

**Lightweight PV modules** with a **weight of 5-6Kg/m** (compared to 15-20Kg for conventional BIPV products) are **manufactured by EPFL**.

\*By substituting typical front glass, with a thin ETFE polymer sheet, the “combi-encapsulant”, as a front sheet, and replacing the standard back sheet with a composite, Al-honeycomb core, sandwich structure

CSEM and EPFL are currently **combining their technologies** to develop **Ligthweight/coloured BIPV products**.

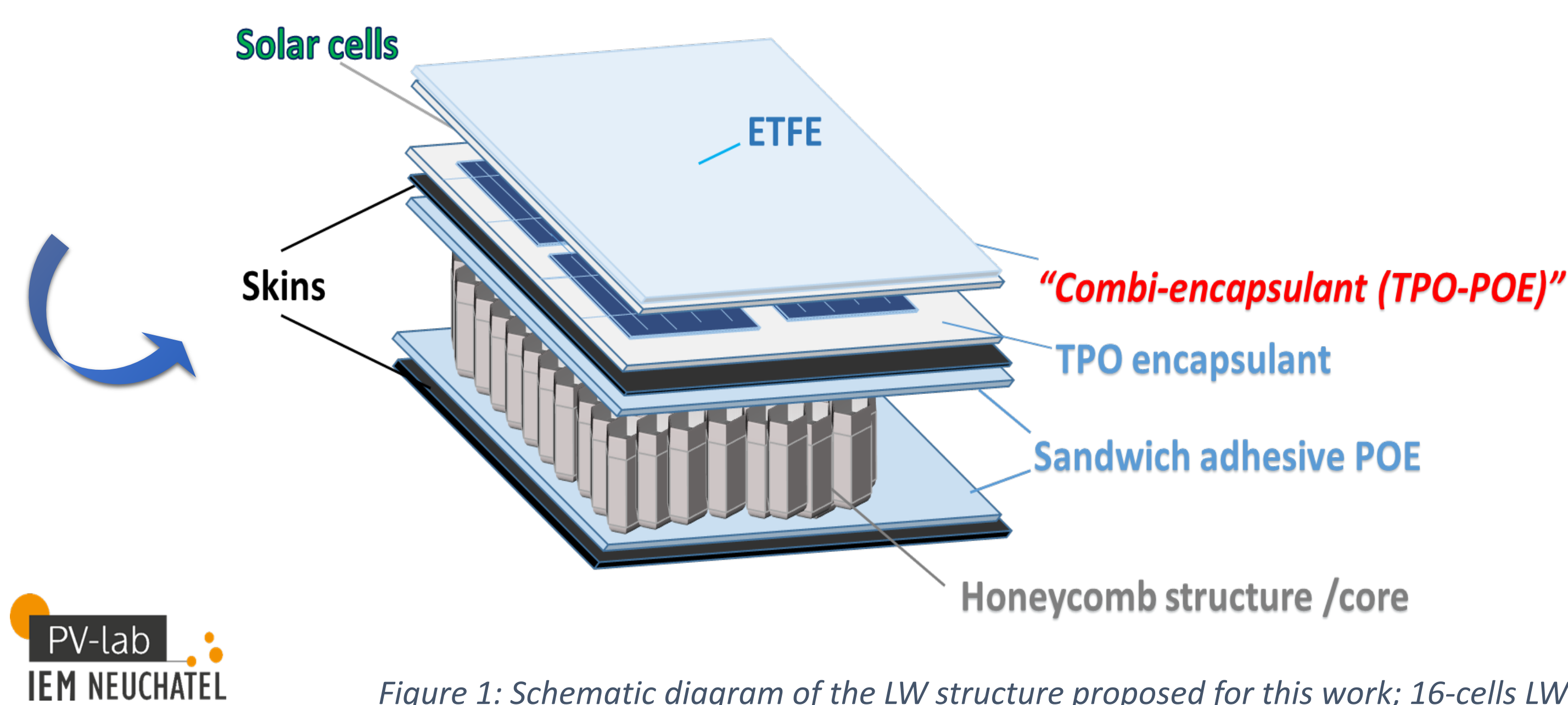


Figure 1: Schematic diagram of the LW structure proposed for this work; 16-cells LW PV modules manufactured @EPFL

**Lightweight glass-free crystalline silicon (c-Si) PV modules** with the standard and colored configuration,, will be installed on two BIPV demo sites, in UK and Romania, as part of the goals of a H2020 European project, **RE-COGNITION** [<https://re-cognition-project.eu/>].

