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TRIUMPH

Triple junction solar modules based on perovskites and silicon for high performance, low-cost and small environmental footprint

Deliverable report

D1.2- Analysis of the implicit biases in the lab infrastructure and facilities

Disclaimer/ Acknowledgment

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About TRIUMPH

TRIUMPH is aimed at developing the next generation PV technology to come after tandems, i.e., an advanced triple junction cell concept. The devices will be based on the cost-effective and highly-efficient perovskites for the middle and top cells and the robust and well-proven silicon for the bottom cell. The **4 objectives** of are:

1. Achieving highly-efficient triple junctions **>33%** with **high stability** on 1 cm^2 area
2. Demonstrating a cost-effective and scalable route for triple junctions on **large-area (≥100 cm^2)** with minimal upscaling losses (efficiency **>90%$_{rel}$** to small-area devices) with **3J modules** passing accelerated reliability testing.
3. Designing triple junction cells and modules for **sustainability** by **reducing CRMs** such as In and Ag, and by introducing **circular concepts** that allow easy recycling at end-of-life of the 3J modules.
4. Establishing the **value chain within EU** for future multi-junction modules.

The project consortium, coordinated by IMEC in Belgium, consists of **15 complementary partners** from renowned research institutions, illustrious universities as well as strong industrial players from across the value chain.

TRIUMPH consortium members

No.	Participant Legal name	Acronym	Country
1 (Coord.)	INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM	IMEC	BE
2	FRAUNHOFER GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN FORSCHUNG E.V	F-ISE	DE
3	L'INSTITUT PHOTOVOLTAÏQUE D'ÎLE-DE-FRANCE	IPVF	FR
3.1	ÉLECTRICITÉ DE FRANCE	EDF	FR
4	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK	TNO	NL
5	SALD B.V.	SALD	NL
6	DYENAMO AB	DYN	SE
7	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	CNRS	FR
7.1	UNIVERSITE PARIS-SACLAY	UPS	FR
8	ALBERT-LUDWIGS UNIVERSITÄT FREIBURG	ALUF	DE
9	HANWHA Q CELLS GMBH	QC	DE
10	RENA TECHNOLOGIES GMBH	RENA	DE
11	ECOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE	EPFL	CH
12	CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA - RECHERCHE ET DÉVELOPPEMENT	CSEM	CH
13	VON ARDENNE GMBH	VA	DE
14	ODTÜ GÜNEŞ ENERJİSİ ARAŞTIRMA VE UYGULAMA MERKEZİ	OG	TR

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Publishable summary

Among the consortium partners a survey focussing on implicit biases within the laboratories was conducted. Nine out of fifteen partners (excluding shared infrastructure) reported on observed limitations, e.g., ergonomic biases towards tall people in relatively good physical shape. In particular, gloveboxes were identified as central fabrication units that are inherently not adapted to scientists with different physical abilities/sizes. This includes limited reach within the boxes due to shorter arm span, different body heights, but also appliances that are heavy, where heavy objects at a far distance create severe leverage. Where possible, we identified easy-to-implement solutions for these obstacles that promote scientific autonomy, i.e., without the need for assistance. Notably, these limitations are statistically more relevant for women due to the on average smaller body height and mean muscle mass and reveal that the often-claimed gender neutrality of scientific research in the field of solar cell research is, in fact, incorrect. There are implicit biases that impact women statistically more often. Notably, we list several means to reduce the implicit biases and also observe that increasing levels of automation, as is the case for the pilot-line tools of some of the industrial partners (e.g. QCells) remove a great portion of the biases the setups otherwise impose.

While the primary focus of this survey was the identification of ergonomic biases, by opening the discussion, we identified other types of biases, e.g., the prevalence of toxicity levels being defined by an average male.

Overall, we observe an increased awareness among the partners throughout the consortium, a strong willingness to identify biases and remove them and believe that providing a dedicated space to discuss this topic will enable even more discussions in future, encourage the involved researchers to express their observations more freely, identify solutions and thereby reach beyond TRIUMPH.