BE-SMART

Together for Active and Efficient Buildings

The BE-Smart project has received funding from The European Union's Horizon 2020 research and innovation programme under grant agreement No 818009.

Multifunctional EPoGs - Module reliability & manufacturing process

1. Tool for simulating in-module temperature profile during lamination for different module designs

2. Develop a low temperature processable encapsulant

3. Extended reliability testing on material level and mini-module level

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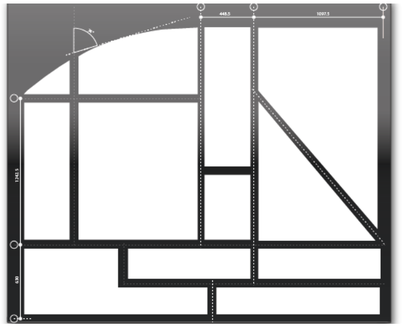
EPOGs size

- Size depends on the on the building architectural requirements (A. Clua Longas, Proceedings of PLEA)

Module size 600x2700mm
Student Housing in Aarhus
(photo Lars Kvist)

Module size 3000x4000mm
Energy Cube in Konstanz
(photo ertex solar)



To respect the geometry of the building or to go around obstacles, “active” **cut parts** of the product are available

- Glass thickness 2.0-10.0mm to meet the mechanical and safety building requirements.

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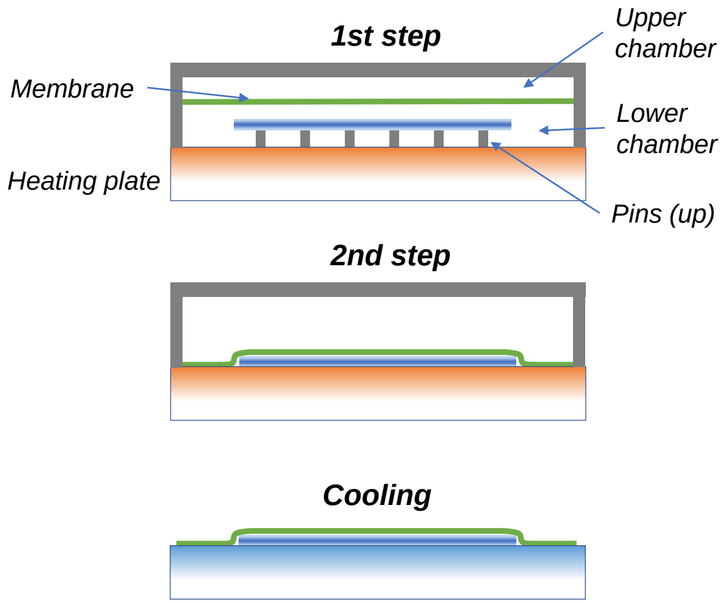
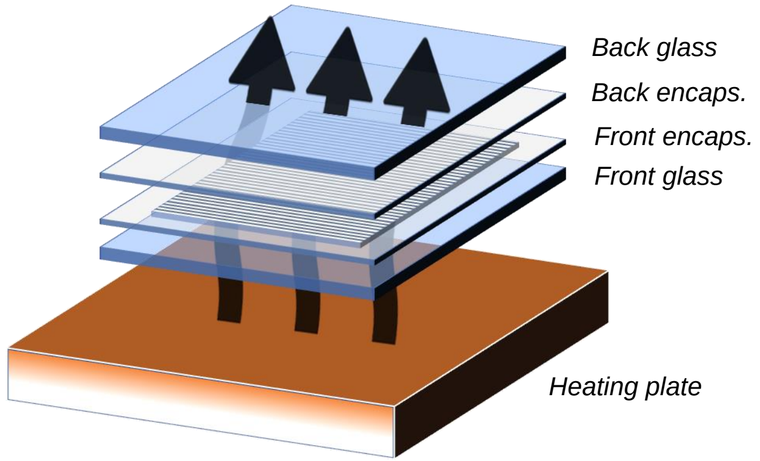
Lamination process





