# Innovative solar cells for low-cost building or product-integrated photovoltaic


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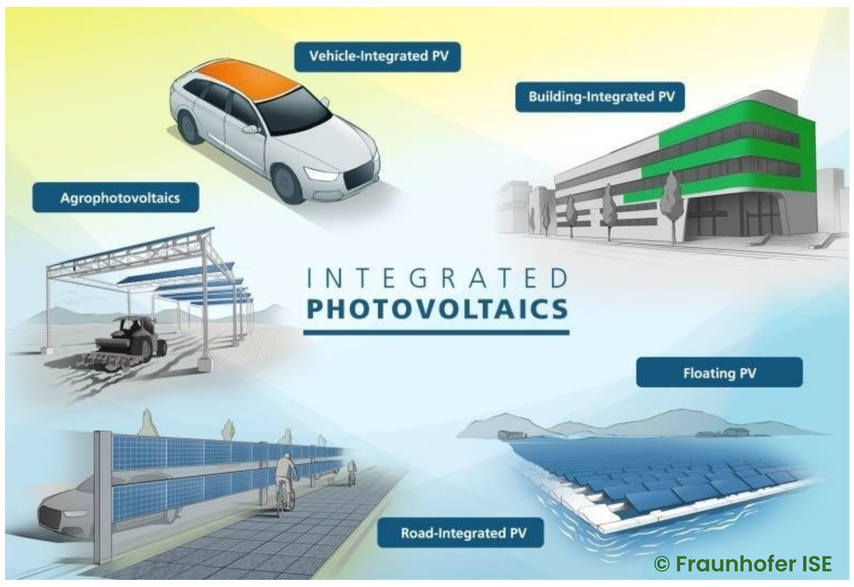
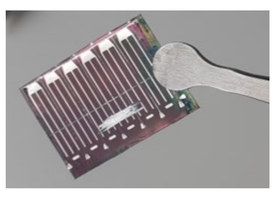



**The quest for sustainable energy solutions has spurred innovation in the photovoltaic (PV) field, leading to the emergence of the incorporation of PV elements into various structures or devices, effectively harnessing solar energy and converting it into electricity for immediate use.**
**Perovskite solar cells (PSCs) and $Cu_2ZnSn(S_xSe_{1-x})_4$ (CZTSSe) solar cells stand out as promising candidates for integrated PV systems, aligning with the demand for cost-effectiveness, versatility, and scalability.**

**Our preliminary results underscore the feasibility and potential of these technologies**

## CZTSSe

We have produced flexible CZTSSe solar cells, developed for vehicles integration to enhance their energy efficiency while reducing their environmental footprint.



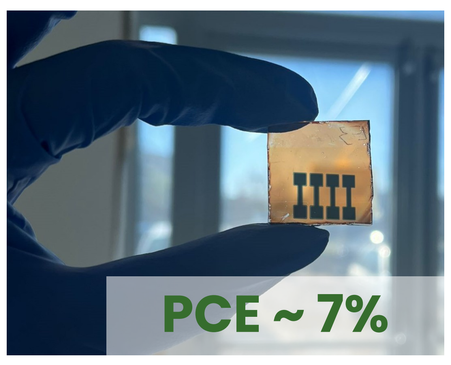
PCE ~ 10%

The method is currently under optimization for a wider range of structural integrations

*Power conversion efficiency (PCE)*

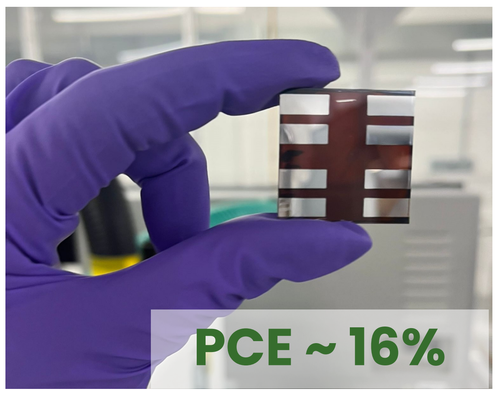
**Crucially, both fabrication processes have been engineered to ensure scalability, facilitating the transition from laboratory prototypes to mass production.**

## PSCs




We have fabricated semi-transparent PSCs under ambient conditions, paving the way for their integration into building infrastructure, where they can simultaneously serve as windows and energy generators.

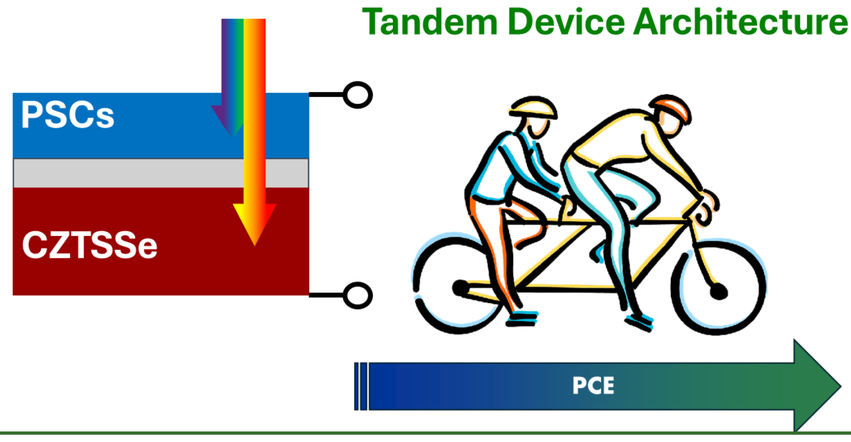
Atomic layer deposition (ALD) will be used to make them colourful while maintaining an average visible transmittance (AVT) of over 50%.




*Power conversion efficiency (PCE)*

## Tandem

The efficiency enhancement is of paramount importance.
Both PSCs and CZTSSe solar cells have been designed to be employed in tandem architectures, aimed at maximizing the energy conversion efficiency, maintaining versatility and scalability.




**Through the development of semi-transparent PSCs for window applications and flexible CZTSSe solar cells for vehicle integration, we have demonstrated the feasibility of incorporating solar energy harvesting capabilities into diverse structures and devices.**
**By focusing on scalability and efficiency enhancement, our work lays a solid foundation for the transition of these technologies from laboratory prototypes to mass production, thereby paving the way for widespread adoption of sustainable energy solutions.**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