo, Vertigo, Diameo</td>
</tr>
<tr>
<td>Outcomes</td>
<td>No emission of heavy metals and/or formaldehyde detected.</td>
</tr>
</tbody>
</table>

The product is nontoxic.

<table>
<thead>
<tr>
<th>Formaldehyde (CH2O)</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadmium (Cd)</td>
<td>0</td>
</tr>
<tr>
<td>Brominated flame retardants (RFB)</td>
<td>0</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>0</td>
</tr>
<tr>
<td>Polyvinyl chloride (PVC)</td>
<td>0</td>
</tr>
<tr>
<td>Selenium (Se)</td>
<td>0</td>
</tr>
<tr>
<td>Mercury (Hg)</td>
<td>0</td>
</tr>
<tr>
<td>Chromium (Cr)</td>
<td>0</td>
</tr>
<tr>
<td>Arsenic (AS)</td>
<td>0</td>
</tr>
<tr>
<td>Perfluorinated compounds (PFC)</td>
<td>0</td>
</tr>
<tr>
<td>Phtalates (PFO, DBP, BBP, DEHP)</td>
<td>0</td>
</tr>
</tbody>
</table>

**annex 19 : Minimal carbon footprint**

<table>
<thead>
<tr>
<th>Object</th>
<th>Determination of the carbon footprint of the product.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Execution date</td>
<td>14.06.2013</td>
</tr>
<tr>
<td>Product</td>
<td>Soleo, Careo, Vertigo, Diameo</td>
</tr>
<tr>
<td>Outcome</td>
<td>The product has a carbon footprint of 9.005 kg of CO\textsubscript{2} / kg of product.</td>
</tr>
</tbody>
</table>

The carbon footprint is lower than the one of the exotic wood.
Water Penetration Test

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

---

### 1. Objective

The objective of this test was to examine the strength of the interface between the WPC skin and the Aluminum 6063. By applying ink to the product it can be determined if there is any notable penetration between the Aluminum layer and the WPC core over a period of 1 week.

### 2. Test method

1. The test samples are treated by accelerated exposure to hot and cold temperatures: 2 hours at -30°C and 2 hours at 80°C for 50 cycles.
2. Dip the WPC-Aluminum Hybrid samples into a tank filled with 40cm of liquid ink (green color on the 2 pictures).
3. Seal up the case to avoid evaporation of ink and keep at 25°C during 1 week.
4. Rinse off samples with water and keep dry for 1 day.
5. Scrape the WPC material from the Aluminum and investigate the interface between those.

---

### 3. Results

The pictures below show that the yellow ink did not penetrate between the WPC layer and Aluminum core.
Peel-off Test under High Temperature, Humidity & Hot Water

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

### Test Method

- Check the peeling off of the (0.25mm) WPC layer from the aluminium surface after constant high temperature (70 degrees Celsius) and high humidity (95%) during 30 days.
- Check the peeling off of the WPC (0.4mm) layer from the aluminium surface after constant immersion in hot water (80 degrees Celsius) during 14 days.

### Results

- Pictures 1 and 2 show no cracks nor peeled off WPC from the aluminium surface was found.
- A thinner WPC layer does not decrease the compatibility between the WPC layer and the aluminium surface.
- The thickness of the WPC layer does not reduce the durability or longevity of the hybrid profile.
- The aging process of WPC is not related to its thickness.
- A hybrid profile with a 1mm WPC layer needs to be extruded and sanded with greater care and under stricter tolerances than a profile with a 2mm thick WPC layer.
- The quality inspection will be stricter for hybrid profiles delivered with a 1mm WPC layer thickness.
Aging Test

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

---

**Color**

| Rosewood |

**Test method**

Accelerated weathering resistance test using Sunshine WeatherMeter, according to JIS-K1571-2010.

**Test condition**

Black panel temperature: 63 °C

**Spray cycle**

18 minutes in 120 minutes (using ion-exchange water).

---

**Variation of Delta E of the WPC layer:**

<table>
<thead>
<tr>
<th>Test Time (hours)</th>
<th>1000</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
<th>5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta E</td>
<td>2.61</td>
<td>2.01</td>
<td>2.19</td>
<td>2.63</td>
<td>2.53</td>
</tr>
</tbody>
</table>
### Humidity and temperature Test

Tested product: **Soleo**  
Concerned products: **Soleo, Careo, Vertigo, Diameo**

#### 1. Humidity Test

**Test method:**  
Alternate product between water of 60 degrees Celsius for 5 days and dry conditions at 80 degrees Celsius for 2 days, during 45 cycles.

**Results:**  
Passed without changes to product surface  
No cracks nor change in color has been observed.

#### 2. Temperature Test

**Test method:**  
Alternate product between -20 degrees Celsius for 2 hours and 80 degrees Celsius for 2 hours, during 50 cycles.

**Results:**  
Passed without changes to product surface.  
No cracks nor change in color.
3. SUV Test

Test method:
Submit product to 2000 hours of UV radiation.

Test Machine:
SUV-W151 EYE Super UV tester / Iwasaki Electric co., Ltd.

Results:
• The Total Color Change (Delta E) showed an immediate color change due to fade of wood powder after 100 hours but very little further change up to 2000 hours of exposure.

• Following the test the material surface is smooth and does not show any cracks nor peeled-off surface layers.

• 1000 hours is generally considered equal to twenty years of outdoor usage.
Resistance to humidity of bended profiles

Tested product: Soleo
Concerned products: Soleo, Careo, Vertigo, Diameo

Rapport d'essais

client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
numéro de commande: SAP-4066

Réception des échantillons:
22.04.2013 (par la poste)

Échantillons:

<table>
<thead>
<tr>
<th>Nombre</th>
<th>Désignation / N°</th>
<th>Superficie</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 pièces</td>
<td>Profilé en bois cintré Soleo 11</td>
<td></td>
</tr>
</tbody>
</table>

Test:

<table>
<thead>
<tr>
<th>Test / Norme</th>
<th>Durée du test</th>
<th>Appareil utilisé pour le test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eau condensée-variation climatique avec 0.2 l SO2 selon la norme DIN EN ISO 3231*</td>
<td>24 cycles</td>
<td>A-SC KBG 400, Fa. Liebsch</td>
</tr>
</tbody>
</table>

Exigence:
aaprés 24 cycles: aucun changement visible

Résultat:

<table>
<thead>
<tr>
<th>Échantillons</th>
<th>Date de début</th>
<th>Durée du test</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 échantillons</td>
<td>26.04.13</td>
<td>24 cycles</td>
<td>aucun changement visible</td>
</tr>
</tbody>
</table>

Évaluation:

Les échantillons ont satisfait aux exigences.

Commentaires / Annexe:

Documentation imagée en annexe

Schwäbisch Gmünd, 02.07.2013

Direction du laboratoire
Rapport d'essais

client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz

 numéro de commande: SAP-4066

Documentation imagée

Image 1 – Échantillons après le test

Image 2 – Échantillons après le test
Color Stability Test

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

Colors:
Rosewood, ebony, paldao, teak.

Objective:
Submit four color samples to SUV and SWOM tests.

Method:
The samples were mounted and exposed to an SUV according to standard JIS K5400 (K5600).

Results:
The initial color and color stability are provided in the following table.

Table 1: EYE Super UV Tester (Accelerated UV Testing)

<table>
<thead>
<tr>
<th>Colors:</th>
<th>Duration</th>
<th>Date</th>
<th>ΔE</th>
<th>ΔL</th>
<th>Δa</th>
<th>Δb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosewood</td>
<td>100H</td>
<td>121120</td>
<td>4.3</td>
<td>4.3</td>
<td>0.3</td>
<td>-0.5</td>
</tr>
<tr>
<td></td>
<td>200H</td>
<td>121126</td>
<td>5.6</td>
<td>5.4</td>
<td>0.2</td>
<td>-1.2</td>
</tr>
<tr>
<td></td>
<td>300H</td>
<td>121204</td>
<td>5.6</td>
<td>5.5</td>
<td>0.7</td>
<td>-0.8</td>
</tr>
<tr>
<td></td>
<td>400H</td>
<td>121211</td>
<td>5.6</td>
<td>5.4</td>
<td>0.9</td>
<td>-0.6</td>
</tr>
<tr>
<td></td>
<td>500H</td>
<td>121221</td>
<td>5.4</td>
<td>5.3</td>
<td>1.3</td>
<td>-0.4</td>
</tr>
<tr>
<td></td>
<td>600H</td>
<td>121226</td>
<td>6.2</td>
<td>6.0</td>
<td>1.6</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>700H</td>
<td>130115</td>
<td>6.1</td>
<td>5.8</td>
<td>1.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Ebony</td>
<td>100H</td>
<td>121016</td>
<td>0.9</td>
<td>0.1</td>
<td>0.2</td>
<td>-0.9</td>
</tr>
<tr>
<td></td>
<td>200H</td>
<td>121023</td>
<td>3.2</td>
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<td>0.3</td>
<td>-1.4</td>
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<td></td>
<td>300H</td>
<td>121029</td>
<td>4.3</td>
<td>-3.8</td>
<td>0.1</td>
<td>-2.0</td>
</tr>
<tr>
<td></td>
<td>400H</td>
<td>121108</td>
<td>5.0</td>
<td>-4.5</td>
<td>0.1</td>
<td>-2.2</td>
</tr>
<tr>
<td></td>
<td>500H</td>
<td>121114</td>
<td>5.7</td>
<td>-5.2</td>
<td>0.1</td>
<td>-2.4</td>
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<tr>
<td>Paldao</td>
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<td>4.2</td>
<td>0.5</td>
<td>0.7</td>
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<td></td>
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<td>121023</td>
<td>2.8</td>
<td>2.0</td>
<td>1.1</td>
<td>1.6</td>
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<td></td>
<td>300H</td>
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<td>1.3</td>
<td>1.3</td>
<td>1.2</td>
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<td>400H</td>
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<td>2.09</td>
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<td>10.1</td>
<td>1.8</td>
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<td>8.4</td>
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<td>10.6</td>
<td>2.0</td>
<td>5.6</td>
<td>8.7</td>
</tr>
</tbody>
</table>
### Table 2: Sunshine Weather Meter (Sunshine Carbon Arc)

<table>
<thead>
<tr>
<th>Duration</th>
<th>Date</th>
<th>color difference</th>
<th>ΔE</th>
<th>ΔL</th>
<th>Δa</th>
<th>Δb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ebony</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100H</td>
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<td>2.46</td>
<td>-0.07</td>
<td>-0.03</td>
<td>-2.46</td>
<td></td>
</tr>
<tr>
<td>200H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>300H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paldao</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100H</td>
<td>121204</td>
<td>4.57</td>
<td>4.51</td>
<td>0.29</td>
<td>-0.68</td>
<td></td>
</tr>
<tr>
<td>200H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>300H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teak</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100H</td>
<td>121204</td>
<td>6.33</td>
<td>5.25</td>
<td>1.63</td>
<td>3.15</td>
<td></td>
</tr>
<tr>
<td>200H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>300H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Resistance to bad weather of bended profiles

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

---

**Rapport d’essais**

**client:** Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz

**numéro de commande:** SAP-4066

**Réception des échantillons:**

09.04.2013 (par la poste)

**Échantillons:**

<table>
<thead>
<tr>
<th>Nombre</th>
<th>Désignation / N°</th>
<th>Superficie</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pièce</td>
<td>Profilé en bois cintré Soleo 10</td>
<td></td>
</tr>
</tbody>
</table>

**Test:**

Test / Norme | Durée du test | Appareil utilisé pour le test
---|---|---
Intempéries accélérées selon la norme DIN EN ISO 11341* | 1000h | XXL+, Fa. Atlas

**Exigence:**

après 1000h: aucun changement de couleur ni d’éclat

**Résultat:**

<table>
<thead>
<tr>
<th>Échantillon</th>
<th>Date de début</th>
<th>Durée du test</th>
<th>Évaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 échantillon</td>
<td>15.04.13</td>
<td>1000h</td>
<td>Couleur: avant le test: ΔE = 39,7 après le test: ΔE = 37,8 Éclat: avant le test: G = 1,35 après le test: G = 1,40</td>
</tr>
</tbody>
</table>

**Évaluation:**

L’échantillon a satisfait aux exigences.

