Outdoor Performance and Degradation of Photovoltaic Roof Tiles under Realistic BIPV Operating Conditions

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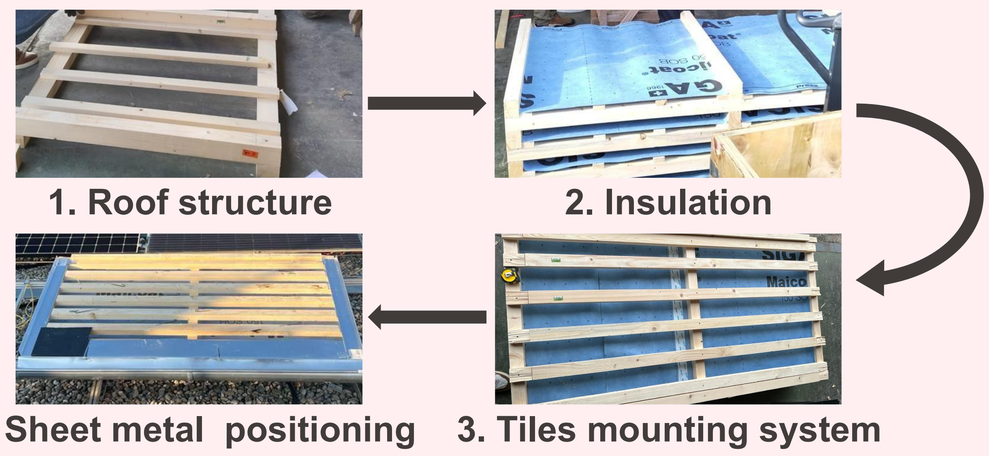
Introduction

- **Context:** PV roof tiles integrated on roofs can show different faults and degradation due to their insulated installation environment.
- **Aim:** Analyse the impact of the working environment on performance by creating mock-ups with roof-like structures.

Rooftile type	STC Power (W/m²)
Classic	147.2
Premium Black	141.9
Heritage	133.2
V-Diamond	84.2