With thicker glass, longer lamination time is needed to transfer heat to the encapsulant

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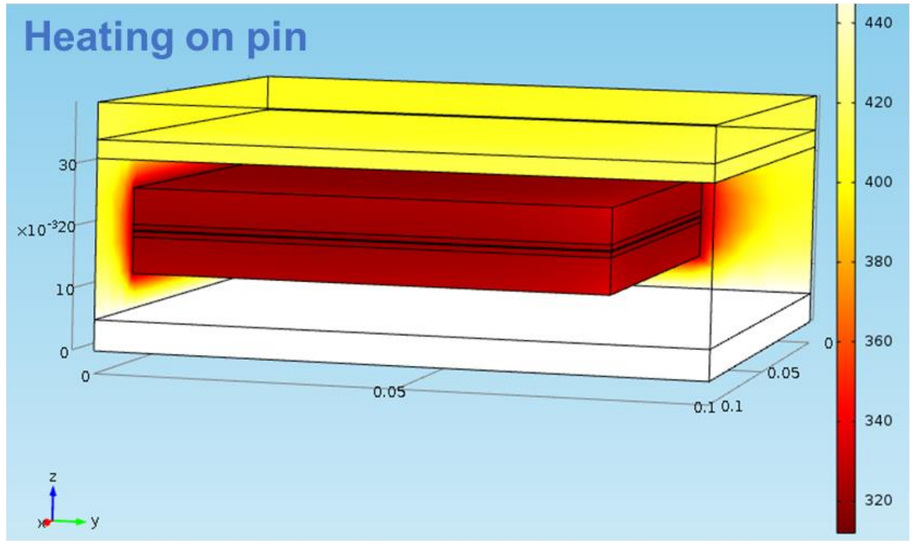
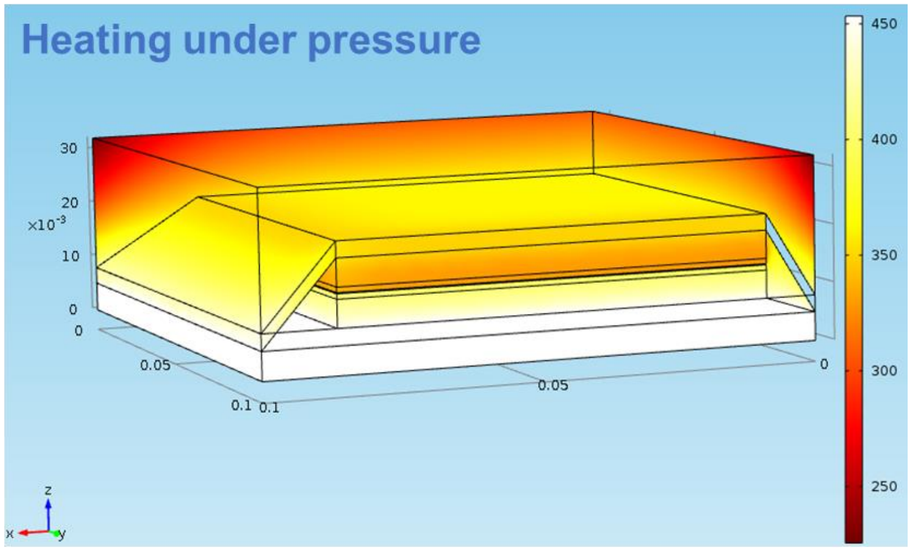
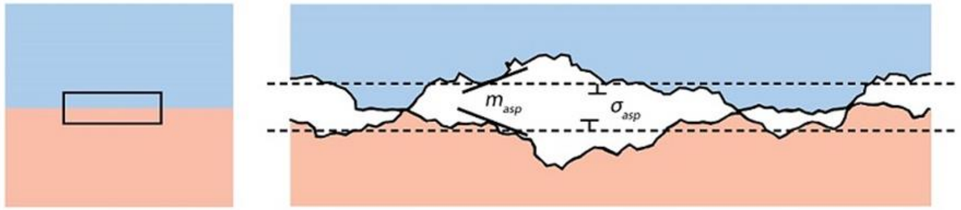
Finite Eelement Method (FEM)