**Commentaires / Annexe:**

Documentation imagée en annexe

Schwäbisch Gmünd, 02.07.2013

Direction du laboratoire
Rapport d'essais

client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
numéro de commande: SAP-4066

Documentation imagée

Image 1 – Échantillon testé (point de mesure marqué)
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz  
Job number: 6523

Sample Date:  
2014-02-18 (mailing)

Samples:  
Count | Name / No.  
--- | ---  
4 pieces | Profile: Geolam  
| Type: Soleo 5  
| Sample size: 150 x 120 x 7 mm  
| Color: ebony

Tests:  
| Name / Standard | Time | Equipment  
--- | --- | ---  
Sulfur dioxide corrosion testing in an alternating atmosphere with 0,2 l SO₂ / DIN EN ISO 3231* | 24 Cycles | A-SC KBG 400, Fa. Liebisch

Requirements:  
-

Results:  
| Sample | Test | Time | Evaluation  
--- | --- | --- | ---  
2 samples | SO₂-test | 24 cycles | no visible change

Assessment:  
-

Comments / Attachments:  
Image documentation after testing.  
The tested samples from SO₂-test were visually compared with a reference sample.

Schwäbisch Gmünd, 2014-05-19

Laboratory manager/ Dr. Papendorf  
Deputy of Laboratory manager/ W. Noack
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sä
Job number: 6523

Image documentation

Image 1 – samples after SO₂ testing, on the left reference
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6523

Sample Date:
2014-02-18 (mailing)

Samples:

<table>
<thead>
<tr>
<th>Count</th>
<th>Name / No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Profile: Geolam</td>
</tr>
<tr>
<td></td>
<td>Type: Soleo 10</td>
</tr>
<tr>
<td></td>
<td>Sample size: 150 x 120 x 7 mm</td>
</tr>
<tr>
<td></td>
<td>Color: ebony</td>
</tr>
</tbody>
</table>

Tests:

<table>
<thead>
<tr>
<th>Name / Standard</th>
<th>Time</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide corrosion testing in an alternating atmosphere with 0,2 l SO₂ / DIN EN ISO 3231*</td>
<td>24 Cycles</td>
<td>A-SC KBG 400, Fa. Liebisch</td>
</tr>
</tbody>
</table>

Requirements:

- 

Results:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Test</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 samples</td>
<td>SO₂-test</td>
<td>24 cycles</td>
<td>no visible change</td>
</tr>
</tbody>
</table>

Assessment:

-

Comments / Attachments:

Image documentation after testing.
The tested samples from SO₂-test were visually compared with a reference sample.

Schwäbisch Gmünd, 2014-05-19

Laboratory manager/ Dr. Papendorf
Deputy of Laboratory manager/ W. Noack
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6523

Image documentation

Image 1 – samples after SO₂ testing, on the left reference
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6658

Sample Date:
2014-05-09 (mailing)

Samples:

<table>
<thead>
<tr>
<th>Count</th>
<th>Name / No.</th>
</tr>
</thead>
</table>
| 3 pieces | Profile: Geolam  
Type: Soleo 7025  
Sample size: 130 x 50 x 30 mm curved  
Radius: 500 mm  
Color: ebony |

Tests:

<table>
<thead>
<tr>
<th>Name / Standard</th>
<th>Time</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt spray tests /DIN EN ISO 9227 NSS*</td>
<td>1000h</td>
<td>MSC 1000, Fa. Liebisch</td>
</tr>
</tbody>
</table>

Requirements: 
-

Results:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Test</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 pieces</td>
<td>NSS</td>
<td>240h</td>
<td>no visible change</td>
</tr>
<tr>
<td>480h</td>
<td>Slightly visible change, white spots are salt residues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>720h</td>
<td>Samples appear brighter than at the beginning and the wood surface is roughened.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000h</td>
<td>Samples appear brighter and matt than at the beginning and the wood surface is roughened.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Assessment: 
-

Comments / Attachments:
Image documentation at the beginning, after 240h, 480h, 720h and 1000h testing.

Schwäbisch Gmünd, 2014-05-20

Laboratory manager/ Dr. Papendorf  
Deputy of Laboratory manager/ W. Noack
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6658

Image documentation

Image 1 – samples at the beginning

Image 2 – samples after 240h NSS
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6658

Accredited by DAkkS (Deutsche Akkreditierungsstelle GmbH) according to German Industrial Standard DIN EN ISO/IEC 17025 accredited test laboratory. The accredited test methods are marked with the Symbol *.

IfO - Institut für Oberflächentechnik GmbH
Alexander-von-Humboldt-Str. 19
D-73529 Schwäbisch Gmünd
Managing Directors: Hans Pfeifer, Michael Müller
Magistrates Court Ulm HRB 701796
VAT/USt-ID: DE 177718678
Phone +49 7171 10407-0, www.ifo-gmbh.de

Bank details: BW Bank
Bank Code 600 501 01
Account No. 800 8891
SWIFT/BIC: SOLA DE ST
IBAN: DE63 6005 0101 0008 0088 91
Inland Revenue Schwäbisch Gmünd
Tax no.: 83085/24935

Image 3 – samples after 480h NSS

Image 4 – samples after 720h NSS
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6658

Image 5 – samples after 1000h NSS
Rapport d’essais

client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
numéro de commande: SAP-4066

Réception des échantillons:
09.04.2013 (par la poste)

Échantillons:
<table>
<thead>
<tr>
<th>Nombre</th>
<th>Désignation / N°</th>
<th>Superficie</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pièce</td>
<td>Profilé en bois cintré Soleo 10</td>
<td></td>
</tr>
</tbody>
</table>

Test:
<table>
<thead>
<tr>
<th>Test / Norme</th>
<th>Durée du test</th>
<th>Appareil utilisé pour le test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intempéries accélérées selon la norme DIN EN ISO 11341*</td>
<td>1000h</td>
<td>XXL+, Fa. Atlas</td>
</tr>
</tbody>
</table>

Exigence:
après 1000h: aucun changement de couleur ni d’éclat

Résultat:
<table>
<thead>
<tr>
<th>Échantillons</th>
<th>Date de début</th>
<th>Durée du test</th>
<th>Évaluation</th>
</tr>
</thead>
</table>
| 1 échantillon | 15.04.13 | 1000h | Couleur: avant le test: ΔE = 39,7  
après le test: ΔE = 37,8  
Éclat: avant le test: G = 1,35  
après le test: G = 1,40 |

Évaluation:
L’échantillon a satisfait aux exigences.

Commentaires / Annexe:
Documentation imagée en annexe

Schwäbisch Gmünd, 02.07.2013

Direction du laboratoire
Rapport d’essais

client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
numéro de commande: SAP-4066

Durch die DAkkS (Deutsche Akkreditierungsstelle GmbH) nach DIN EN ISO/IEC 17025 akkreditiertes Prüflabor.
Die akkreditierten Prüfverfahren sind mit dem Symbol * gekennzeichnet.

IfO - Institut für OberflächenTechnik GmbH
Alexander-von-Humboldt-Str. 19
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IBAN: DE63 6005 0101 0008 0088 91
Finanzamt Schwäbisch Gmünd
Steuernr.: 83085/24935

Image 1 – Échantillon testé (point de mesure marqué)
# Test Report

**Client:** Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz  
**Job number:** 6523

**Sample Date:** 2014-02-18 (mailing)

## Samples:

<table>
<thead>
<tr>
<th>Count</th>
<th>Name / No.</th>
</tr>
</thead>
</table>
| 2 pieces | Profile: Geolam  
| | Type: Soleo 10  
| | Sample size: 150 x 120 x 7 mm  
| | Color: ebony |

## Tests:

<table>
<thead>
<tr>
<th>Name / Standard</th>
<th>Time</th>
<th>Equipment</th>
</tr>
</thead>
</table>

**Requirements:**  
Suntest after 1000h: no changes in color and gloss

## Results:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Test</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| 1 samples | Suntest | 1000h | Color after testing: ΔE = 2,4  
| | | | Gloss: before testing: G = 3,8  
| | | | after testing: G = 2,9 |

**Assessment:**  
The samples fulfil the requirements.

**Comments / Attachments:**  
Image documentation after testing.  
The color and gloss determination of the sample was carried out by measurement before and after the Suntest on the same sample. The gloss was determined at 85° measuring angle.

Schwäbisch Gmünd, 2014-05-19

Laboratory manager/ Dr. Papendorf  
Deputy of Laboratory manager/ W. Noack
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6523

Image documentation

Image 1 – samples after 1000h Suntest, on the left reference
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6523

Sample Date: 2014-02-18 (mailing)

Samples:
Count | Name / No.
2 pieces | Profile: Geolam
| Type: Soleo 0
| Sample size: 150 x 120 x 7 mm
| Color: ebony

Tests:

<table>
<thead>
<tr>
<th>Name / Standard</th>
<th>Time</th>
<th>Equipment</th>
</tr>
</thead>
</table>

Requirements:
Suntest after 1000h: no changes in color and gloss

Results:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Test</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 samples</td>
<td>Suntest</td>
<td>1000h</td>
<td>Color after testing: ( \Delta E = 2,7 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gloss: before testing: ( G = 1,6 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>after testing: ( G = 1,4 )</td>
</tr>
</tbody>
</table>

Assessment:
The samples fulfil the requirements.

Comments / Attachments:
Image documentation after testing.
The color and gloss determination of the sample was carried out by measurement before and after the Suntest on the same sample. The gloss was determined at 85° measuring angle.