Preliminary view of demo PV systems



Case Study 1  
Corby (UK)



Case Study 2  
Technical University  
of Cluj-Napoca (Romania)



Figure 2: prototype of the2 demo sites for the installation of ventilated façades with LW glass-free c-Si PV modules

Figure 3: photo of colored (0.1x1) m2 LW PV modules and the respective mini-modules at the bottom

**Reliability and long-term performance** ↔ careful **optimization** of the **module structure** and **processing methods** as careful **materials selection!** static **mechanical load (SML)**, and **fire test**; showing no degradations, nor visual defects (delamination, corrosion, or bending of the module).

## Excellent mechanical performance

This is one of the most challenging test to pass, since the rigidity of the glass is missing and the integrity of the solar cells is exposed to high risk.

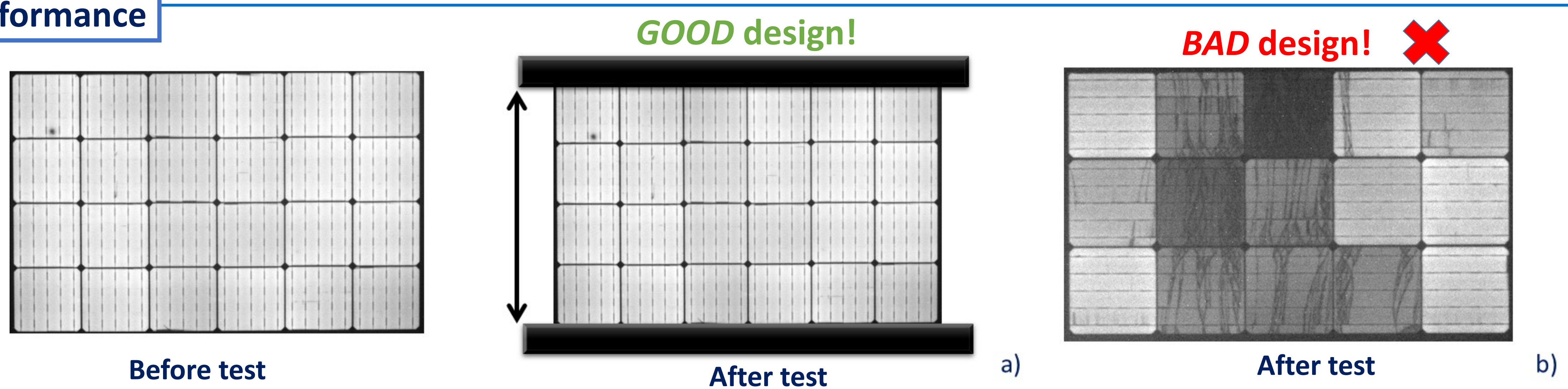
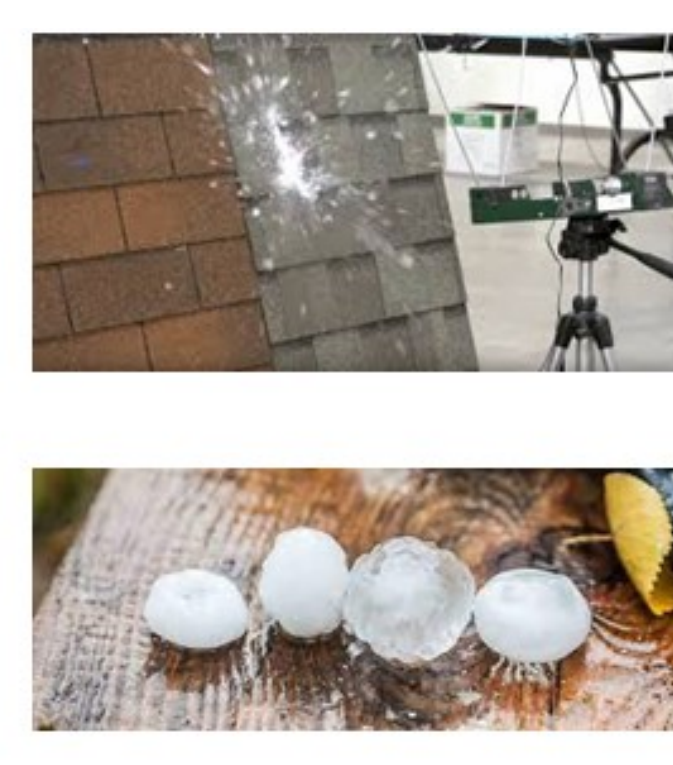
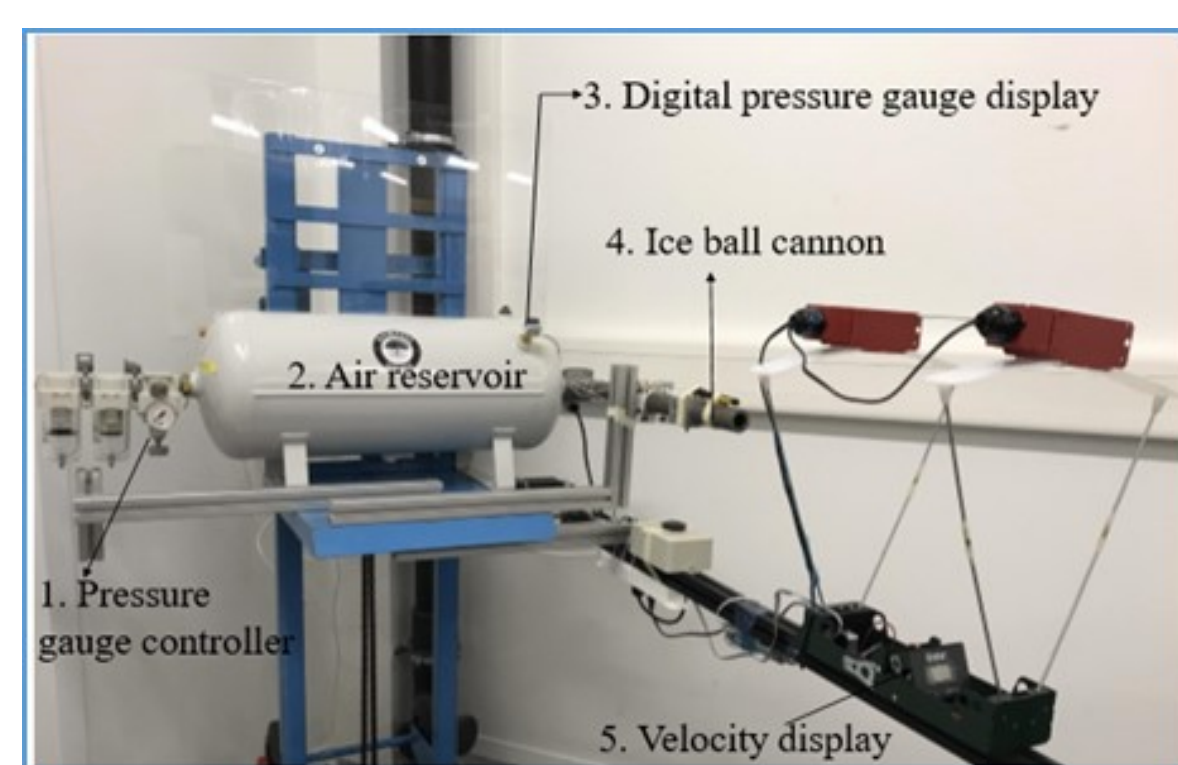
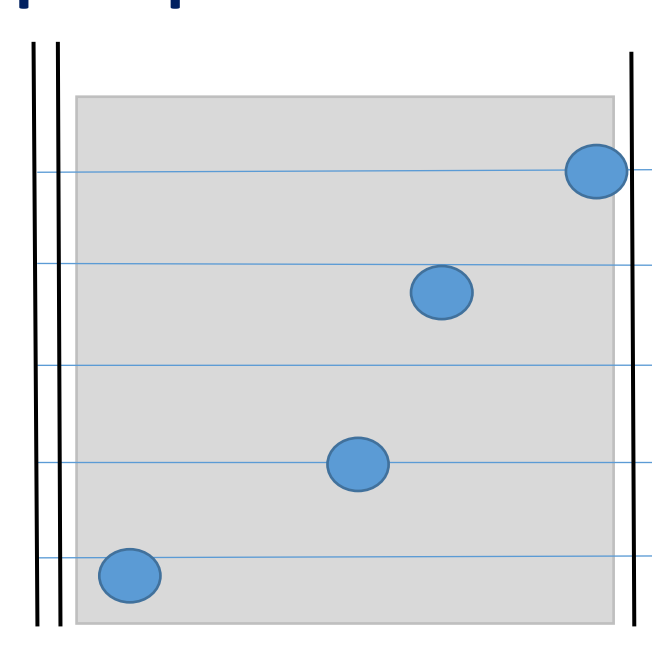