Thermal resistance contact

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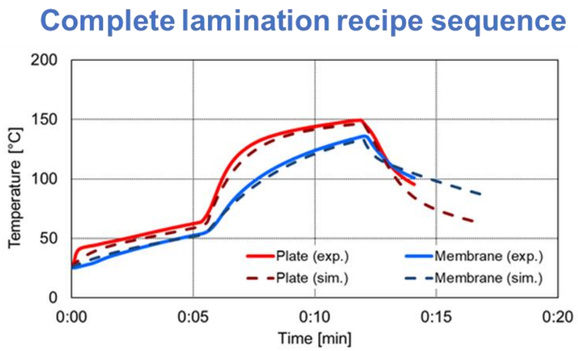
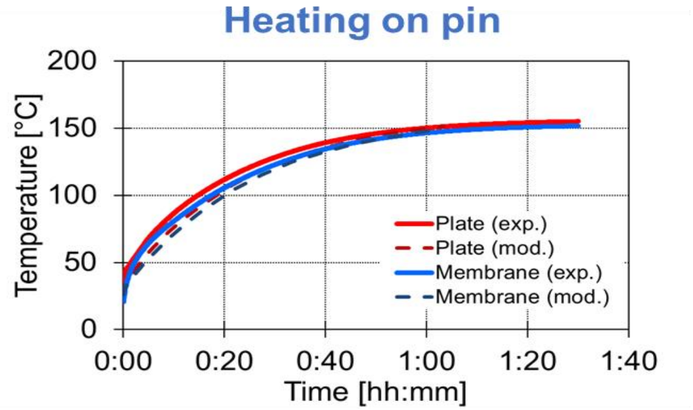
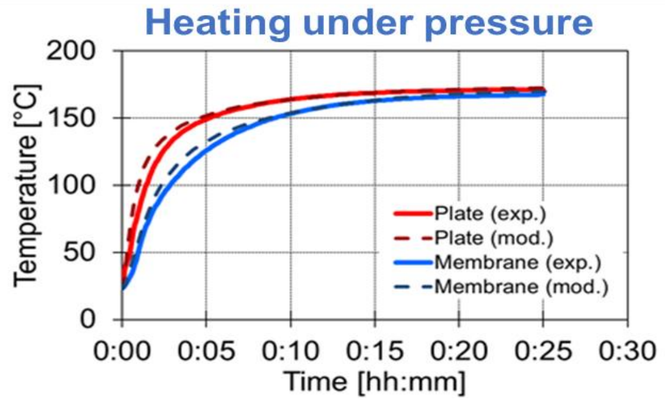
Model validation



Temperature difference between experimental and simulated data at the end of the pressure step before starting the cooling is less than 2°C