Schwäbisch Gmünd, 2014-05-19

Laboratory manager/ Dr. Papendorf
Deputy of Laboratory manager/ W. Noack
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6523

Image documentation

Image 1 – samples after 1000h Suntest, on the left reference
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6523

Sample Date:
2014-02-18 (mailing)

Samples:

<table>
<thead>
<tr>
<th>Count</th>
<th>Name / No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 pieces</td>
<td>Profile: Geolam</td>
</tr>
<tr>
<td></td>
<td>Type: Soleo 5</td>
</tr>
<tr>
<td></td>
<td>Sample size: 150 x 120 x 7 mm</td>
</tr>
<tr>
<td></td>
<td>Color: ebony</td>
</tr>
</tbody>
</table>

Tests:

<table>
<thead>
<tr>
<th>Name / Standard</th>
<th>Time</th>
<th>Equipment</th>
</tr>
</thead>
</table>

(DIN EN ISO 11341* withdrawn)

Requirements:
Suntest after 1000h: no changes in color and gloss

Results:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Test</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 samples</td>
<td>Suntest</td>
<td>1000h</td>
<td>Color after testing: ΔE = 2,7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gloss: before testing: G = 5,5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>after testing: G = 5,5</td>
</tr>
</tbody>
</table>

Assessment:
The samples fulfil the requirements.

Comments / Attachments:
Image documentation after testing.
The color and gloss determination of the sample was carried out by measurement before and after the Suntest on the same sample. The gloss was determined at 85° measuring angle.

Schwäbisch Gmünd, 2014-05-19

Laboratory manager/ Dr. Papendorf
Deputy of Laboratory manager/ W. Noack
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6523

Image documentation

Image 1 – samples after 1000h Suntest, on the left reference
# Test Report

**Client:** Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz  
**Job number:** 6523

**Sample Date:**  
2014-02-18 (mailing)

**Samples:**

<table>
<thead>
<tr>
<th>Count</th>
<th>Name / No.</th>
</tr>
</thead>
</table>
| 2 pieces | Profile: Geolam  
Type: Soleo 11.0  
Sample size: 150 x 50 x 30 mm  
Color: ebony |

**Tests:**

<table>
<thead>
<tr>
<th>Name / Standard</th>
<th>Time</th>
<th>Equipment</th>
</tr>
</thead>
</table>

**Requirements:**
Suntest after 1000h: no changes in color and gloss

**Results:**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Test</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| 1 samples | Suntest | 1000h | Color after testing: ΔE = 2.6  
Gloss: before testing: G = 3.3  
after testing: G = 3.3 |

**Assessment:**

The samples fulfil the requirements.

**Comments / Attachments:**

Image documentation after testing  
The color and gloss determination of the sample was carried out by measurement before and after the Suntest on the same sample. The gloss was determined at 85° measuring angle.

Schwäbisch Gmünd, 2014-05-19

Laboratory manager/ Dr. Papendorf  
Deputy of Laboratory manager/ W. Noack
Test Report

Client:          Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number:      6523

Image documentation

Image 1 – samples after 1000h Suntest, on the left reference
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6523

Sample Date:
2014-02-18 (mailing)

Samples:

<table>
<thead>
<tr>
<th>Count</th>
<th>Profile / No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Geolam</td>
</tr>
<tr>
<td></td>
<td>Type: Soleo 5</td>
</tr>
<tr>
<td></td>
<td>Sample size: 150 x 120 x 7 mm</td>
</tr>
<tr>
<td></td>
<td>Color: ebony</td>
</tr>
</tbody>
</table>

Tests:

<table>
<thead>
<tr>
<th>Name / Standard</th>
<th>Time</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide corrosion testing in an alternating atmosphere with 0,2 l SO₂ / DIN EN ISO 3231*</td>
<td>24 Cycles</td>
<td>A-SC KBG 400, Fa. Liebisch</td>
</tr>
</tbody>
</table>

Requirements:

SO₂-test after 24 cycles: no visible change
Sunset after 1000h: no changes in color and gloss

Results:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Test</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 samples</td>
<td>SO₂-test</td>
<td>24 cycles</td>
<td>no visible change</td>
</tr>
<tr>
<td>1 samples</td>
<td>Suntest</td>
<td>1000h</td>
<td>Color after testing: ΔE = 2,7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gloss: before testing: G = 5,5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>after testing: G = 5,5</td>
</tr>
</tbody>
</table>

Assessment:

The samples fulfil the requirements.

Comments / Attachments:

Image documentation after testing.
The tested samples from SO₂-test were visually compared with a reference sample. The color and gloss determination of the sample was carried out by measurement before and after the Suntest on the same sample. The gloss was determined at 85° measuring angle.

Schwäbisch Gmünd, 2014-05-09

Laboratory manager/ Dr. Papendorf | Deputy of Laboratory manager/ W. Noack
Test Report

Client: Geolam Management GmbH, Churerstraße 47, CH-8808 Pfäffikon Sz
Job number: 6523

Image documentation

Image 1 – samples after SO₂ testing, on the left reference

Image 2 – samples after 1000h Suntest, on the left reference
Termite Resistance test

Tested product: **Hybrid samples**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

**Test method:** JIS-K-1571-2010

<table>
<thead>
<tr>
<th></th>
<th>Weight loss (mg)</th>
<th>Weight loss (%)</th>
<th>Termite mortality rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid profile</td>
<td>4.8</td>
<td>0.1</td>
<td>50.1</td>
</tr>
<tr>
<td>Japanese Cedar sapwood</td>
<td>4.8</td>
<td>34.6</td>
<td>23.5</td>
</tr>
</tbody>
</table>

**Testing picture:**

![Testing picture](image-url)
Rot Resistance test

Tested product: Hybrid samples
Concerned products: Soleo, Careo, Vertigo, Diameo

Test method: JIS-K-1571-2010

<table>
<thead>
<tr>
<th></th>
<th>Fomitopsis palustris after 12 weeks</th>
<th>Trametes versicolor after 12 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid profile - sanded</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>Hybrid profile – not sanded</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Japanese Cedar sapwood</td>
<td>27.6</td>
<td>33.4</td>
</tr>
</tbody>
</table>

Testing picture
# Hardness and Abrasion test

Tested product: **Soleo**  
Concerned products: **Soleo, Careo, Vertigo, Diameo**

## 1. Hardness - Brinell Scale

The Brinell scale characterizes the indentation hardness of materials through the scale of penetration of an indenter, loaded on a material test-piece. It is one of several definitions of hardness in materials science.

<table>
<thead>
<tr>
<th>Natural wood - Beech</th>
<th>Natural wood - Teak</th>
<th>Soleo (between the rib)</th>
<th>Soleo (on the rib)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brinell scale (N/mm²)</td>
<td>19.5</td>
<td>24.5</td>
<td>26.8</td>
</tr>
</tbody>
</table>

**Results:**  
the Soleo profile can be used for decking and is harder than teak and beech natural wood.

## 2. Abrasion Resistance

Abrasion is a measurement of weight loss by a sample being impacted by repeated abrasion force using sandpaper.

<table>
<thead>
<tr>
<th>1000g, 500 rotations</th>
<th>Blank (g)</th>
<th>Results (g)</th>
<th>Weight loss (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soleo</td>
<td>51.236</td>
<td>51.168</td>
<td>0.068</td>
</tr>
<tr>
<td>WPC dec</td>
<td>79.482</td>
<td>79.253</td>
<td>0.229</td>
</tr>
</tbody>
</table>

**Tested by JAS Flooring A method**

**Results:**  
The abrasion test shows that the Soleo profile do carry as stronger resistance to abrasion than any WPC decking profile.
Resistance to Peeling off of Surface Material

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

### 1. Scope

This testing standard is defined by JIS-K-a5600-5-6 (Testing methods for paints - Part 5: Mechanical property of film - Section 6: Adhesion test). It specifies a test method for assessing the resistance of WPC surface layer to separation from the Aluminum surface when a right angle lattice pattern is cut into the WPC surface layer, penetrating through to the Aluminum surface. The property measured by this empirical test procedure depends among other factors, on the adhesion of the WPC surface layer to either the preceding WPC surface layer or the Aluminum surface layer.

### 2. Apparatus

**Cutting tool**
Single-blade cutting tool with 20 to 30 degree angle edge and a blade thickness of 0.43mm ± 0.03mm.

**Guiding and spacing edges**
In order to space the cuts correctly, a series of guiding and spacing edges is necessary when using a single-blade cutting tool. Guiding and spacing edges is ten spacing edges 1mm thick.

**Adhesive tape**
The adhesive tape has a width of 25mm.

### 3. Procedure

**Number of cuts**
- The number of cuts in each direction of the lattice pattern shall be six (4mm cuts to cuts span).
- Hold the cutting tool with the blade normal to the test panel surface. With uniform pressure on the cutting tool and using the appropriate spacing guide, make the agreed number of cuts in the coating at a uniform cutting rate. All the cuts shall penetrate the Aluminum Surface.
- Repeat this operation, making further parallel cuts of equal number, crossing the original cuts at 90° so that a lattice pattern is formed.
- Place the center of the tape over the lattice in a direction parallel to one set of cuts and smooth the tape into place over the area of the lattice and for a distance of at least 20mm beyond with a finger.
- Five min. after having applied the tape, remove the tape by grasping the free end and pulling it off steadily in 0.5 s to 1.0 s at an angle which is as close as possible to 60°

### 4. Results

Detachment/peeling off of small flakes of the WPC surface layer at the intersections of the cuts. A cross cut area must be below 1/25 (4%) from 4mm cuts * 25 lattice pattern.
Possibility and effects of cleaning paint stains

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

**Test Method**

1. Apply antigraffiti on the WPC-AL Hybrid surface and keep during 48hrs
2. Paint white spray (solvent base) and yellow spray (water base) and keep during 24hrs
3. As shown in table 1, apply graffiti guard (remover) and keep during 15 minutes
4. Rinse the surface using high pressure water and investigate effectiveness of high (aprx 7Mpa) and low (2-4Mpa) pressure

**Table 1: Combination antigraffiti and graffiti guard**

<table>
<thead>
<tr>
<th>Antigraffiti</th>
<th>Graffiti Guard</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 TDS2221</td>
<td>2060</td>
</tr>
<tr>
<td>#2 TDS5400</td>
<td></td>
</tr>
<tr>
<td>#3 TDS5020</td>
<td>N/A</td>
</tr>
<tr>
<td>#4 TDS2221</td>
<td>2030</td>
</tr>
<tr>
<td>#5 TDS5400</td>
<td></td>
</tr>
</tbody>
</table>

**Test**

Table 2 shows #4 is the best combination to remove Graffiti.

