Innovative Technologies 1.3

What is the long-term reliability of BIPV?

BIPV products in general are amazingly stable against UV and weathering. Typical guarantees of performance extend now for 25 or 30 years, ensuring profitability of the installation well after the end of the depreciation period [cf. sheet 4.4]. Here is a review of ongoing work in the field.

Long-term reliability and durability testing are critical to identifying product issues that may manifest in the field after several years. The main identified factors influencing BIPV lifetime, reliability and durability are high operating temperatures, non-homogeneous conditions (due to customization), regular shading, and mechanical and thermal stresses due to building skin.

Keywords: BIPV building skin; Active facade; Skin technology; Long-term reliability; Durability.
Target audience: Owners & other decision makers; Architects & engineers; Suppliers & companies.

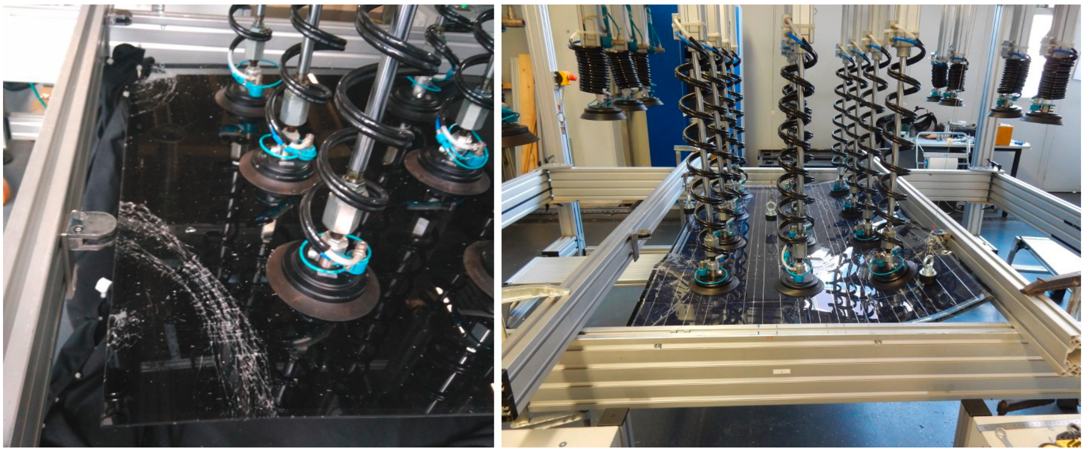

Fig. 1 Mechanical load on a PV module (©SUPSI).

EN 61215 and **EN 61646** qualification tests allow us mainly to identify initial **short-term reliability** issues of PV modules. Aging tests in climatic chamber and mechanical loads (Fig. 1) are also performed but it is important to note that there is no guarantee for PV modules to effectively sustain outdoor conditions and last for twenty or more years. Long-term reliability is a key issue for PV manufacturers and end-users. Nevertheless, it is not always considered in standards under preparation or covered by existing standards. For **long-term reliability** analysis, tests on PV modules are undergone by simulating accelerated stress tests based on measured data collected. Typical accelerating stressors are temperature, voltage, mechanical load, thermal cycling, humidity and vibration. Thus, in order to ensure long-term reliability of PV modules, it is important to identify their installation conditions and to adapt, accordingly, tests done indoors [1].

Moreover, there may be a need to differentiate between the **lifetime for generating electricity** (conventional PV) and the **lifetime and reliability as a building component** for a BIPV module. It remains to be seen whether the durability and reliability tests for conventional PV guarantee the performance of BIPV modules as part of building skin systems. Vice versa, it also remains to be seen whether the PV modules should undergo the same durability and reliability tests as their corresponding building element.

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70 NRP Energy Turnaround National Research Programme

To combine the different functional requirements of **building technique and electrotechnic** in a BIPV product, BIPV qualification needs a special application.

According to EN 50583, Parts 1 and 2 "Photovoltaics in buildings", "Photovoltaic modules are considered to be building-integrated, if the PV modules form a construction product providing a function as defined in the European Construction Product Regulation CPR 305/2011."

Testing and assessment of building-integrated PV products, according to the current standard, EN 50583: PV in Buildings, are conducted via an "adapted" application of IEC 61730/61215/61646 to building-integrated PV along with other qualification procedures/requirements for construction products. A list of current requirements for BIPV glass qualification is reported in [2] and includes the determination of:

- BIPV glass as laminated safety glass (EN 14449) for facades and overhead installations;
- watertightness against driving rain and uneven snow loads on roof systems;
- flammability and fire reaction/resistance of construction materials;
- noise insulating and absorption properties;
- dynamic wind stress tests according to window and facade standards;
- heat and light transmission;
- reflection properties;
- adhesive strength with tensile and shear load tests.

Today, we call for efforts to be made towards the **harmonization** and definition of **performance reference and procedures** for BIPV products. This not only calls into question the reference to building codes but also, in some cases, the definition of new procedures specifically developed for laminated BIPV glass and their particularities. Some examples for BIPV are [3]:

- dynamic mechanical load (new IEC TS 62782:2016)
- temperature ranges in existing standards (61215) due to increased operating temperatures of BIPV modules
- PV as a source-of-fire (arcing).

BIPV modules/systems should be envisioned and designed as building elements/systems in accordance with a **local and performance-based approach**, in order to guarantee the essential building requirements [4,5] and, at the same time, provide the necessary attention to the photovoltaic system.

The next challenge in the BIPV field, as also discussed in SP04, will be to identify missing gaps within the current standardization work and existing norms in relation to the most relevant BIPV requirements, performance risks, reliability and potential failure mechanisms to define which are the main routes for the development of new qualification procedures to support the market. Development and application of **adapted test methods for BIPV** is still a matter under investigation both at the lab/research level and within the standardization framework.

References

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