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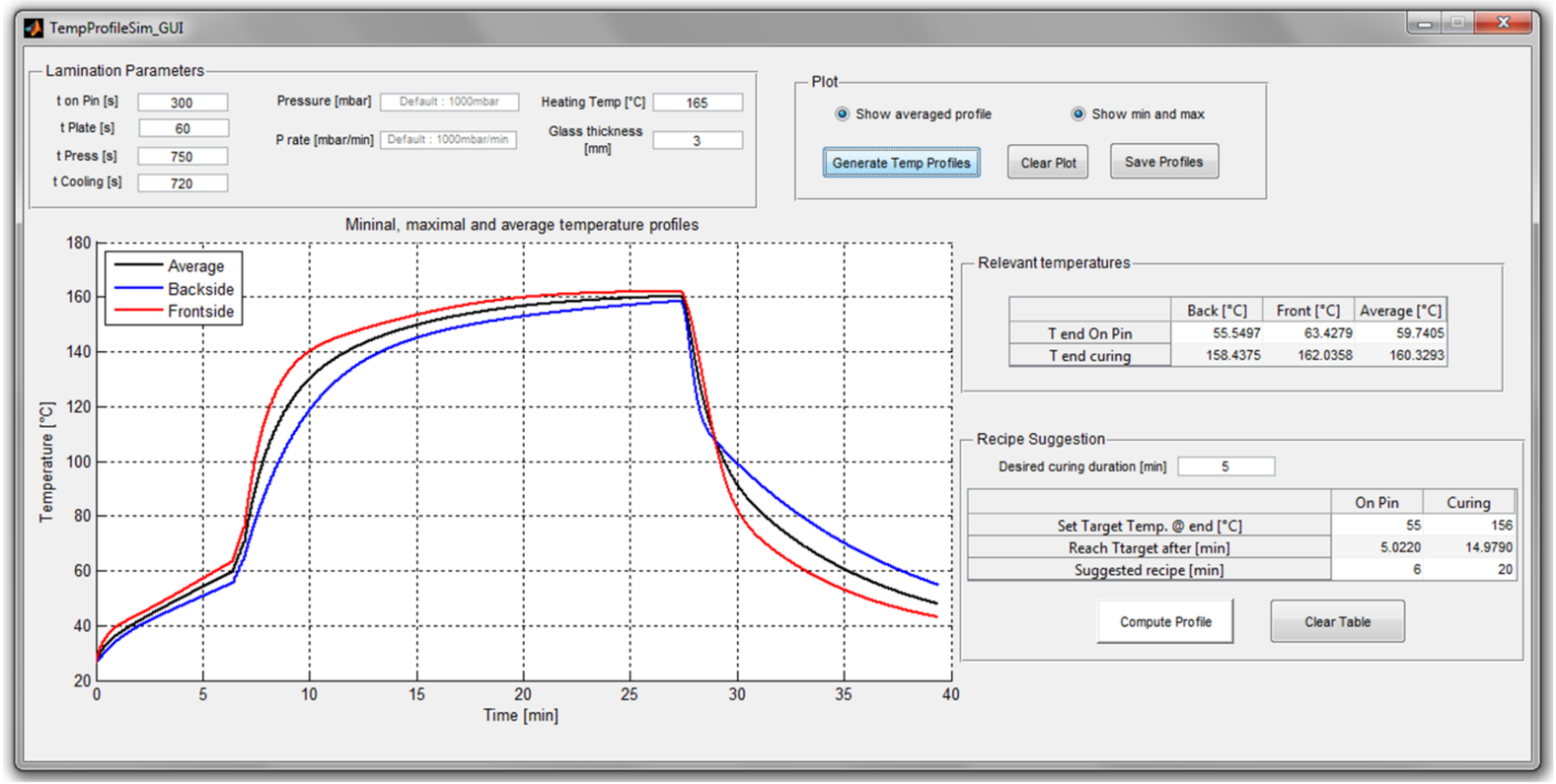
Simulation program



