

Sustainability Innovation

Future



H2020-NMBP-03-2016-720907

Advanced strategies for substitution of critical raw materials in photovoltaics

Welcome

After our successful start on **January 2017**, this newsletter offers a summary of the project's goals, work plan and latest news. This number also presents the new recruitments that have become part of the STARCELL team.



Objectives

STARCELL aims to substitute two critical raw materials (In and Ga) used in conventional thin film photovoltaic (PV) technologies, via the **introduction of sustainable Kesterite** ($\text{Cu}_2\text{ZnSn}(\text{S},\text{Se})_4$ - CZTS) semiconductors.

Targets

Optimize materials, processes and devices to achieve a **Kesterite solar cell with 18% efficiency** (16% at mini-module level) at a cost ≤ 0.30 €/Wp at TRL5.



Consortium



The consortium includes the 3 leading research teams with the highest efficiencies for Kesterite in Europe (EMPA, IMRA and IREC) and the world record holder group (Department of Mechanical Engineering and Materials Science at Duke University, USA) lead by Prof. Dr. David Mitzi, along with AIST (the most renowned Japanese research centre in the field).

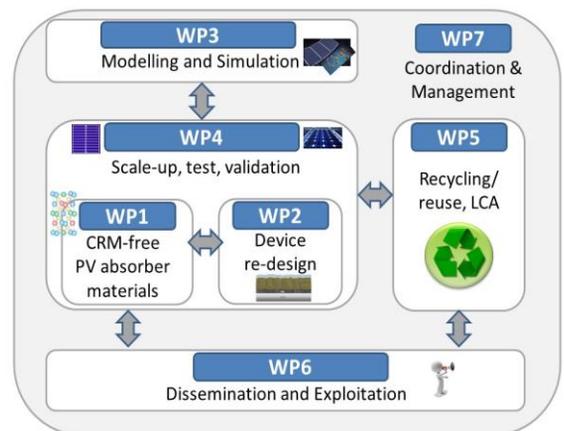
The consortium is completed with the leading groups in this technology for: innovative interfaces (CEA); advance characterization (HZB, UU); and modeling and simulation (ICL, MLU) along with companies specialized in the production of thin film modules (MIDS), supply and recycling of materials (WIREC), and potential end users (AYESA).



Work Plan

STARCELL is structured in **7 complementary work packages**:

- WP1** – CRM free PV absorber materials optimization
- WP2** – Materials solutions for optimised solar cell structure
- WP3** – Modelling and simulation
- WP4** – Up-scaling, test and validation of the CRM-free technology
- WP5** – Recycling/reuse, material supply chain and LCA
- WP6** – Dissemination and exploitation
- WP7** – Coordination & management

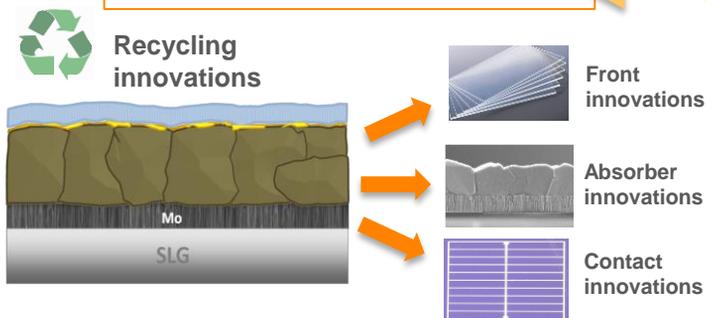


Innovation



Through an innovative approach, STARCELL will cover the complete value chain of the technology under development, from the supply chain of raw materials to the product recycling/reuse, by planning the development of Kesterite PV in a sustainable circular economy approach from the beginning.

Value chain innovations



Latest news



KoM

On 24th and 25th January 2017, the 13 STARCELL partners from 8 countries and 3 different continents met in Brussels (COST Association Building, Avenue Louise 149, 1050 Brussels, Belgium), for the official launch of the Project activities. During the meeting, the main characteristics of STARCELL were reviewed and the scientific activity for the next 6 months were planned. Two prestigious professionals from the Academy (Prof. Dr. Susanne Siebentritt, University of Luxembourg) and the Industrial sectors (Dr. Teodosio del Caño, Onyx Solar), assisted as representatives of the Advisory Board. Next Project Meeting will be organized in 8-9 June 2017 by ICL in London, UK.

Web page

We are happy to announce that our official website has been launched:

<http://www.starcell.eu>.

We invite you to follow our latest updates through our site and through our Twitter and LinkedIn accounts.



Workshops

STARCELL will organize two specialized workshops during this year, with special emphasis in the overview and perspectives of critical raw materials free photovoltaics.

NEXTGEN PV SCHOOL 2017

STARCELL in collaboration with the European H2020 project is organizing a special workshop in Kesterites, in the frame of the NEXTGEN PV school to be held in Palma de Mallorca, Balearic Islands, Spain, on next 12-15 September 2017. The projects will join worldwide recognized experts in the field encouraging the active participation of young researchers of the consortium.

More details at www.nextgennanopv.com.



8th EUROPEAN KESTERITE WORKSHOP

STARCELL will co-organize the next Edition of the most relevant workshop in Kesterites in Europe. This will be the 8th edition, and will be held in Barcelona, Spain, during 8-10 November 2017. The most relevant scientist and researcher groups in Europe working in the field will be present, in order to discuss the last advancements in this technology as well as their future perspectives. More details will be available soon at www.starcell.eu.