**Table 2: Test results**

<table>
<thead>
<tr>
<th>Test</th>
<th>Antigraffiti</th>
<th>Graffiti Guard</th>
<th>Paint</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>#1</td>
<td>TDS2221</td>
<td>2060</td>
<td>Solvent</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Water</td>
<td>1</td>
</tr>
<tr>
<td>#2</td>
<td>TDS5400</td>
<td>2060</td>
<td>Solvent</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Water</td>
<td>1</td>
</tr>
<tr>
<td>#3</td>
<td>TDS5020</td>
<td>N/A</td>
<td>Solvent</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Water</td>
<td>1</td>
</tr>
<tr>
<td>#4</td>
<td>TDS2221</td>
<td>2030</td>
<td>Solvent</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Water</td>
<td>4</td>
</tr>
<tr>
<td>#5</td>
<td>TDS5400</td>
<td>2030</td>
<td>Solvent</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Water</td>
<td>4</td>
</tr>
</tbody>
</table>
Reference

**Picture 1**: with low pressure water spray

**Picture 2**: with high pressure water spray

**Picture 3**: Apply antigraffiti on the 4G surface and keep during 48hrs

- Sample 4 and 5 with Graffiti Guard 2030 starts
- Sample 1, 2 and 3 do not show the performance
- Sample 4 and 5, graffiti is completely removed
- Sample 1 and 2, at closer distance water spray helps to remove the graffiti

**After low pressure water spray, brushing the surface.**

**Apply 2030, brushing and high pressure water spray.**

No effect

Completely removed
Conclusion

GraffiGuard
GraffiGuardR 2030 shows very good performance as graffiti is completely gone. Using a brush and water also helps to remove the graffiti. GraffiGuardR 2060 does not work.

Anti Graffiti
AntiGraffitiGuard TDS2221 shows better performance. We believe TDS2221 makes the surface flat which removes the paint easily from the surface.

Paint
There is no differences between solvent based paint and water based paint. Both AntiGraffitiGuard TDS2221 and GraffiGuardR 2030 do not cause chemical damage on the surface of WPC-AL Hybrid.
# Solar Reflectance Index (SRI)

Tested product: **Soleo**  
Concerned products: **Soleo, Careo, Vertigo, Diameo**

**Test method**: JIS-K-5602

**Test results:**

<table>
<thead>
<tr>
<th>Hybrid profile</th>
<th>Tested product</th>
<th>Solar Reflectance Index (SRI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>All wave lengths</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300-2500nm</td>
</tr>
<tr>
<td>Rosewood</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>Teak</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>Wenge</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>Limba</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>Silver color</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td>Bronze color</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
</tr>
</tbody>
</table>
PROCES-VERBAL DE CLASSEMENT
DE REACTION AU FEU D'UN MATERIAU

Selon l’arrêté du 21 novembre 2002 relatif à la réaction au feu des produits de construction et d’aménagement
Laboratoire pilote agréé du Ministère de l’Intérieur (arrêté du 05/02/59, modifié)

N° RA13-0125

Valable 5 ans à compter du 16 avril 2013

Matériau présenté par : GEOLEM MANAGEMENT
Churerstrasse 47
8808 PFaffikon SZ
SUISSE

Marque commerciale : GEOLEM SOLEO WHS 4G

Description sommaire :
Profilés en aluminium revêtus par co-extrusion d'une couche décorative en bois composite ignifugée composée de résine polypropylène mélangée à de la fibre de bois.
Références des profilés présentés : « Soléo 10 » et « Soléo 11 ».
Masses linéiques nominales : 730 g/m (« Soléo 10 ») et 2330 g/m (« Soléo 11 »).
Épaisseurs normales des parois extérieures d'aluminium : 1,10 mm (« Soléo 10 ») et 1,40 mm (« Soléo 11 »).
Épaisseurs mesurées de résine de bois : environ 1,7 à 2,0 mm (« Soléo 10 ») et environ 1,2 à 1,7 mm
(« Soléo 11 »).
Largeurs nominales : 128 mm (« Soléo 10 ») et 51,5 mm (« Soléo 11 »).
Épaisseurs nominales totales : 53 mm (« Soléo 10 ») et 31,5 mm (« Soléo 11 »).
Essence de fibres de bois présentée (80 %) : Palissandre.

Nature de l'essai :
Essai par rayonnement

Classement : M2 valable pour une gamme d'épaisseurs de résine de bois de 1,2 à 2,0 mm et pour une gamme d'épaisseurs totales de profilés de 31,5 à 53,0 mm

Durabilité du classement (Annexe 2 – Paragraphe 5) : Non limitée a priori.

Le process verbal atteste uniquement des caractéristiques de l'échantillon testé aux essais et ne prélève pas des caractéristiques de produits similaires. Il ne constitue donc pas une certification de produits au sens des articles L.115-27 à L.115-33 et R.115-1 à R.115-3 du code de la consommation.

Champs-sur-Marne, le 16 avril 2013

Le Technicien
Responsable de l'essai
Mickael Goule

Le Chef du laboratoire
Réaction au Feu
Nicolas ROURE

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RAPPOR D'ESSAIS N° RA13-0125
DE REACTION AU FEU D'UN MATERIAU
Selon l'arrêté du 21 novembre 2002 relatif à la réaction au feu des produits de construction et
d'amenagement
Valable 5 ans

L'accréditation de la section laboratoire du COFRAC atteste
de la compétence des laboratoires pour les tests effectués
en vertu de l'accréditation.

Ce rapport d'essais atteste uniquement des caractéristiques
de l'objet soumis aux essais et ne préjuge pas des
caractéristiques de produits similaires. Il ne constitue pas une
certification de produits au sens des articles L 115-37 à L
115-33 et R 115-1 à R 115-3 du code de la consommation.

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Il comporte 6 pages.

A LA DEMANDE DE :

GEOLAM MANAGEMENT
Churerstrasse 47
8808 PFAFFIKON SZ
SUISSE

CENTRE SCIENTIFIQUE ET TECHNIQUE DU BATIMENT
SIÈGE SOCIAL : 84 AVENUE JEAN JAURES | CHAMPS-SUR-MARNE | 77147 MARNE-LA-VALLÈE CEDEX 2
TÉL. (33) 01 64 88 84 12 | FAX. (33) 01 64 88 84 79 | www.cstb.fr
MARNE-LA-VALLÈE | PARIS | GRENOBLE | NANTES | SOPHIA-ANTIPOLIS
Rapport d'essais n°RA13-0125

OBJET

Les essais rapportés par le présent document ont pour but de déterminer le comportement des matériaux, conformément aux essais prescrits par l'Arrêté Ministériel référencé ci-dessous, relatif à la réaction au feu des matériaux de construction et d’aménagement.

TEXTES DE REFERENCE


NATURE DE (S) L’ESSAI (S)

Essai par rayonnement selon la norme NF P 92-501.

DATE (S) D’ESSAI (S)

15 et 18 mars 2013.

PROVENANCE ET CARACTERISTIQUE DES ECHANTILLONS

Date de livraison : 08 mars 2013
Matériau présenté par : GEOlam MANAGEMENT
Churerstrasse 47
8808 PFaffikon SZ
SUISSE
N° Identification : ES541120812
Marque (s) commerciale (s) : GEOlam SOLEO WHS 4G
Fabricant (s) : WPC Corporation
5F Toranomon S Mori Building
1-17-1 Toranomon
Minato-ku
105-0001 TOKYO
JAPON

L’attention est attirée sur le fait que les résultats obtenus avec l’échantillon objet du présent rapport d’essais ne sont pas généralisables sans justification de la représentativité des échantillons et essais.

Le Technicien
Responsable de l’essai

Mickaël GOULE

Le Chef du laboratoire
Réaction au Feu

Nicolas ROURE

Champs-sur-Marne, le 16 avril 2013

Trame rapport Rev.04
DESCRIPTION SOMMAIRE

Profils en aluminium revêtus par co-extrusion d’une couche décorative en bois composite ignifugée composée de résine polypropylène mélangée à de la fibre de bois.
Références des profils présentés : « Soléo 10 » et « Spléo 11 ».
Masses linéiques nominales : 730 g/m (« Soléo 10 ») et 2330 g/m (« Soléo 11 »).
Épaisseurs nominales des parois extérieures d’aluminium : 1,10 mm (« Soléo 10 ») et 1,40 mm (« Soléo 11 »).
Épaisseurs mesurées de résine de bois : environ 1,7 à 2,0 mm (« Soléo 10 ») et environ 1,2 à 1,7 mm (« Soléo 11 »).
Largeurs nominales : 128 mm (« Soléo 10 ») et 51,5 mm (« Soléo 11 »).
Épaisseurs nominales totales : 53 mm (« Soléo 10 ») et 31,5 mm (« Soléo 11 »).
Essence de fibres de bois présentée (80 %) : Palissandre.

CARACTERISTIQUES COMPLEMENTAIRES

La composition détaillée du produit figure au dossier.
La nature et la quantité d’agent ignifugé figurent au dossier (information confidentielle).
Masses linéiques mesurées : environ 736 g/m (« Soléo 11 ») et environ 2230 g/m (« Soléo 10 »).
Épaisseurs mesurées parois + résine : environ 1,99 à 2,47 mm (« Soléo 11 ») et environ 3,20 à 3,30 mm (« Soléo 10 »).
Épaisseurs totales mesurées : environ 31,7 mm (« Soléo 11 ») et environ 52,1 mm (« Soléo 10 »).
Largeur mesurée du profilé + résine : environ 51 mm (« Soléo 11 ») et 127 mm (« Soléo 10 »).

Photographies des échantillons : 

Trame rapport Rev.04
ESSAI PAR RAYONNEMENT

L'échantillon (30 x 40 cm) disposé à 45° est soumis à un rayonnement défini émis par un radiateur électrique dont la surface est à 30 mm du plan de l'éprouvette. Les gaz échappés passent au contact d'inflammables disposés du part et d'autre de l'éprouvette.

Chaque épreuve dure 30 minutes.

Les éléments déterminant sont : le temps d'inflammation initial, les hauteurs de flammes et la durée de l'inflammation.

A. DEFINITION DE L'INDICE DE CLASSEMENT

$t_i$ est le temps depuis le début de l'essai où l'inflammation apparaît sur la face exposée.

$t_f$ est le temps depuis le début de l'essai où l'inflammation apparaît au dos de l'éprouvette.

$t_d$ est le temps au bout duquel la flamme dépasse la limite du bord supérieur de la partie plane de la surface radiante de l'éprouvette sur la face exposée.

$t_e$ est le temps au bout duquel la flamme dépasse le trait repère zéro au dos de l'éprouvette.

$a_1$, $a_2$ sont les temps depuis le début de l'essai où, soit il y a extinction, soit les flammes ne dépassent plus la surface radiante - sur la face exposée ($a_1$) ou dos de l'éprouvette ($a_2$).

$q = \frac{100 \sum h_i}{t_i \Delta t}$

$t_i$ est le temps depuis le début de l'essai, où la première inflammation effective apparaît.

$h$ est la longueur maximale exprimée en centimètre atteinte par les flammes au cours de chaque période de 30 secondes durant chaque épreuve.