GUI of the simulation program

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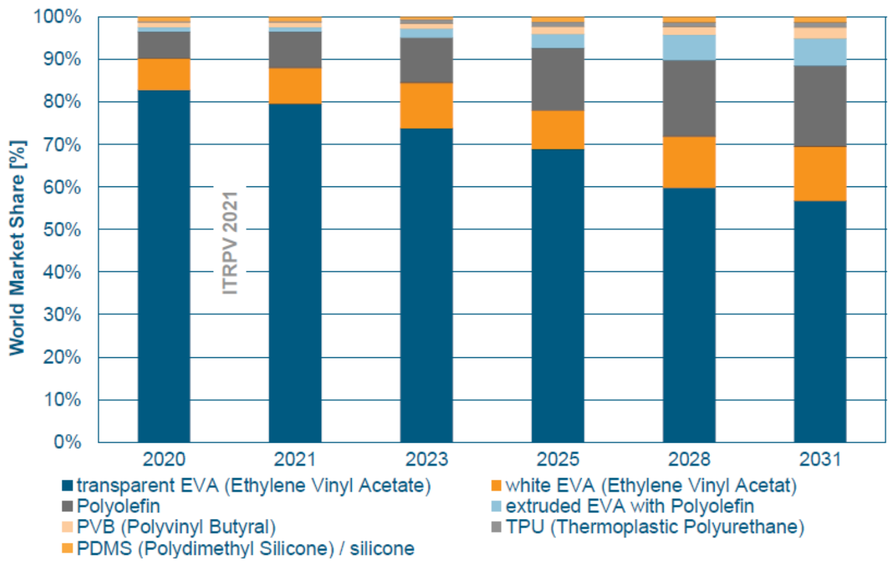
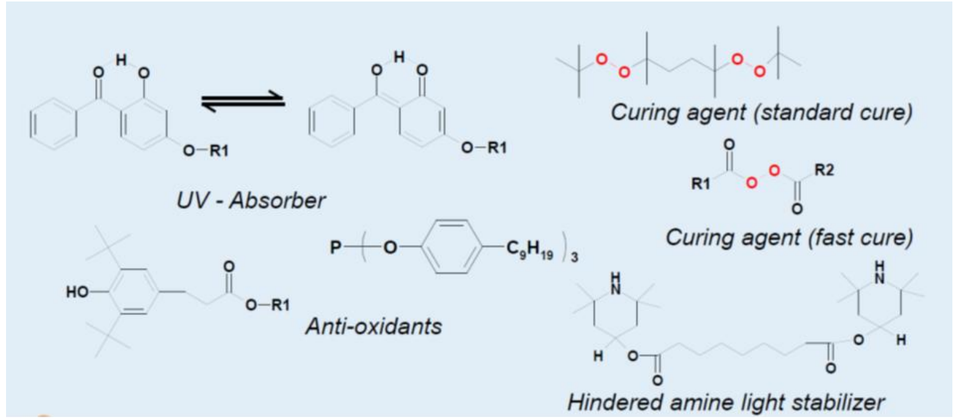
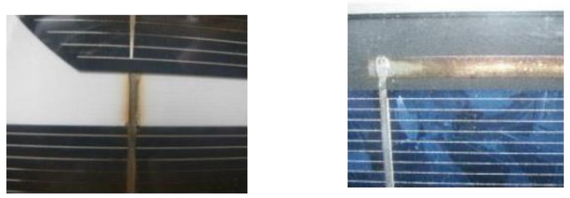
Standard EVA encapsulant

- Ethylene Vinyl-Acetate polymers (EVA) films are currently mainly used for the encapsulation of photovoltaic modules





