BOBTandem
Band Offset selective Barrier Three Terminal perovskite on silicon high efficiency Tandem Solar Cell

Project duration: from 09.2019 to 08.2022
Report submitted: 01.2020

Publishable Summary

In global solar cell research, multijunction solar cells (or “tandems”) are the most promising route to improving crystalline silicon (c-Si) solar cells. They consist of two (tandem) or more solar cells of increasing bandgap which are combined in one device and can reach efficiencies well beyond 29%. These multijunction cells achieve such high efficiencies by reducing the amount of cell heating due to the incident sunlight, and by instead collecting some of this heat as useful electrical power. This is termed “reducing themalisation losses”.

These MJ solar cells come in a range of configurations in terms of connection. Briefly, these traditionally include two terminal (2T) and four terminal (4T) designs have yielded the best results but suffer technological bottlenecks due to tunnel junctions (2T) which impose current continuity and grid alignment (4T).

The BOBTANDEM project proposes a new three terminal (3T) concept which we call the “3T-SBOB” which eliminates the 2T and 4T technological bottlenecks. The 3T-SBOB device, patented in 2018, uses an internal barrier (the Selective Band Offset Barrier or SBOB) to allow this reduction in thermalisation by isolating charged current carriers in different regions of the cell.

The result is that the two cells making up 3T-SBOB device operate independently without series limitations, and with a single grid on the front surface, together with interdigitated back contacts on the back surface.

The BOBTandem project will demonstrate this concept for the first time, using the exciting emerging perovskite solar cell technology and integrating it with a silicon back-contact solar cell which is in industrial mass production by the project partner ISC-Konstanz.

The project is coordinated by researchers at the origin of the 3T-SBOB concept (GeePs CentraleSupelec / CNRS / EDF). The perovskite cell is integrated by perovskite solar cell researchers (EPFL) active since the start of the field of perovskites. The interdigitated back contact silicon expertise and fabrication is assured by solar cell industrial partners managing mass production of the ZEBRA IBC cell in 2019. Theoretical modelling and analysis is provided by researchers at the PVMD group of TU Delft deploying accurate optical modelling and comprehensive energy yield modelling of the 3T SBOB device. These researchers are brought together with the recently patented concept, which has been independently demonstrated in the field of infra-red detectors. These strong industrially-validated IBC and SBOB concepts yield a novel 35% efficient tandem device without the limitation of tunnel junctions, and without the complex optical interconnection issues of 4T designs.

For more information we refer you to the project website: https://bobtandem.wordpress.com/

Project consortium

Coordinator and all contact details:

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Participating countries and financing:

Country	**Number of organisations involved**	**Project costs in EUR**	**Public funding in EUR**
France	2	739'344.01	336'275.40
Germany	1	352'816.00	282'253.00
The Netherlands	1	240'302.00	232'302.00
Switzerland	1	352'640.00	≈ 200'934.58*
Total	*5*	*1'685'102.01*	*1'051'764.98*

• 215,000 CHF, at 1€ = 1.07 CHF (rate of 24/01/202)

Funding agencies involved and contracts

Funding Agency	**Contract N° and Title**
ANR	ANR-19-SOL2-0001 “BOBTandem“
SFOE	S/501919-01, "Research contract (grant)"
ANR	ANR-19-SOL2-0001 “BOBTandem“
PtJ	FKZ 03EE1030, title: "Band Offset selektive Barriere von hoch effizienten Drei-Terminal
RVO	Perowskit/Silizium - Tandemsolarzelle, Entwicklung und Optimierung einer