Welcome to the second newsletter of the CABRISS project!

The originality of CABRISS lies in the projects’ cross-sectorial approach associating Powder Metallurgy (fabrication of Si powder based low cost substrate), PV industry (innovative PV Cells) and the recycling industry (hydrometallurgy and pyrometallurgy).

CABRISS implements a pioneering approach towards a PV circular economy demonstrating the re-usability and recyclability of key PV materials for PV and other applications like electronics, metallurgy and glass industries.

The CABRISS five main objectives:

→ Develop industrial symbiosis by providing raw materials as feedstock for other industries
→ Collect up to 90% of the PV waste throughout Europe (as compared to the 40% rate in 2013)
→ Retrieve up to 90% of the high value raw materials from PV cells & panels (silicon, indium & silver)
→ Manufacture PV cells and panels from recycled raw materials achieving lower cost (25% less) and at least the same performances (i.e. cells efficiency yield) as by conventional processes
→ Involve EU citizens and industry

CABRISS - Implementation of a Circular economy Based on Recycled, reused and recovered Indium, Silicon and Silver materials for photovoltaic and other applications
H2020-WASTE-2014

Starting date:  
June 1st, 2015
Duration:  
36 months
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www.youtube.com

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CABRISS WORK IN PROGRESS

Metallic extraction from broken cells
SOLITEK is providing Si waste, originated from the wafer brakeage at different technological steps during solar cell processing (Figure 1).

The simplest case is the as-cut wafers, which can be broken upon handling. In this case perfect multi-Si based ingots have been grown (Figure 2) and sliced into standard size wafers at FRAUNHOFER.

The CABRISS partner LOSER is providing Si scrap originated from broken Si based solar cells after extraction of Ag and Al based metallization. Prior the ingot growth, Si scrap has to be chemically treated, to remove SiNx based layers, the highly doped phosphorous based emitter and the Al diffused region on the backside of each piece of broken Si cell.

Recycling Silicon waste from demetallized broken cells pieces
The CABRISS partner FERROATLANTICA is contributing to the recycling of silicon pieces using waste from the photovoltaic cell and module industry based on crystalline silicon. Small pieces were provided by partner LOSER as demetallized silicon shards (Figure 3).

Analytical tests carried out on the demetallized pieces of silicon during the first year of the project have shown that the main impurities to be observed are aluminium, silver and phosphorous.

Taking into account these results, several hydrometallurgical tests have been performed for purifying this material with the aim of achieving silicon that is suitable as a raw material for the photovoltaic industry (Figure 4). Our first results show that the content of impurities is sufficiently low for using the recycled silicon as raw material for photovoltaic wafers producers.
Growing Si ingots using Si waste
After the purification step, good quality Si ingots can be grown (Figure 5). Such an ingot has already been sliced at FRAUNHOFER and relevant wafers are currently under inspection.

RESITEC is providing Si powder collected from wafer sawing (Si kerf). Different sources of Si-kerf are available and can be more or less different. The powder can be a mixture of silicon metal and particles like aluminum oxide, silicon oxide, and silicon carbide. Conventional growth of Si multi-Si ingot showed that oxide particles, which are present in initial material cannot be segregated during solidification of the melted material (Figure 6).

It can be concluded, that wafering of such ingots is not possible and that innovative technological steps have to be developed to remove or segregate particles or inclusions before or during the Si ingot growth, respectively. CABRISS partners will work with different sources of Si-kerf to ensure the robustness of the processes.

Upcoming: CABRISS M12 progress meeting
The internal Month 12 CABRISS progress meeting will be held from June 30th to July 1st 2016 at the SINTEF Headquarter in Trondheim (Norway).
PV RECYCLING HIGHLIGHTS

March 11, 2016 – CABRISS initiates event on Photovoltaic LCA & Recycling, Challes les Eaux
This event, co-organized by CEA-INES and IPVF, was the first to be organized in Europe on the topic and has been initiated by the CABRISS project. In the future, it will be held every year and will constitute an important opportunity to discuss PV recycling technologies with regard to regulation issues. The event brought together manufacturers, recycling companies, researchers, and experts in economic and regulatory aspects. Special attention was paid to the whole lifecycle analysis of photovoltaic panels. CEA presented: “CABRISS project: recycled, reused and recovered indium, silicon and silver materials”. www.ines-solaire.org/en/events/pv-recycling/


Publications and activities of CABRISS partners focusing on PV recycling (beyond the project)

WHERE TO MEET US: CABRISS at EU PVSEC AND INTERSOLAR EUROPE

In 2016, the two leading European solar PV events will be held in Munich from 21st to 24th June 2016:
INTERSOLAR Europe is the world’s leading exhibition of the solar industry. In collaboration with ees Europe, Europe’s largest exhibition for batteries and energy storage systems, it serves as the industry’s international meeting place for the PV business sector.