EVA additives and stabilizers (Report IEA-PVPS T13-09:2017



Electrical contacts corrosion (Report IEA-PVPS T13-09:2017

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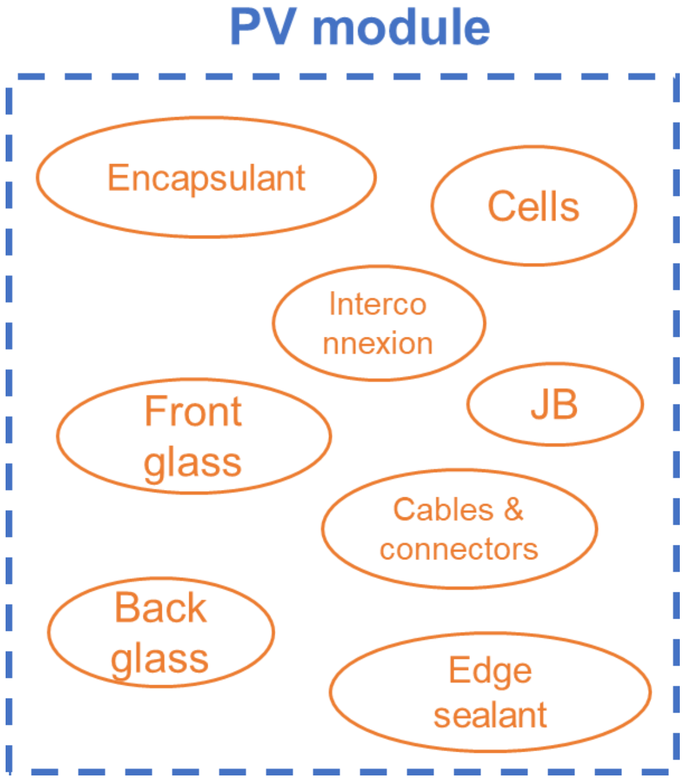
Extended reliability testing



IEC 62788

Measurement procedures for materials used in photovoltaic modules

IEC 61215

Terrestrial photovoltaic (PV) modules – Design qualification and type approval

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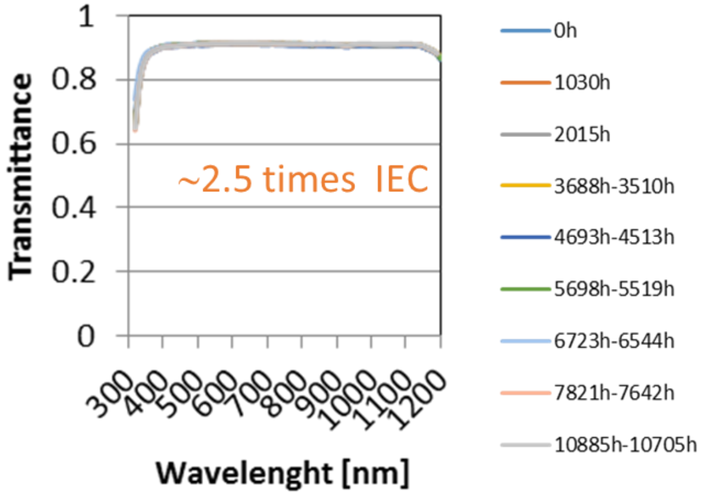
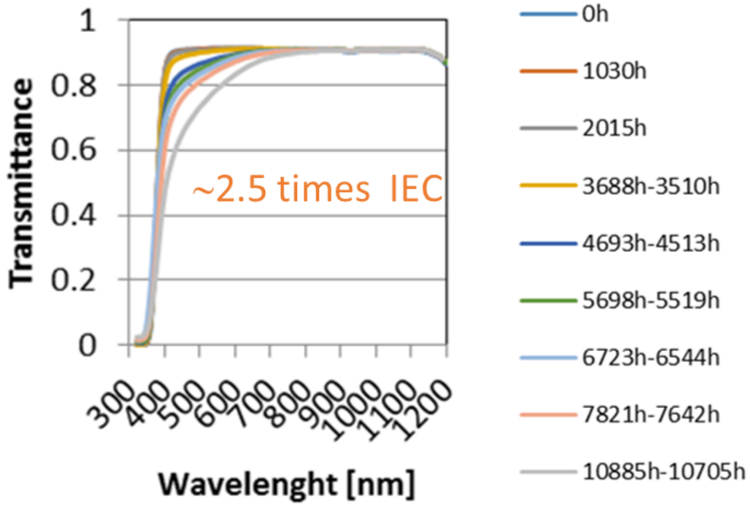
Extended reliability testing

- Clear low temperature encapsulant

IEC UV test
- Temp. 70°C
- Irr. 0.8 W/m^2 @ 340 nm
- Time: 4000h





IEC DH test
- Temp 85°C
- Humidity: 85%
- Time: 1000h

DH Time [h]	ΔP_{max} [%]	ΔI_{sc} [%]	ΔFF [%]	Δv_{oc} [%]
0	-	-	-	-
2318	-3.4	-0.40	-2.69	-0.23
7155	-10.1	-0.79	-8.94	-0.33
8855	-20.5	-2.61	-15.60	-3.23

