Success factors for the integration of Photovoltaic in Buildings: current and future solar cells technologies

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AGC Glass Europe
AGC GROUP

- 3 main business segments: Glass, Electronics, Chemicals

- Sales: €11 billion
- 50,000 employees
- 200 companies in over 30 countries
- Headquarters and stock exchange listing: Tokyo

AGC product range for building

Wide range of architectural glass solution
Passive / Active glass

Improve everyday life by consuming less energy and adding light to homes

Large range of decorative glass products specially designed for interior applications in homes and businesses

**BIPV Specifics**

- Replaces conventional building material
- If removed, integrity of the building structure is compromised
- Different from Building Added Photovoltaics (BAPV)

- Orientation, tilt angle, shadows and ventilation far from ideal

- Sunshading
- Daylighting
- Insulation
- Safety
- ...

Must fulfill Building **Standards**, including **aesthetic** expectations

SunEwat® XL: AGC BIPV product range

- Laminated Safety Glass
- Available in Insulated Glass Units: Thermobel SunEwat®
- All dimensions up to 2000x4000mm
- Certifications under both building and photovoltaic standards (EN14449, EN12600, EN1279, IEC 61215, IEC61730)

SunEwat® XL:
Mono / poly crystalline cells
SunEwat® XL

- Glass composition: tempered glass extra clear, clear, colored, silk-screened or other
- Glass thickness: 4 – 6 – 8 – 10 – 12mm depending on architectural constraints

**Certifications:**

- EN 14449 (Evaluation of conformity: laminated safety glass)
- EN 12600 (Pendulum safety test)
- EN 1279 (Evaluation of conformity: Insulated Glass Unit) Including moisture penetration and gas leakage
- IEC 61215 (Crystalline silicon photovoltaic modules - Design qualification and type approval). Including Factory inspection
- IEC 61730 class II (Photovoltaic module safety qualification)

**Warranties:**

- 10 years on product
- 10 & 20 years on performances
BIPV in spandrels

- Spandrels represent 25 – 70% of facade total surface
- The use of opaque spandrels allows highest installed power

<table>
<thead>
<tr>
<th></th>
<th>Spandrels</th>
<th>Vision glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cells per m²</td>
<td>36</td>
<td>28</td>
</tr>
<tr>
<td>Light Transmission (%)</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Power (Wp/m²)</td>
<td>146</td>
<td>116</td>
</tr>
</tbody>
</table>

Thermal challenge due to insulation
BIPV in Spandrels: the thermal challenge

Maximum potential temperature must be determined for each project.

<table>
<thead>
<tr>
<th>Orientation</th>
<th>Time</th>
<th>Max. temperature (^\circ) C</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>Summer</td>
<td>69</td>
</tr>
<tr>
<td>South East</td>
<td>Summer</td>
<td>75</td>
</tr>
<tr>
<td>South West</td>
<td>Summer</td>
<td>83</td>
</tr>
<tr>
<td>South West</td>
<td>Autumn</td>
<td>95</td>
</tr>
</tbody>
</table>

Maximum temperature Toulon (F). Source: AGC internal

BIPV spandrels must be adapted to high thermal load.

Interlayer maximum temperature in BIPV spandrel applications (Source: AGC internal)

New product: SunEwat ® XL for spandrels

SunEwat XL product features:

- Dimensions and compositions versatility up to 2.0x4.0m
- Laminated Safety Glass
- Certified under both Building and Photovoltaic standards

Multiple colors available for back glass (silk screen)

Product guaranteed for applications up to 100° C
BIPV Success Factors

- **PV**
  - Efficient and durable
  - High performance in building environment (low light, no ventilation, ...)

- **Building**
  - Easily adaptable to the broad variation in size and shape
  - High visual uniformity and color quality

- **Tools**
  - Integration in the very early design phase of the building
  - Quantify not only the energy but also the additional benefits

- **Cost**
  - LCOE comparable to that of standard PV roof panels
    (additional cost compared to equivalent “non-PV” building element)
Gap analysis with Crystalline solar cells

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AGC BIPV Roadmap

Applications

Vision Glass

Spandrels

Sunshades

Technologies

1st generation: c-Si cells

2nd generation: Thin Film (a-Si)

3rd generation: OPV, DSSC...

Stepped out

Heliatek and AGC signed a development agreement to integrate organic solar films in glass

AGC targets

Integration of Heliafilm® in Laminated Safety Glass

Delivery of integrated solutions for the glass envelope of buildings
Expected AGC BIPV value proposition with Heliafilm®

• Products for facade applications due to superior harvesting factor
• High temperature resistance products for spandrel applications
• Laminated glass for high durability
• High level of customization
• Short energy payback time

- Dresden, Germany
- 36 m², 960 Wp
Thank you for your attention

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www.yourglass.com