Figure 5: EL images of a 24-cells LW PV module, before and after being exposed to the mechanical load test (a); example of bad design and failure after the mechanical test(b)

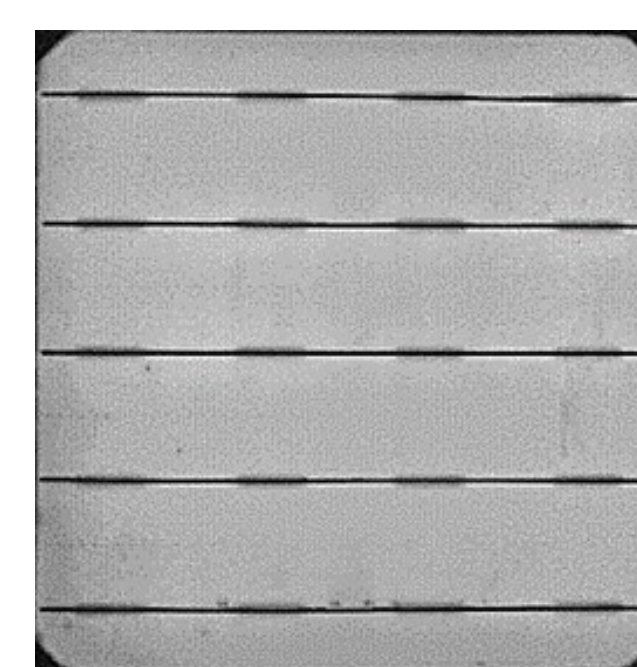
## Excellent resistance to HAIL impact



Impact point of the ice balls

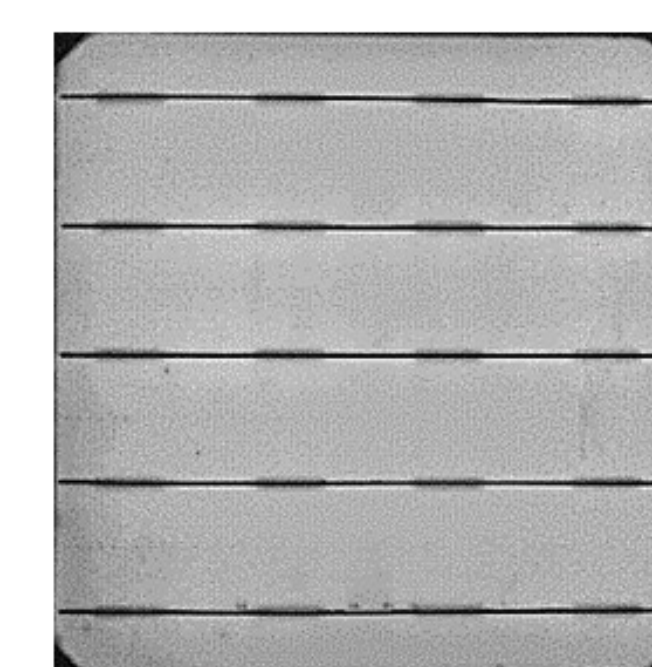


b)