$\Delta t$ est la somme des hauteurs pendant la durée de chaque épreuve.

$t_d$ est la durée totale de présence de flamme dépassant la limite supérieure de la partie plane de la surface radiante en une ou plusieurs périodes supérieures ou égales à 5 secondes sur l'une ou l'autre des faces de l'éprouvette ou sur les deux faces.

Par convention, dans le cas particulier des matériaux qui ne s'enflamment pas effectivement (durée inférieure à 5 secondes), il est admis que l'indice $q$ soit nul.

Trame rapport Rev.04
B. OBSERVATIONS ET CRITERES DE CLASSEMENT DES DIFFERENTES EPREUVES REALISEES

Résultats : 1 épreuve effectuée par sens sur l'épaisseur 31,5 mm du produit référencé « GEOLAM 4G ».

<table>
<thead>
<tr>
<th>Eprouvette</th>
<th>n°2</th>
<th>Sens</th>
<th>td₁</th>
<th>544 s</th>
<th>t₁</th>
<th>544 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>transversal</td>
<td></td>
<td></td>
<td>td₂</td>
<td>—</td>
<td>t₂</td>
<td>69 cm</td>
</tr>
<tr>
<td>Coloris</td>
<td></td>
<td></td>
<td></td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bois</td>
<td></td>
<td></td>
<td></td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>q</td>
<td>0.68</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eprouvette</th>
<th>n°4</th>
<th>Sens</th>
<th>td₁</th>
<th>325 s</th>
<th>t₁</th>
<th>325 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>longitudinal</td>
<td></td>
<td></td>
<td>td₂</td>
<td>—</td>
<td>t₂</td>
<td>696 s</td>
</tr>
<tr>
<td>Coloris</td>
<td></td>
<td></td>
<td></td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bois</td>
<td></td>
<td></td>
<td></td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>q</td>
<td>3.01</td>
</tr>
</tbody>
</table>

Observations : nous observons que le sens longitudinal est le sens le plus défavorable. Nous procérons donc à 3 épreuves supplémentaires sur ce sens afin de déterminer le classement.

<table>
<thead>
<tr>
<th>Eprouvette</th>
<th>n°3</th>
<th>Sens</th>
<th>td₁</th>
<th>398 s</th>
<th>t₁</th>
<th>398 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>longitudinal</td>
<td></td>
<td></td>
<td>td₂</td>
<td>—</td>
<td>t₂</td>
<td>165 cm</td>
</tr>
<tr>
<td>Coloris</td>
<td></td>
<td></td>
<td></td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bois</td>
<td></td>
<td></td>
<td></td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>q</td>
<td>2.03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eprouvette</th>
<th>n°5</th>
<th>Sens</th>
<th>td₁</th>
<th>260 s</th>
<th>516 s</th>
<th>1 150 s</th>
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<td>1 200 s</td>
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<td>—</td>
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<td></td>
<td></td>
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Indice de classement :

\[ q = \frac{\sum q}{n} = 4.30 \]

n est le nombre d'épreuves

Trame rapport Rev.04
Résultats (suite) : 2 épreuves effectuées par sens sur l'épaisseur 53 mm du produit référencé « GÉOLAM 4G ».

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<tr>
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<td>d₀</td>
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<th>Δh</th>
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<td>d₀</td>
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<table>
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<th>Δt</th>
<th>Δh</th>
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<tr>
<td>bois</td>
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Indice de classement :

\[ q = \frac{\sum q}{n} = 0.10 \]

n est le nombre d'épreuves

FIN DU RAPPORT D'ESSAIS
Objet : Résultats des essais de Réaction au Feu
Affaire suivie par : M. Mickaël GOULE
Tél. : 01.64.68.85.10
N° dossier : ES54130655

A Champs-sur-Marne, le 24 mars 2014

ATTESTATION PROVISOIRE DE CLASSEMENT

Les épreuves sur le produit référencé « SOLEO 7025 Formulation n° 10 » sont à présent terminées.

Au vu des résultats et dans l’attente de confirmation par le Procès Verbal de classement, votre produit obtient le classement M2, valable pour les caractéristiques suivantes :

- Profilé en aluminium revêtu par co-extrusion d’une couche décorative en bois composite ignifugées composée de résine polypropylène mélangée à de la fibre de bois.
- Référence profilé : « Soléo 7025 ».
- Largeur nominale : 50 mm.
- épaisseur nominale : 30 mm.
- Teinte : ébène.

Nous vous prions d’agréer, Monsieur, l’assurance de notre considération distinguée.

Le Technicien
Responsable de l’essai

Mickaël GOULE

Les informations contenues dans ce document sont considérées provisoires dans l’attente de leur validation.
DIRECTION SECURITE STRUCTURES ET FEU
Réaction au feu

GEOLAM MANAGEMENT GmbH
A l’attention de M. Manuel GARCIA

Objet : Résultats des essais de Réaction au Feu

Affaire suivie par : M. Mickaël GOULE
Tél : 01.64.68.85.10
N° dossier : ES541130655

A Champs-sur-Marne, le 31 mars 2014

ATTESTATION PROVISOIRE DE CLASSEMENT

Les épreuves sur le produit référencé « SOLEO 7026 Formulation n° 5 » sont à présent terminées.

Au vu des résultats et dans l’attente de confirmation par le Procès Verbal de classement, votre produit obtient le classement M2, valable pour les caractéristiques suivantes :

Profilé en aluminium revêtu par co-extrusion d’une couche décorative en bois composite ignifugée composée de résine polypropylène mélangeé à de la fibre de bois.

Référence profilé : « Soléo 7026 ».
Largeur nominale : 120 mm.
Epaisseur nominale : 30 mm.
Teinte : ébène.

Nous vous prions d’agréer, Monsieur, l’assurance de notre considération distinguée.

Le Technicien
Responsable de l’essai

Mickaël GOULE
DIRECTION SECURITE STRUCTURES ET FEU
Réaction au feu

GEOLAM MANAGEMENT GmbH
A l'attention de M. Manuel GARCIA

Objet : Résultats des essais de Réaction au Feu

Affaire suivie par : M. Mickaël GOULE
Tél : 01.64.68.85.10
N° dossier : ES541130655

A Champs-sur-Marne, le 24 mars 2014

ATTESTATION PROVISOIRE DE CLASSEMENT

Les épreuves sur le produit référencé « SOLEO 7026 Formulation n° 10 » sont à présent terminées.

Au vu des résultats et dans l’attente de confirmation par le Procès Verbal de classement, votre produit obtient le classement M1, valable pour les caractéristiques suivantes :

Profilé en aluminium revêtu par co-extrusion d’une couche décorative en bois composite ignifugée composée de résine polypropylène mélangée à de la fibre de bois.

Référence profilé : « Soléo 7026 ».
Largeur nominale : 120 mm.
Epaisseur nominale : 30 mm.
Teinte : ébène.

Nous vous prions d’agréer, Monsieur, l’assurance de notre considération distinguée.

Le Technicien
Responsable de l’essai

Mickaël GOULE
Radioactivity test

UNITIKA ENVIRONMENTAL TECHNICAL CENTER LTD.
23, Ujikozakura Uji Kyoto, Japan
TEL: +81-774-23-2522 FAX: +81-774-25-2355

ATTESTATION

Report No.: RVB7522
DATE: December 06, 2012

This is to certify that we tested the following sample in accordance with the request as follows.

Requested by
KURABO INDUSTRIES LTD.

Object of survey: Aluminum-Recycled Wood Compound (LOT: 120926)
Destination: –
Shipper: –
Buyer: –
L/C No.: –
Invoice No.: –
Location of Measurement: At the Tokyo Office of UNITIKA ENVIRONMENTAL TECHNICAL CENTER LTD., Chuo, Tokyo, Japan
Date of Measurement: December 05, 2012, 17:34
Survey Equipment: NaI (TI) scintillation Survey Meter “ALOKA γ SURVEY METER TCS-172”

Result of Measurement

<table>
<thead>
<tr>
<th>Measurement Point</th>
<th>Max. Value (μSv/h)</th>
<th>Min. Value (μSv/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front side</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>Rear side</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>Left side</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>Right side</td>
<td>0.07</td>
<td>0.06</td>
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<tr>
<td>Upper side</td>
<td>0.07</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Measurement Point | μSv/h
Background Radiation | 0.07

Certified Radiation Protection Supervisor by Ministry Of Education, Culture, Sports, Science and Technology Japan

Kenichiro Tokuda
Kenichiro Tokuda
Dissolution test of heavy metals

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

---

### Test Report

1. **Date of Application**: December 3, 2012 (No.172-12-1-0232)
2. **Sample**: Aluminum-Recycled Wood Compound Material (LOT : 120926) one sample

3. **Test Items and Methods**:

3.1 Dissolution test of the Heavy metals

   Testing method regarding metals contained in industrial waste (Environment Agency Notification No.13,1973)

   - **Cadmium** (Cd) : JIS K 0102 56.2 Electrothermal type atomic absorption spectrometry
   - **Lead** (Pb) : JIS K 0102 54.2 Electrothermal type atomic absorption spectrometry
   - **Mercury** (Hg) : Appendix No.1, Environment Agency Notification No.59,1971 Cold vapor atomic absorption spectrometry
   - **Selenium** (Se) : JIS K 0102 67.2 Atomic absorption spectrometry by hydride
   - **Arsenic** (As) : JIS K 0102 61.2 Atomic absorption spectrometry by hydride
   - **Chromium(VI)** : JIS K 0102 68.2.1 Diphenylcarbazide absorption spectrometry

3.2 Determination of formaldehyde emission : JIS A 1460(2001) Desicator method

4. **Test Results**:

4.1 Dissolution test of the Heavy metals

<table>
<thead>
<tr>
<th>Items</th>
<th>Unit</th>
<th>Aluminum-Recycled Wood Compound Material (LOT : 120926)</th>
<th>Lower Limits of detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadmium (Cd)</td>
<td>mg/L</td>
<td>N.D.</td>
<td>0.002</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>mg/L</td>
<td>N.D.</td>
<td>0.01</td>
</tr>
<tr>
<td>Mercury (Hg)</td>
<td>mg/L</td>
<td>N.D.</td>
<td>0.0005</td>
</tr>
<tr>
<td>Selenium (Se)</td>
<td>mg/L</td>
<td>N.D.</td>
<td>0.002</td>
</tr>
<tr>
<td>Arsenic (As)</td>
<td>mg/L</td>
<td>N.D.</td>
<td>0.005</td>
</tr>
<tr>
<td>Chromium(VI)</td>
<td>mg/L</td>
<td>N.D.</td>
<td>0.05</td>
</tr>
</tbody>
</table>

N.D.: Less than the lower limits of detection.

4.2 Determination of formaldehyde emission

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Aluminum-Recycled Wood Compound Material (LOT : 120926)</th>
<th>Lower Limits of detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde emission</td>
<td>mg/L</td>
<td>N.D.</td>
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</table>

N.D.: Less than the lower limits of detection.

