

ASSESSMENT OF AN EXTERNAL SKIN FAÇADE PHOTOVOLTAIC INTEGRATED CONSTRUCTION SYSTEM

FLEXBRICK

Product: Flexbrick with integrated photovoltaics

Tejido Flexbrick® is an industrialized system for flexible ceramic sheets for the construction of cladding and laminated structures. These ceramic textiles open up an endless range of possibilities for dry-assembly cladding systems in architecture.

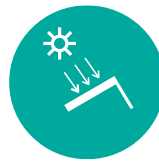
Flexbrick, in its commitment to the environment, is working on the integration of the photovoltaics in the ceramic sheets.



TR House in Barcelona (Spain).
PMMT Architecture, 2015.

Pilot Measurement & Verification Line 1

Managed by: TECNALIA Research & Innovation



PM&VL1

PM&VL1 has set-up a dedicated test chain for a comprehensive Building Integrated Photovoltaic (PV), Solar Thermal (T) and hybrid Photovoltaic/Thermal (PV/T) façade systems characterization, facing both Efficiency and Safety requirements. This PM&VL is managed by TECNALIA, the leading private and independent research and technology organization in Spain, with the goal of transforming knowledge into GDP.



Which is the need covered by this service?

These innovative products are usually out of standardized assessment methods and that is why, to offer manufacturers evidences about the safety, liability and robustness of their systems within the building envelope market, new assessment methods have been developed. The design of experiments is based on new assessment methods, intended to cover the following specific needs:

1. Optical measurements are typically done at 90°. To know which is the optimal orientation of a BIPV product, it is proposed to do this measurement at any incident angle.
2. As part of a façade, BIPV products face stressors that could compromise the safety of the system. The dynamic wind test, impact test and reaction to fire experiment assess the reliability of the products against different stressors.
3. During their life cycle BIPV modules must endure environmental actions without major decrease in energy output. The combined test sequence evaluates the power output of the products after various degradation processes.

Design of Experiments

1. Optical tests (280-2500 nm normal hemispherical reflectance and directional reflectance for different angles for incidence of radiation and sample)
2. Static Wind test according to EAD 090062-01-0404
3. Impact test according to EAD 090062-01-0404
4. Reaction to fire (according to EN 13823 -SBI- and EN ISO 11925 -ignitability)
5. Mechanical stresses and environmental actions ageing sequence (new sequence based on IEC 63092:2020, IEC 61215 and IEC TS 63209-1)



Set-up for dynamic wind load test as part of ageing sequence

Results

Main results/outcomes of each test/assessment procedure are shown below:

1. Optical tests:

1.1. Normal hemispherical reflectance results

Light reflectance (%)	Solar direct reflectance(%)
4.3	8.0

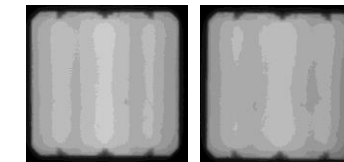
2. Static wind test: The module withstood a static load stress of 2,400 Pa. Another additional test was performed to check electrical performance of PV modules. It was concluded that they did not suffer any anomaly, as voltage was measured at similar values before, during and after the test.

3. Impact test results: Impact use category III was obtained.

4. Reaction to fire: B-s1,d0 classification was obtained.

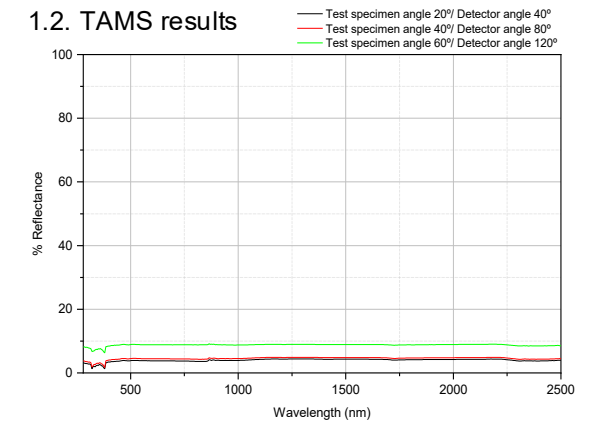
5. Mechanical stresses and environmental actions test sequence

- The samples showed no degradation in terms of short-circuit current after all tests. The modules passed all the insulation tests too. Variations in fill-factor and maximum power were observed due to degradation of the connection to the solar simulator (probably avoided by use of standard connectors upon installation).
- The Flexbrick samples withstood the dynamic wind test with no incidence. Besides, the modules were able to withstand hail impacts of up to 2J.



EL before (left) and after (right) the full sequence, with no change

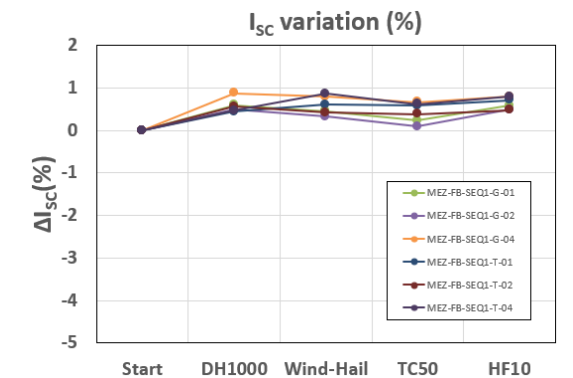
1.2. TAMS results



Spectral reflectance at different test specimen angles and detector angles reference



SBI test



I_{sc} variation during mechanical stresses and environmental actions test sequence

Conclusions

Tejido Flexbrick BIPV modules have endured all performed tests, exhibiting resistance to fire, wind, impacts, and a combination of environmental and mechanical stresses.

Regarding the performed assessment methods:

- The new tests provide significant information about the endurance of the BIPV products against different stressors.
- A new mechanical and environmental actions sequence has been tested showing the reliability of the product against a demanding combination of stresses.



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