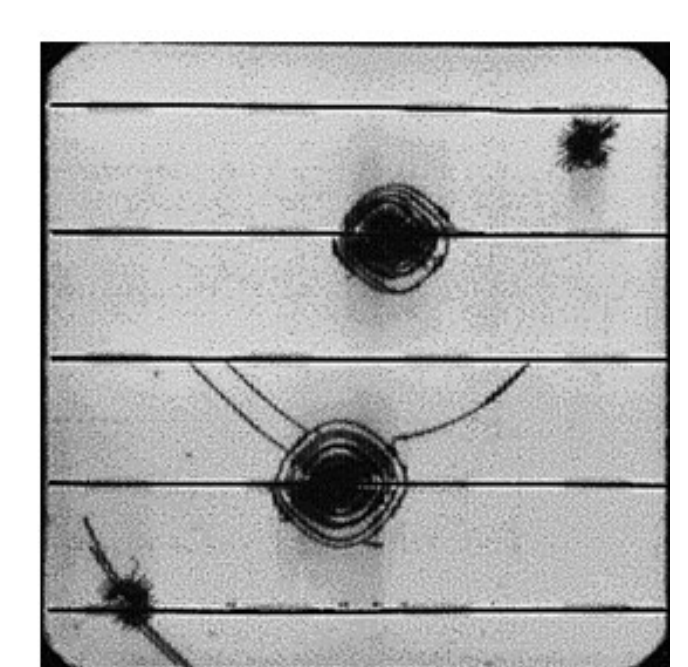
Initial

## GOOD design!



After HT

## BAD design! ❌



After HT

c)

Figure 6: Hail test homemade used @EPFL, example of hail impact on the modules and ice balls (a), impact points of the ice balls on the PV modules (b) and EL images before and after the test (c)

## Resistance to FIRE!

Preliminary test performed at a “fire station” gave promising results: with both colored and standard configurations the fire self-extinguished, leaving the structure with obvious, inevitable defects, primarily by visual inspection.

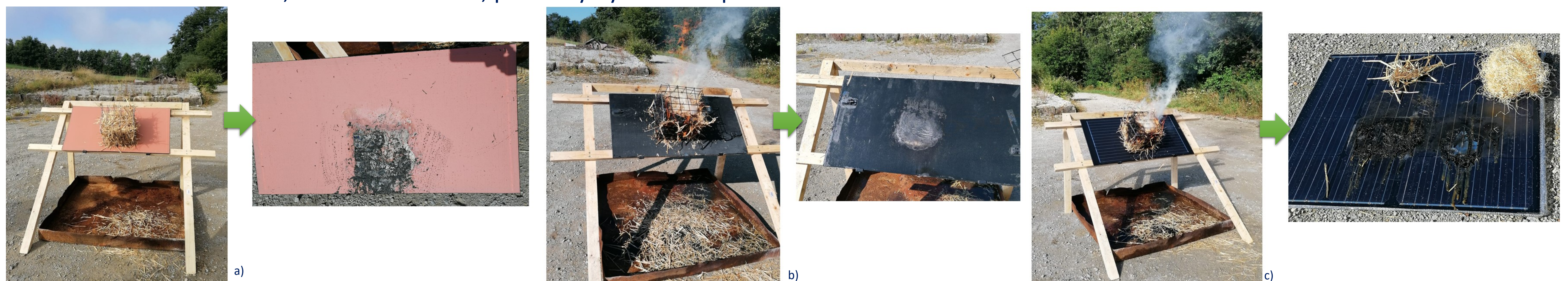


Figure 7: preliminary results of the fire test, performed on colored LW PV modules (a); at the back of the LW PV module(b), and on the standard black LW PV modules ©

## In summary:

- \*Robust and resilient glass-free lightweight c-Si PV modules, with a weight of ~5Kg/m2, were designed with optimal BOM
- \*successfully passing the criteria of the IEC 61215 and 61730, maintaining high optical properties and ideal thermo-mechanical performances.
- \*Within the frame of a an H2020 European project, RE-COGNITION, two BIPV ventilated façades will be realised, in UK and Romania, as part of the final goals.