5. **Date of issue**: December 20, 2012

---

Approved signatory:

Issued by: Hiroshi Tadokoro
General Manager
Tokyo Laboratory
Chemicals Evaluation and Research Institute, Japan
1600, Shimotakano, Sugitomachi, Kitakatsushika-gun, Saitama 345-0043, Japan
Tel +81-480-37-2601  Fax +81-480-37-2521

Please receive the approval of this Institute beforehand when you reprint this test report.
Carbon footprint analysis

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

### 1. Calculating LCCO₂ of Aluminum Hybrid Profiles

**System boundaries and scenarios**
In this analysis, figure 1 shows the system boundaries.

**Fig. 1**: System boundaries

### 2. Calculating LCCO₂ of the WPC Surface

**SYSTEM BOUNDARIES AND SCENARIOS**
In this analysis, we have adopted the evaluation scope proposed by Wada et al for the purpose of assessing how the use of recycled materials in Geolam production affects the LCCO₂ value for Geolam. Figure 2 shows the system boundaries. In the case of recycled products, the process of generating raw production materials from original products that were themselves produced from raw materials is included within the system boundaries as a raw material procurement process.
Plastic materials are typically recycled from plastic containers and packaging as well as industrial waste. Wood flour from wood material is timber scrap derived from recycled construction scrap.

Product manufacturing processes consist of mixing the raw materials and sanding processed into the finished product. The ratio of plastic to wood material is an average based on figures supplied by the manufacturers we interviewed. Although Geolam products can take a variety of forms, our discussion here will be restricted to standard hollow panels.

In terms of product usage, we assume that the panels are deployed in outdoor settings.

Our analysis does not include capital goods production (such as building factories and processing facilities) associated with the various processes.
CALCULATION CONDITIONS FOR INDIVIDUAL PROCESSES

This analysis employs bottom-up calculations using foreground data wherever possible. Where process data was unavailable, we have used what we consider to be representative data taken from previous reports and research papers.

**Raw material procurement—plastic**

From Figure 3, raw material procurement processes for plastics (in the form of recycled pellets) consist of transporting used plastic, sorting, reprocessing, flake shredding, manufacturing recycled pellets, and transporting recycled pellets.

Since all of the Geolam licensee purchase recycled plastic pellets through trading firms, we were unable to obtain foreground data on the sorting, reprocessing, and flake shredding process or the pellet manufacturing process. Instead, we calculated CO2 emissions for these processes based on data provided in past literature.

We used past literature to determine the criteria for calculating CO2 emissions associated with transportation of used plastic products. Based on the scenario of a 10-t truck loaded at 62% capacity and traveling a distance of 500 km, unit CO2 emissions were calculated at 0.1300 kg-CO2/t-km and CO2 emissions per kilogram carried were 0.0650 kg-CO2/kg.

CO2 emissions from sorting, reprocessing and flake shredding were 0.0857 kg-CO2/kg. This figure is based on emissions for manual sorting and disassembly of waste plastic products as stated in past literature. CO2 emissions from recycled pellet manufacturing were 0.0838 kg-CO2/kg, based on emissions figures for melting and extrusion in the literature.

Once again, CO2 emissions associated with transportation of recycled pellets were calculated on the basis of the criteria stated in past literature. For a 10-t truck loaded at 62% capacity and traveling a distance of 500 km, unit CO2 emissions were 0.1300 kg-CO2/t-km, and CO2 emissions per kilogram carried were 0.0650 kg-CO2/kg.

**Raw material procurement—wood**

From Figure 3, raw material procurement processes for wood (in the form of wood flour) consist of transporting timber scrap, sorting, making woodchips, transporting woodchips, manufacturing wood flour, and transporting wood flour.

We used past literature to determine the criteria for calculating CO2 emissions associated with transportation of timber scrap. Based on the scenario of a 4-t truck loaded at 62% capacity and traveling a distance of 10 km, unit CO2 emissions were calculated at 0.2178 kg-CO2/t-km, and CO2 emissions per kilogram carried were 0.0022 kg-CO2/kg.

None of the Geolam licensee manufactures their woodchips in-house, so we were obliged to use background data from past literature in regards to sorting and woodchip making processes. Based on the energy consumption values for lumber sorting and crushing (typically using magnetic separators, air graders and/or metal detectors), we arrived at the consumption figures of 0.0233 kWh/kg (for electricity) and 0.00185 l/kg (for diesel). We then multiplied these by the respective emission coefficients set out in the Environment Ministry publication Calculation methodology and emission coefficients for calculation, reporting and publication purposes. The resulting figure for CO2 emissions associated with sorting and woodchip manufacturing was 0.0179 kg-CO2/kg. Around 70% of woodchip output is considered suitable for Geolam material recycling, with the remaining about 30% used as fuel.

Next, we calculated power consumption associated with production of wood flour at 0.9084 kWh per kilogram. This is an average figure based on the foreground data obtained from Geolam licensee who produce their own wood flour. Once again, we multiplied this figure by the corresponding CO2 emission coefficient in Calculation methodology and emission coefficients for calculation, reporting and publication purposes to calculate the CO2 emissions for wood flour production. The result was 0.5096 kg-CO2/kg. Product yield was 94.3%.

For CO2 emissions associated with transportation, we used the scenario of a 10-t truck loaded at 62% capacity traveling a distance of 54.4 km, based on past literature. The unit emissions value was 0.1300 kg-CO2/t-km, while emissions per kilogram carried were 0.0071 kg-CO2/kg. These figures were applied to transportation of both woodchips and wood flour.

**Production WPC layer**

Power consumption associated with production WPC compound was found to be 1.8220 kWh per kg Geolam, based on the average of foreground data obtained from Geolam licensee. Multiplied by the CO2 emissions coefficient for electric power, this leads to an emissions figure of 1.0221 kg-CO2/kg. Product yield was 94.3%.
Product transportation
It was difficult to define the CO$_2$ emissions for the product transportation process because of the variety of different sales channels employed by Geolam licensee from whom we were able to obtain foreground data. For this reason, we used the transportation criteria given in past literature and assumed a scenario of a 10-t truck loaded at 62% capacity traveling a distance of 500 km. On this basis, unit emissions were 0.1300 kg-CO$_2$/t-km and emissions per kilogram carried were 0.0650 kg-CO$_2$/kg.

Usage
We assumed that Geolam compound was used as the surface layer of Geolam Aluminum hybrid profiles in an outdoor louvers. Since Geolam does not require ongoing maintenance such as repainting, we assumed zero CO$_2$ emissions during the period of use.

RESULTS
The LCCO$_2$ value for WPC layer was 1.54 kg-CO$_2$ per kilogram of WPC layer.

<table>
<thead>
<tr>
<th>Process</th>
<th>Average</th>
<th>Proportion of CO2 emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>WPC layer Procurement of raw plastic material</td>
<td>Input material (plastics)</td>
<td>0.515 kg</td>
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<td></td>
<td>Transportation of used plastics</td>
<td>CO2 emissions</td>
</tr>
<tr>
<td></td>
<td>Sorting, reprocessing, flake shredding</td>
<td>CO2 emissions</td>
</tr>
<tr>
<td></td>
<td>Manufacturing recycled pellets</td>
<td>CO2 emissions</td>
</tr>
<tr>
<td></td>
<td>Transportation of recycled pellets</td>
<td>CO2 emissions</td>
</tr>
<tr>
<td>WPC layer Procurement of raw wood material</td>
<td>Input material (woods)</td>
<td>0.833 kg</td>
</tr>
<tr>
<td></td>
<td>Transportation of timber scrap</td>
<td>CO2 emissions</td>
</tr>
<tr>
<td></td>
<td>Sorting, making woodchips</td>
<td>CO2 emissions</td>
</tr>
<tr>
<td></td>
<td>Transportation of woodchips</td>
<td>CO2 emissions</td>
</tr>
<tr>
<td></td>
<td>Making wood flour</td>
<td>CO2 emissions</td>
</tr>
<tr>
<td></td>
<td>Transportation of wood flour</td>
<td>CO2 emissions</td>
</tr>
<tr>
<td>Process</td>
<td>Input material (plastics)</td>
<td>0.506 kg</td>
</tr>
<tr>
<td>Process</td>
<td>Input material (woods)</td>
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<td>Process</td>
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<td>CO2 emissions</td>
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<td>Process</td>
<td>Product usage (20 years)</td>
<td>CO2 emissions</td>
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<tr>
<td>Total</td>
<td></td>
<td>1.54 kg-CO$_2$ / kg</td>
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</tbody>
</table>
3. LCCO$_2$ assessment of Aluminium

OVERVIEW
Previously we calculated the LCCO$_2$ value per kg of WPC layer. In this Chapter, We begin by calculating the LCCO$_2$ value per kg of aluminium decking.

CALCULATING LCCO$_2$ FOR ALUMINIUM
System boundaries and anticipated scenarios
Figure 4 shows the anticipated scenarios and system boundaries. The scenarios involve manufacturing the aluminium materials from a combination of virgin and secondary aluminium as well as scrap. Based on past literature (reference 14), the breakdown was 51.7% virgin aluminium, 25.6% secondary aluminium, 17.2% scrap and 5.6% other metals such as added metals and alloys.

In the virgin aluminium procurement process, in order to align the WPRC system boundaries and evaluation scope, we have added waste disposal and treatment (equivalent to the landfill process for aluminium production material in this section) of the same recycled materials used in the original product (see Figure 2).

For the usage process, we envisage flat boards used in an outdoor setting, the same as for WPRC, with the products being sent to landfill after use.

Figure 4: Aluminium scenarios
Calculation conditions by process
We calculated LCCO2 values for aluminium materials based on background data from past literature. Among the scenarios in Figure 4, combined CO2 emissions associated with the processes enclosed within double lines, including some of the raw material procurement and product manufacturing processes, is taken from LCI Data for Rolled Aluminum Products14) from the Japan Aluminium Association (JAA). Emissions per kg of aluminium materials associated with the processes enclosed in double lines was 7.11 kg-CO2.

Calculation conditions for other processes are described below.

Raw materials procurement processes
Among the raw material procurement processes, the transportation process (as far as the landfill facility) and landfill process generated 0.0016 kg-CO2 per kg, based on past literature (7).

The conditions for calculating CO2 associated with the transportation process (as far as the secondary aluminium manufacturing facility) was taken from past literature.

Transportation by 10-ton truck5) over a distance of 500 km5) at 62%5) loading generated 0.1300 kg-CO2 per ton per km5)6) resulting in CO2 emissions of 0.0650 kg-CO2/kg.

Product transportation process
We plotted the anticipated WPRC transportation route and determined the conditions from past literature. Transportation by 10-ton truck5) over a distance of 500 km5) at 62%5) loading generated 0.1300 kg-CO2 per ton per km5)6) resulting in CO2 emissions of 0.0650 kg-CO2/kg.