New recruitments



STARCELL has recruited 7 high level researchers from the beginning of the project, following the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, taking care to achieve gender balance during the recruitment process.

MSs. Jacob Andrade Arvizu PhD student at IREC

He obtained his bachelor and master studies in physics and mathematics at the National Polytechnic Institute of Mexico (IPN). During his master program he investigated the synthesis by physical & chemical pathways as well as the physical characterization (with different methods, of tin sulphide (SnS) thin films aiming photovoltaic applications. He collaborated in the development of a theoretical device model for CdS/Cu₂ZnSnS₄ (CZTS) solar cell in which the trap-assisted tunnelling and the CdS/CZTS interface recombination were introduced as the most important loss mechanisms for that solar cell. His PhD position in the STARCELL project is focused on physical strategies for the synthesis and the alloying for obtaining “U-shaped” graded band gaps for CZTSSe absorbers.



Dr. Yudenia Sánchez Researcher at IREC

Her research is focused on low-cost techniques such as spray pyrolysis and chemical bath deposition (CBD) of buffer layers for solar cells and the physicochemical study of these materials. She obtained a B.S. in Chemistry from the University of Havana in 1999. In 2004 she obtained her master degree in Inorganic Chemistry at the University of Havana. From September 2012 to February 2013 she has worked as a Research Associate at IREC in several European projects. She received her PhD degree from the Department of Physics from the University of Barcelona, Spain in 2016. Now she is a Research Associate at IREC. She has acquired advanced technological expertise in chemical processes for thin films participating in different technology transfer programs with a traceable record of 34 publications in peer-reviewed journals within the field of PV and materials science.



Laure Giuliano PhD student at IMRA EUROPE

She carried out her studies at “Centrale Supélec” Engineering School, in France, and a Master in Energy Technologies at Cambridge University. There, she carried out a research activity in a spin-off company on the topic of synthesis and characterization of electrodes deposited by wet techniques such as screen-printing. Her PhD is being pursued under the framework of the French CIFRE (Industrial Convention of Training by Research). She is carrying out the research in IMRA EUROPE, in connection with the public engineering laboratory MINES ParisTech. Her PhD position in the STARCELL project is focused on the improvement of the active absorber layer, by controlling and understanding different aspects such as the annealing steps, the ionic order/disorder, the effect of alkaline doping, and the alloying for obtaining graded band gaps for the absorber layer.





Chris Bluhm

PhD student at Martin-Luther-University Halle-Wittenberg (MLU)

After finishing the A-levels in his hometown Lutherstadt Eisleben he enrolled at the MLU to study physics. His bachelor and master thesis considered the topic of material investigations using the positron annihilation lifetime spectroscopy. Using this technique he investigated the defect behaviour of Al-In-alloys after rapid quenching. With help of positron spectroscopy and theoretical models an unexpected correlation of dislocations and In-vacancies was discovered. His PhD position in the STARCELL project is focused on the in-situ XRD during the growth of Kesterite absorbers and the analyzation of prepared Kesterite solar cells (TRPL, Current-Voltage measurements, SEM, EDX, EQE). In the first stage of his PhD the optimization of the Kesterite growth is the major goal.

Ling Xie

Post-doctor at Uppsala University



He achieved his bachelor in physics at Lanzhou University. He worked at SG-NEC Company as a CVD process engineer. He started his master and PhD studies at Uppsala University. During his PhD study, he joined an EU project called as "SNAPSUN" and he collaborated with synthesis groups to characterize the interfacial nanostructures between the precipitated nanoparticles and surrounding matrix in all three dimensions formed in solar cell absorber layer using TEM. He also had experience in analysing the nanostructures formed in biological materials using TEM or Atomic Force Microscopy (AFM). His Post-doctor position in the STARCELL project is focused on structural characterization in CZTSSe absorbers using spectroscopic techniques on TEM. The main research activities in the first stages are focused on studying elemental distribution in absorbers for the Kesterite system down to the atomic level.

Antonio Cabas Vidani

PhD student at Empa, Dübendorf



He achieved his bachelor and master degree in process and materials engineering at the University of Trieste. His master thesis was entitled "Inkjet-printing of GIZO nanoparticles for transparent and flexible transistor fabricator" and the goal was to exploit GIZO nanoparticles deposited by inkjet-printing as semiconductor layer on a transparent and flexible thin film transistor (TFT) at low processing temperature to answer the growing demand of low-cost and large-area technology. The research was carried out at the CENIMAT laboratories in Caparica, Portugal. To fully manufacture and characterize the top-gated TFT, different chemical and physical processes were involved. His PhD position within "STARCELL" will focus on exploring new doping, annealing, alloying approaches for improving the efficiency of solution-processed Kesterite solar cells.

M^a Pilar Asensio Cano

PhD student at WIREC

She obtained her bachelor's degree in chemistry at the University of Zaragoza. She attained a Master's degree in molecular and macromolecular chemistry at the University of Bordeaux. She investigated the synthesis and characterization of magnetic liquid crystals by organic synthesis, coordination chemistry and characterization by NMR, IR, POM, DSC and SAXS. Back in Zaragoza, she did two internships for a few months at SAICA and at the carbochemistry institute-CSIC. Her PhD is focused on the "Recovery of metals from electrical and electronic equipments". A part from the technical management of the project, her work in the STARCELL consists on the recovery of Se, Cu, Zn and Sn of the Kesterite absorbers from solar panels at laboratory scale by physical and chemical processes; the treatment of SO₂ as well as the recycling of the PV minimodules and the validation and feasibility assessment of the scale-up of the process.