DH Time [h]	ΔP_{max} [%]	ΔI_{sc} [%]	ΔFF [%]	Δv_{oc} [%]
0	-	-	-	-
2318	-0.7	-0.62	+0.14	-0.20
7155	-0.5	-1.09	+1.54	-0.97
8855	+0.9	-1.08	+2.66	-0.56

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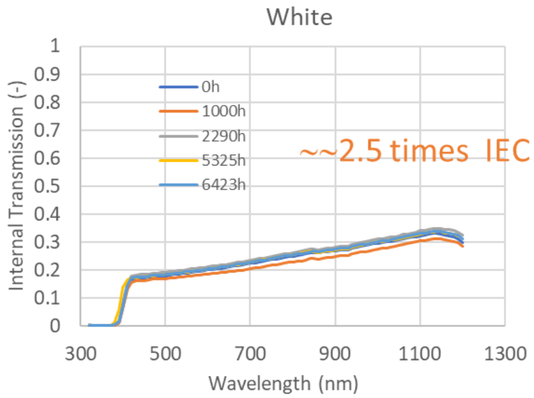
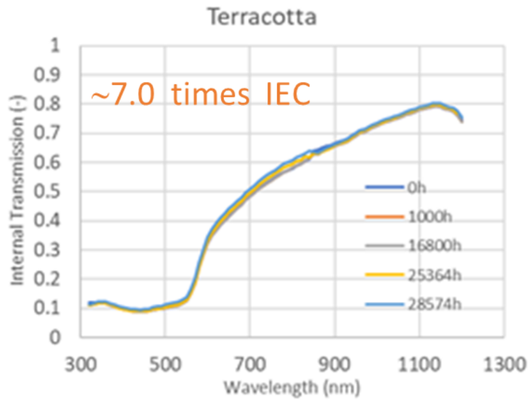
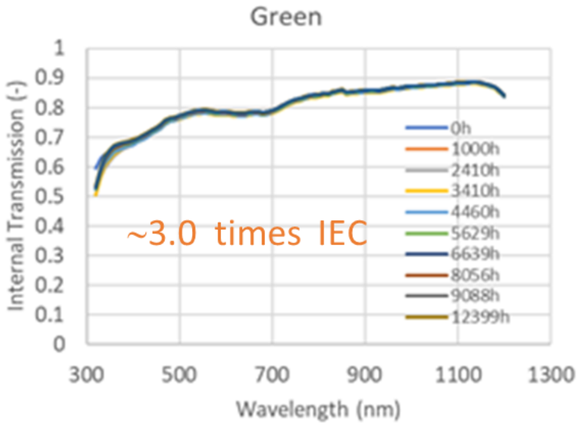
Extended reliability testing