Product usage process
As with WPRC, the usage process assumed flat boards used as outdoor construction materials. It was assumed that no CO2 was emitted during the usage period.

Waste treatment/disposal process
The waste treatment/disposal process consists of transportation to the landfill site and disposal in landfill, as shown in Figure 4.

CO2 emissions associated with transportation to the landfill site were 0.0016 kg-CO2/kg, based on past literature (7).

3.2 RESULTS
Table 2 shows the calculation results. The LCCO2 value for aluminium materials was 7.19 kg-CO2 per kg.

Table 2: LCCO2 calculation results for aluminium materials (CO2 per kg product)

<table>
<thead>
<tr>
<th>Process</th>
<th>Quoted value</th>
<th>Proportion of CO2 emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Raw material procurement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(up to landfill)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation (to secondary aluminium manufacturing facility)</td>
<td>CO2 emissions</td>
<td>0.017 Kg-CO2</td>
</tr>
<tr>
<td>Transportation (to landfill)</td>
<td>CO2 emissions</td>
<td>0.001 Kg-CO2</td>
</tr>
<tr>
<td>Landfill</td>
<td>CO2 emissions</td>
<td></td>
</tr>
<tr>
<td><strong>Raw material procurement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(from raw material manufacturing to product manufacturing)</td>
<td>CO2 emissions</td>
<td>7.11 Kg-CO2</td>
</tr>
<tr>
<td><strong>Product transportation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>CO2 emissions</td>
<td>0.065 Kg-CO2</td>
</tr>
<tr>
<td><strong>Product usage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product usage (20 years)</td>
<td>CO2 emissions</td>
<td>0.000 Kg-CO2</td>
</tr>
<tr>
<td><strong>Waste treatment/disposal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>CO2 emissions</td>
<td>0.002 Kg-CO2</td>
</tr>
<tr>
<td>Incineration</td>
<td>CO2 emissions</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7.19 Kg-CO2/kg</td>
<td>100%</td>
</tr>
</tbody>
</table>
4 Calculating LCCO2 of Aluminum Hybrid Profiles

SYSTEM BOUNDARIES AND SCENARIOS
Figure 5 shows the Geolam Aluminum Hybrid profile scenario discussed in this analysis.

![Figure 5: System Boundaries](https://example.com/fig5)

WPC surface materials are calculated in section 2 and Aluminum profile is calculated in section 3.

Geolam aluminum hybrid profile, the material is composed of WPC on the surface, a special glue in the middle to increase the interface compatibility and Aluminum in the core. The ratio of WPC surface layer to Aluminum profile is an average based on figures supplied by the manufacturers we interviewed. Although Geolam Aluminum hybrid profiles can take a variety of forms, our discussion here will be restricted to standard hollow panels EW6008.

CALCULATION CONDITIONS FOR INDIVIDUAL PROCESSES
This analysis employs bottom-up calculations using foreground data wherever possible. Where process data was unavailable, we have used what we consider to be representative data taken from previous reports and research papers.

Raw material procurement—WPC surface and Aluminum profile
For raw material that are the same as the WPC layer scenario in Figure 2, we used the calculation results from Section 2 Calculating LCCO2 of WPC layer and from Section 3 Calculating LCCO2 of Aluminum profile.

Production Geolam Aluminum Hybrid profile
Power consumption associated with production WPC layer obtained from Geolam licensee multiplied by the CO2 emissions coefficient for electric power, this leads to an emissions figure of 0.21CO2/kg.

Product transportation
It was difficult to define the CO2 emissions for the product transportation process because of the variety of different sales channels employed by Geolam licensee from whom we were able to obtain foreground data. For this reason, we used the transportation criteria given in past literature and assumed a scenario of a 10-t truck loaded at 62% capacity traveling a distance of 500 km. On this basis, unit emissions were 0.1300 kg CO2/t-km, and emissions per kilogram carried were 0.0650 kg CO2/kg.

Usage
We assumed that Geolam Aluminum hybrid profile was used as outdoor louvers. Since Geolam does not require ongoing maintenance such as repainting, we assumed zero CO2 emissions during the period of use.

RESULTS
The LCCO2 value was 9.005 kg CO2 per kilogram of Geolam. (EW6008)
Table 3: LCCO2 for WPRC per kilogram of product—calculation results

<table>
<thead>
<tr>
<th>Process</th>
<th>Average</th>
<th>Proportion of CO2 emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WPC layer Procurement of WPC layer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Table 1</strong></td>
<td>1.54 kg-CO2</td>
<td>17.1%</td>
</tr>
<tr>
<td><strong>Table 2</strong></td>
<td>7.19 kg-CO2</td>
<td>79.8%</td>
</tr>
<tr>
<td><strong>Input material (WPC)</strong></td>
<td>0.178 kg</td>
<td></td>
</tr>
<tr>
<td><strong>Input material (Aluminum)</strong></td>
<td>0.822 kg</td>
<td></td>
</tr>
<tr>
<td><strong>Geolam Aluminum Hybrid profile</strong></td>
<td>1.000 kg</td>
<td></td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td>0.065 kg-CO2</td>
<td>0.0%a 0.7%</td>
</tr>
<tr>
<td><strong>Product usage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Product usage (20 years)</strong></td>
<td>0.000 kg-CO2</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>9.005 kg-CO2</td>
<td>100%</td>
</tr>
</tbody>
</table>

5 Conclusions

The following conclusions were drawn from our analysis.

The LCCO2 for Geolam aluminum hybrid profile was 9.005 kg-CO2/kg.

6 References


Methods Used for Durability Tests

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

1. The mechanical property of WPC-Aluminum Hybrid products is investigated using the Japan Industrial Standard (JIS) test methods, methods of analysis and inspection approach.

2. Since there are variety of testing methods to comply with a variety applications and usage environment the testing method shall be chosen according to client technical needs.

3. We are committed to continuously review and improve testing methods in order to increase product quality.

<table>
<thead>
<tr>
<th>Test method</th>
<th>Test Item</th>
<th>Purpose</th>
<th>Test method</th>
<th>Criteria</th>
<th>Test logic / reason for selecting test method</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIS</td>
<td>Sunshine weather meter test</td>
<td>Check the accelerated weather resistance.</td>
<td>5000 hours</td>
<td>JIS K5400</td>
<td>1000Hr is generally considered equal to two years for outdoor usage. Test Machine: 300 Sunshine Weather Meter WEL300 / Suga Test Instruments Co., Ltd</td>
</tr>
<tr>
<td></td>
<td>Cold-Hot repeat test</td>
<td>Check the peeling off of the WPC layer from the Aluminum surface due to expansion and contraction</td>
<td>2 hours at -10C and 2 hours at 80C, 50 cycles</td>
<td></td>
<td>Under Japanese weather condition, the expected minimum surface temperature of material is minus 10C. The expected maximum surface temperature of material (dark color) is 80C. Test Machine: INCUBATOR / Sanyo. The expected duration to stabilize the material from expansion/contraction is two hours. The expected duration per cycle is 0.2 years thus 50 cycles is estimated equal to 10 years.</td>
</tr>
<tr>
<td>Test methods established by our technicians based on client needs</td>
<td>Hot water and dry environment</td>
<td>Check the peeling off of the WPC layer from the Aluminum surface due to expansion/contraction and change in humidity</td>
<td>Heavy condition: 5 days in 60C hot water/2 days dry at 80C, 15 cycles</td>
<td>Light condition 5 hours in 60C hot water/2 hrs dry at 80C, 15 cycles</td>
<td>Free from cracking or peeling of the surface layer by resin. Under Japanese weather condition, the expected maximum water temperature is 60C. The expected maximum surface temperature of the material (dark color) is 80C. The expected duration to dry and wet condition is 2 days (48Hrs). The peel off phenomenon will occur after 7-10 cycles, thus we specified to test 15 cycles.</td>
</tr>
<tr>
<td></td>
<td>Constant temperature and humidity</td>
<td>Check the peeling off of the WPC layer from the Aluminum surface due to constant high temperature and high humidity</td>
<td>70C 95% humidity, 30 days duration</td>
<td></td>
<td>General testing standard for outdoor decoration material. Test Machine: PR-2KP / ESPEC Corp.</td>
</tr>
<tr>
<td></td>
<td>Water Absorption</td>
<td>Check the peeling off of the WPC layer from the Aluminum surface due to water absorption</td>
<td>Immersion for 30 days at a normal (20C) temperature condition</td>
<td></td>
<td>General testing standard for outdoor decoration material. The peel off phenomenon will occur at 20 days, thus we specified to test 30 days.</td>
</tr>
<tr>
<td></td>
<td>Hot Water resistance</td>
<td>Check the peeling off of the WPC layer from the Aluminum surface due to hot water absorption</td>
<td>Immersion for 14 days at a hot (80C) temperature condition</td>
<td></td>
<td>General testing standard for outdoor decoration material. The peel off phenomenon will occur at 7 days, thus we specified to test 14 days. As the plastic material starts to soften over 80C, we specified the testing temperature at 80C.</td>
</tr>
<tr>
<td></td>
<td>SUV</td>
<td>Check accelerated weather resistance</td>
<td>500 hours</td>
<td></td>
<td>SUV is a rapid test to check color fading as well as surface deterioration. However, the correlation between laboratory testing and actual tests shows that SWOM is more reliable than SUV. Test Machine: SUV-W151 EYE Super UV tester, IWASAKI ELECTRIC CO., LTD. 100Hr is generally considered equal to two years of outdoor usage.</td>
</tr>
</tbody>
</table>
Material Safety Data Sheet
Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

**Material characteristics**

**Compound:**
Metal-resin composite

**Chemical composition:**
Surface layer: Polypropylene resin extrusion
Polypropylene resin: 60% - 70%
Wood flour: 15% - 25%
Pigments/additives: 5% - 25%
Adhesive layer: Ethylene copolymer resin
Core: Aluminum alloy

**UN classification:**
n/a

**Hazard/toxicity classification:**
No classification

**First Aid Measures**

**Eye contact:**
Can cause injury to eyeball. Wash gently in plenty of clean running water. Do not rub. If foreign matter remains in the eye, seek advice from a specialist.

**Skin contact:**
For dust, remove by washing with soap and water. For hot melt, douse clothing in cold water to cool, then remove affected garments and seek medical advice.

**Inhalation:**
For significant quantities of dust, seek medical advice. For significant quantities of molten resin gas, relocate to a fresh air environment.

**Ingestion:**
For small quantities, induce vomiting where practicable. If patient still feels unwell, seek medical advice.

**Fire Fighting Measures**

**Warnings:**
Wear fireproof clothing and respiratory equipment. Be-ware of intense heat, thick black smoke, carbon dioxide, carbon monoxide and nitrogen oxide gas.

**Extinguishing media:**
Water/water spray, powder, foam or carbonic acid gas.

**Accidental Release Measures**
- Sweep up and dispose of dust generated during cutting and finishing work.
- Dust can be highly slippery under foot. Ensure floors are properly cleaned and maintained.
- Collect and remove all surface spills, particularly in drainage system.