The EU PVSEC is the world’s major Conference in the field of photovoltaics and combines scientific, technological, industrial & application-related issues. With more than 1,000 keynote, plenary, oral & visual presentations, EU PVSEC covers all PV topics from nanostructures to utility scale.

In 2016, CABRISS will be presented at the INTERSOLAR in Munich (22.-24.06.) at the booths of INES/CEA (A2.312) and LOSER Chemie GmbH (A3.470, joint booth Saxony Anhalt).
At the EU PVSEC, the following presentations are supported by the partner SINTEF:
3DV.1.15 Solar Cells and Mini-Modules Based on 40 μm-Thick Epitaxial Si Foils: Towards Conductive Bonding onto Low-Cost Si Powder Sintered Supporting Substrates (A. Ulyashin, SINTEF). (23.06., 08:30- 09:30)
5DO.15.5 Recycling of Broken Si Based Structures and Solar Cells (M. Syvertsen, SINTEF). (23.06., 15:15-16:45)
PAST EVENTS

December 8, 2015 – CABRISS at "Boosting synergies on EU WASTE Research and Innovation projects", Brussels
CEA presented CABRISS at the kick-off & networking meeting for EU WASTE Research and Innovation projects which was hosted by the Executive Agency for Small and Medium-sized Enterprises (EASME) in order to create synergies among projects from the H2020 Waste 2014 call "A resource to Recycle, Reuse and Recover Raw Materials". The event received a very positive feedback and was considered very helpful for the facilitation of collaboration and knowledge sharing among project beneficiaries and in the contribution to the exploitation of synergies for more effective project implementation.

January 28 and 29, 2016 – CABRISS M6 meeting at IMEC, Leuven
At the General Assembly meeting, the consortium discussed overall management issues, technical progress implementation by workpackages and overall status of the project.

April 15, 2016 – CABRISS at “Horizon 2020 – Climate challenges and Austrian-French research partnerships”, Vienna
TU Vienna presented CABRISS at the event organized at the Institut Français d’Autriche in Vienna (Austria). The aim of the conference was the discussion of possible cooperation and exchanges among Austrian and French climate research projects in the H2020 Framework Programme.

April 20, 2016 – CABRISS at the SPIRE projects' conference, Brussels
CABRISS participated at the SPIRE projects' conference in Brussels the 20th April, organized back-to-back with the SPIRE PPP Impact workshop organized by the European Commission. The event was an excellent platform for the representatives of projects to learn about approaches & innovations in other projects, and to discuss new ideas.

May 5, 2016 – CABRISS at European Materials Research Society, Lille
A presentation of CABRISS was given at the “2016 E-MRS Spring Meeting and Exhibition” on May 5th in Lille (France). An overview of the project was presented in the session E “Substitution of critical raw materials: synthesis, characterization and processing of new advanced materials in optoelectronic and magnetic devices”. The E-MRS Spring Meeting is organized every year in May or June and offers on average 25 topical symposia. It is widely recognized as being of the highest international significance and is the greatest of its kind in Europe with about 2,500 attendees every year. The meeting thus represented a suitable technology platform to present the CABRISS project in one of the largest conference concerning the research in the materials science.
CEA presented the CABRISS project at the PVTC, The Photovoltaic Technical Conference, in Marseille (France). The PVTC is the 7th event of a series of international PV specialty conferences. This year, the conference took place in Marseille, at the International Center of Villa Méditerranée. Each year, PVTC welcomes international speakers and attendees coming from all over the world (Algeria, Australia, China, France, Germany, Italy, Japan, Morocco, Poland, Spain, Switzerland, USA, Tunisia...). The Photovoltaic Technical Conference offered an excellent opportunity for the whole value chain, from equipment and material suppliers up to application driven players and from academic research institutions up to industry, to share and discuss leading-edge photovoltaic technologies.
www.photovoltaic-technical-conference.com/

CABRISS participated at the EU PV Clusters 3rd Workshop and General Assembly at LEITAT Technological Center (LEITAT) in Barcelona (Spain), focusing on progress in photovoltaics, materials and nanotechnology during H2020.

CABRISS Consortium

www.cea.fr
www.sinif.no
www.imec.be
www.loserchemie.de
www.ferroatlantica.es
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