- Colored low temperature encapsulant

IEC UV test
- Temp. 70°C
- Irr. 0.8 W/m² @ 340 nm
- Time: 4000h







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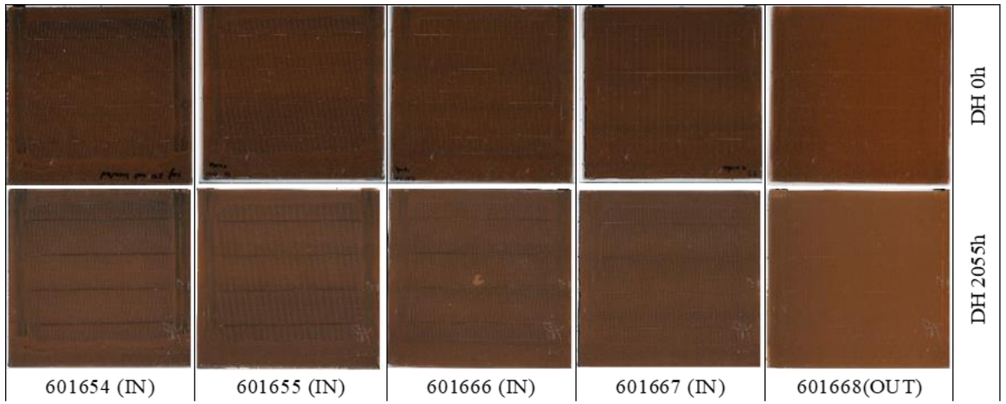
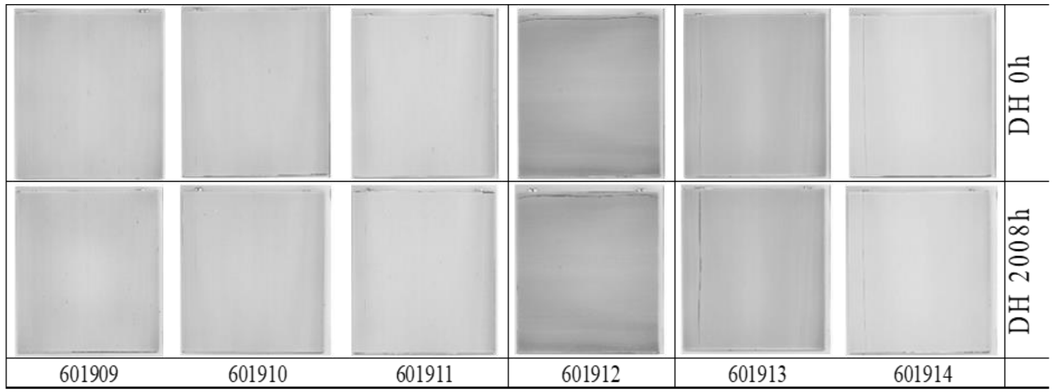
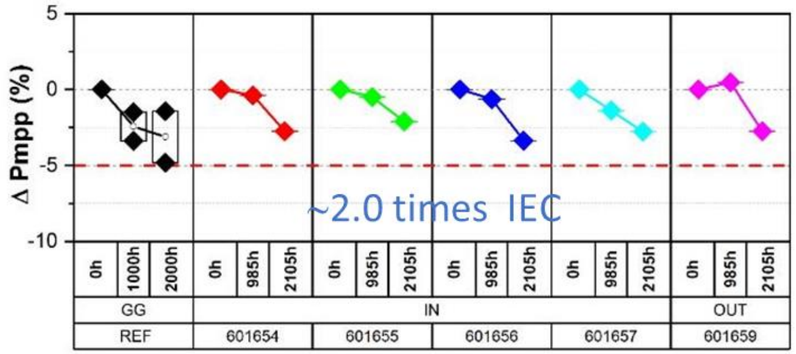
Extended reliability testing

- Mini-modules with coloured low temperature encapsulant







IEC DH test

- Temp 85°C
- Humidity: 85%
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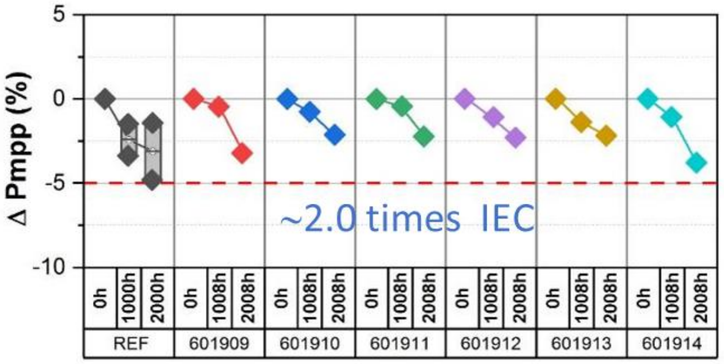

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Thank you for your attention.