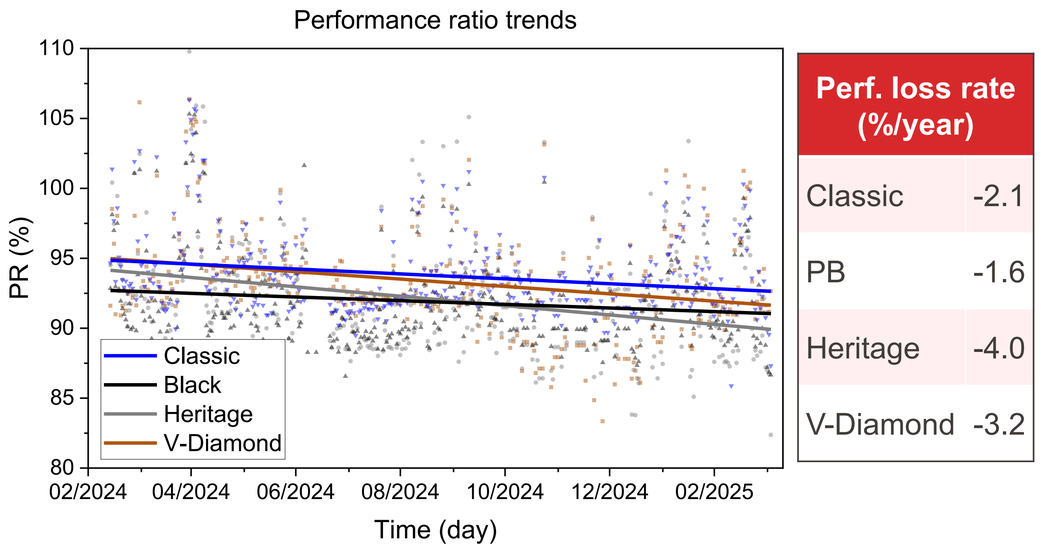
Mock-up preparation



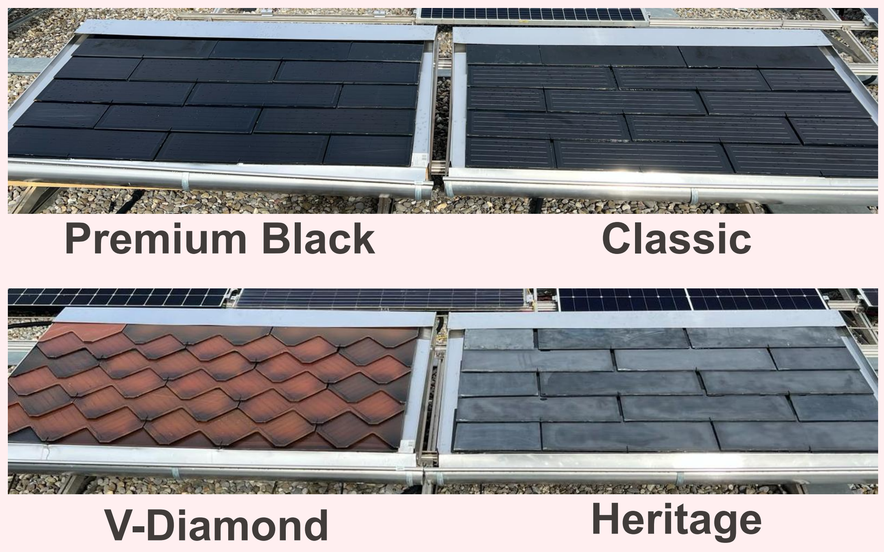
Results

1. Outdoor-level monitoring

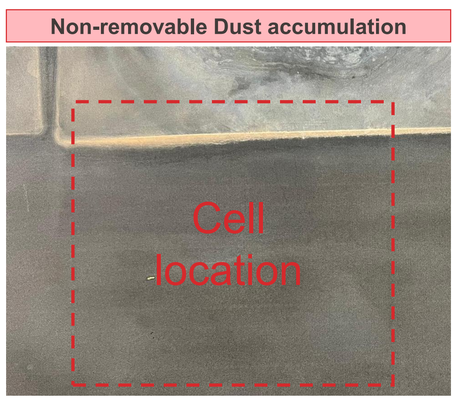
- **Higher average performance loss rate** (PLR) for coloured product (V-Diamond) and for satinated glass product (Heritage).

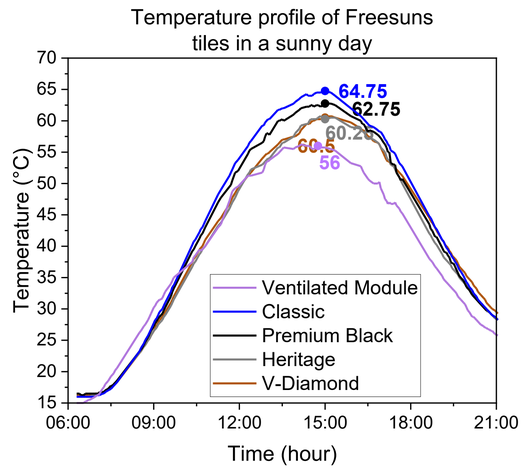


Perf. loss rate (%/year)	
Classic	-2.1
PB	-1.6
Heritage	-4.0
V-Diamond	-3.2



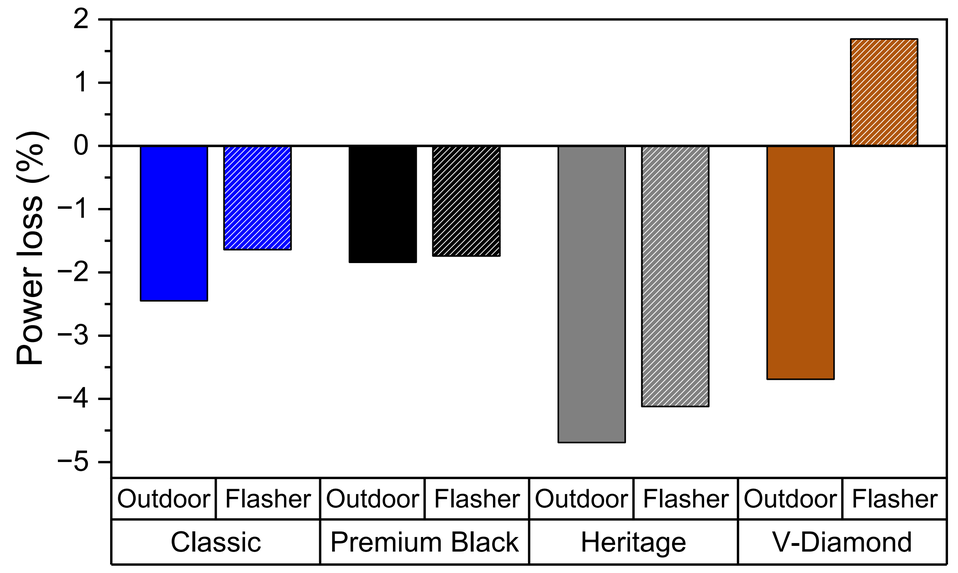
- **Heritage:** Accumulation of non-removable dust on structured glass below the overlap location → light blocking on covered cells.
- **Temperature:** 4 to 9 °C increase in temperature of roof-like structures compared to a typical ventilated module → may lead to higher degradation rates.





2. Indoor-level measurements

- Indoor and outdoor measurements correlate well, except for the V-diamond system.
- High discrepancy between outdoor and indoor characterisation for the coloured system → further investigation is required.



Conclusion

- **Performance loss rate:** higher degradation of Heritage tiles due to the accumulation of dust on textured glass.
- **Higher temperature:** increase in temperature due to the roof-like structures may lead to additional degradations.
- **Deviation between indoor and outdoor testing:** discrepancy in the performance analysis for coloured solutions → further analysis required.
- **New developments:** future innovations will be implemented to render the solar tiles dust-free, highly efficient, and stable.

Acknowledgements

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