**Handling and Storage**

**Handling**
Although the product does not ignite at normal temper-ature, it should be stored properly and kept away from sources of flame in the workplace.

Do not store resin in powder form as it can potentially ex-plode. Product is flammable. Keep well away from ignition sources during use.

Product has an aluminum alloy core which may be exposed at the ends. Wear protective gloves and handle with care.

**Storage**
Product is a designated flammable material and as such is subject to special provisions on storage and handling. Store well away from sources of flame.
Exposure Controls

Concentration in workplace environment: n/a
Allowable concentration: n/a
Ventilation: Ventilation equipment should be installed where processing heat generates low molecular weight substances.
Protective gear: Dust masks and safety goggles should be worn where dust is given off.

Physical and Chemical Properties

Melting point: Data not available
Vatility: n/a
Solubility: Not soluble in water

Hazard Information

Flammability: Flammable
Ignition point: Data not available
Oxidizability: Data not available
Dust explosion properties: Explosive
NB: Aluminum dust can be explosive. Beware dust from aluminum core during cutting and working.

Stability/reactivity: Stable and nonreactive under normal storage conditions.

Toxicological Information

Skin causticity: None
Skin/eye irritant: Data not available (NB: May act as physical stimulant)
Subacute toxicity Data not available
Chronic toxicity: Data not available
Carcinogenicity: Data not available

Disposal Considerations

1. The product is a compound of aluminum alloy and synthetic resin and should be disposed of as a flammable substance in accordance with applicable laws and regulations and the relevant handling provisions.
2. Should be disposed by incineration, landfill or entrusted to an industrial waste disposal contractor. Dispose of product in accordance with the requirements of the Waste Management and Public Cleansing Law.
3. Incineration can generate black smoke and/or toxic fumes with potential environmental consequences.

Transport Information

1. Exercise due care during transportation to prevent damage.
2. Product should be treated as flammable and subject to the handling and storage provisions detailed above.

Applicable Legislation

Fire Service Act:
• Designated flammable substances—synthetic resin, 3000 kg
• Law Concerning Pollutant Release and Transfer (PRTR Law): n/a
• Industrial Safety and Health Act: n/a
• Waste Management and Public Cleansing Act

Other Information

The information presented in this MSDS is based on currently available data. This MSDS does not in any way constitute a warranty or guarantee in relation to any of the physical and chemical properties of the product nor its hazard and toxicity characteristics. The advice and warnings provided in this MSDS are predicated on standard usage and handling procedures. Additional safety measures may be required for non-standard usage or handling of the product.
Product Delivery Specifications

Tested product: **Soleo**
Concerned products: **Soleo, Careo, Vertigo, Diameo**

### Base Materials

<table>
<thead>
<tr>
<th>Part</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td></td>
</tr>
<tr>
<td>Aluminum Type</td>
<td>A6063S, as per JIS H4100</td>
</tr>
<tr>
<td>Surface finish</td>
<td>AA10 equivalent, as per JIS H8601</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>150 N/mm² or better</td>
</tr>
<tr>
<td>Load bearing capacity</td>
<td>110 N/mm² or better</td>
</tr>
<tr>
<td>Elongation</td>
<td>8% or better</td>
</tr>
<tr>
<td>Bonding layer</td>
<td>Olefin resin</td>
</tr>
<tr>
<td>Surface layer</td>
<td>Regenerated wood flour resin containing PP-based non-halogenated flame retardant</td>
</tr>
</tbody>
</table>

### Product Specifications

<table>
<thead>
<tr>
<th>Category</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sectional dimensions</td>
<td>See data sheets</td>
</tr>
<tr>
<td>Length dimensions</td>
<td>As per JIS B0405 lower grade (e.g. ±4 mm at up to 4000 L)</td>
</tr>
<tr>
<td>Warp/bend</td>
<td>Within L/800 (e.g. within 5 mm for product length of 4,000 mm)</td>
</tr>
<tr>
<td>Color</td>
<td>Consistent with color sample</td>
</tr>
<tr>
<td>Dirt, scratches, dents, contamination</td>
<td>Not visible when viewed from a distance of two meters</td>
</tr>
<tr>
<td>Sanding finish</td>
<td>Consistent with standard sample</td>
</tr>
<tr>
<td>Adhesion</td>
<td>Surface layer bonds with aluminum with no evidence of peeling</td>
</tr>
<tr>
<td>Combustibility</td>
<td>CSTB, LNE, Effectis France combustion tests</td>
</tr>
</tbody>
</table>

**Note:** Initial values shown
## Product Inspection

<table>
<thead>
<tr>
<th>Inspection item</th>
<th>Procedure</th>
<th>Frequency</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sectional dimensions</td>
<td>Measured in-process</td>
<td>Every 50 articles</td>
<td>Calipers, Convex</td>
</tr>
<tr>
<td>Length dimension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warping</td>
<td>Measured in-process as per Figure 1</td>
<td>Every 50 articles</td>
<td>Specific tool</td>
</tr>
<tr>
<td>Bending</td>
<td>Measured in-process as per Figure 2</td>
<td>Every 50 articles</td>
<td>Specific tool</td>
</tr>
<tr>
<td>Color</td>
<td>Compared to standard sample (in-process)</td>
<td>100%</td>
<td>Visual inspection</td>
</tr>
<tr>
<td>Dirt, scratches, dents, contamination</td>
<td>Not visible when viewed from a distance of two meters (in-process)</td>
<td>100%</td>
<td>Visual inspection</td>
</tr>
<tr>
<td>Sanding finish</td>
<td>Compared to standard sample (in-process)</td>
<td>100%</td>
<td>Visual inspection</td>
</tr>
<tr>
<td>Initial adhesion</td>
<td>Visual inspection (in-process)</td>
<td>100%</td>
<td>Visual inspection</td>
</tr>
<tr>
<td>Bending strength</td>
<td>Measure maximum stress in 800-mm span subject to loading at test speed of 20 mm/min</td>
<td>Once per lot*</td>
<td>Autograph</td>
</tr>
</tbody>
</table>

* Refers to lot of aluminum core. (Once per aluminum core lot, n = 3).

Perform the inspections listed above, record the results on the prescribed inspection record form and retain records.

Inspection records must be produced upon request.

Place the product against the measuring jig and measure the gap in the center section.

Warping is defined as vertical deflection relative to the extrusion direction (Figure 1).

Bending is transverse deflection (Figure 2).
## Durability Evaluation Results

<table>
<thead>
<tr>
<th>Test</th>
<th>Type</th>
<th>Method</th>
<th>Criteria</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immersion</td>
<td></td>
<td>Immersed in water at room temperature</td>
<td>Continuous accelerated for 30 days</td>
<td>No Peel off warranted</td>
</tr>
<tr>
<td>Heating and cooling</td>
<td></td>
<td>50 cycles of -10°C to 80°C every two hours x 50 cycles accelerated</td>
<td></td>
<td>No Peel off warranted</td>
</tr>
<tr>
<td>Hot water immersion and drying</td>
<td>in-house tests</td>
<td>Immersed in water heated to 60°C for five days followed by drying at 80°C for two days x 15 cycles accelerated (lighter conditions)</td>
<td>Absolute absence of evidence of surface peeling</td>
<td>No Peel off warranted</td>
</tr>
<tr>
<td>Normal temperature and humidity</td>
<td></td>
<td>Subjected to 70°C, 95% humidity environment continuously accelerated for 30 days</td>
<td></td>
<td>No Peel off warranted</td>
</tr>
<tr>
<td>Hot water immersion</td>
<td></td>
<td>Immersed in water heated to 80°C continuously accelerated for 14 days</td>
<td></td>
<td>No Peel off warranted</td>
</tr>
<tr>
<td>Boiling water immersion</td>
<td></td>
<td>Immersed in water heated to 98°C continuously accelerated for 14 days</td>
<td></td>
<td>No Peel off warranted</td>
</tr>
<tr>
<td>Weathering SUV accelerated</td>
<td>-</td>
<td>500 hours</td>
<td></td>
<td>DE 5.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DL 5.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Da 1.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Db -0.36</td>
</tr>
<tr>
<td>Weathering SWOM accelerated</td>
<td>JIS A 1415</td>
<td>5000 hours</td>
<td></td>
<td>DE 2.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DL 1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Da 0.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Db -1.5</td>
</tr>
</tbody>
</table>
Lots

**Definition**
A lot is the collective term for all products processed on a given day.

**Labeling**
The display format is as per the Packaging Specifications:
PO number, number of pieces, length, color, type.

Packaging and Stacking for Transport

As per the Packaging Specifications.

Usage and Handling

**Storage**
- Store indoors on a level surface. Do not lean the product at an angle.
- Use spacers to compensate for any irregularities.
- Spacers should all be the same height and no further apart than one meter.
- To prevent deflection, do not store product that is bent.
- If storing outdoors, cover with sheeting to protect from rain and other water sources.
- Ensure that any load from heavy objects on the product is evenly dispersed.
- Note that excessive load may lead to deformation or damage.
- Keep well clear of naked flame and other heat sources to prevent possible deformation or discoloration.

**Transportation**
- Handle the product with due care during transportation.
- Rough treatment may lead to damage.

Product Characteristics

**Usage**
- The products shall be used as a louver or as a cladding. It is not intended to be used as a structure or load-bearing element.
- The product must be designed and manufactured to the appropriate safety standards including resistance to wind pressure. (These specifications apply to the use of the material as a louver and do not extend to issues arising from the manner of installation.)

**Color**
- The product is made of reconstituted wood flour resin, which is subject to potential fading and discoloration as well as other forms of deformation and degradation. Product color may vary between batches at the time of delivery. The rate of fading and discoloration over time may also vary between batches.
- The product is sanded during manufacture to produce an authentic wood feel. The sanding process produces a directional grain. Thus, the appearance and color of the product may differ depending on the angle of viewing and the direction of the incident light.
Surface Coatings

- The surface layer contains Polypropylene and is unsuitable to be covered for most commercially available surface coatings.

Drainage

- The product should be installed with a sufficient angle to ensure good drainage and prevent water from pooling on the surface or internally. It may be necessary to consider additional drainage holes or slopes.

Maintenance

Recommended maintenance procedures are outlined below.

Exterior dirt

- Dirt and contamination on the surface of the product should be wiped off with a cloth or high pressure water.
- If a cleaning agent is required, use a mild, neutral detergent that does not contain acid or ammonia.

Scratches and cigarette burns

- Use sandpaper (grain 24) to remove any scratches or cigarette burns on the surface of the product.
- For best results, rub the sandpaper in the longitudinal rather than transverse direction.
- Avoid excessive sanding, which could remove the surface resin and expose the aluminum core material.

 Modifications

These documents may be modified or amended only with the approval of the purchaser or end user (which may be a subcontractor).