Newsletter

Year #1 update | July 2023

Development of technological solutions for reusing Silicon, recycling PV modules and designing new products

The RESILEX project has just concluded its first year of activities. Here we are summarizing the achievement so far and the ongoing work.

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1. Recovery of critical raw materials from mining wastes and wastewater

Partner CETAQUA first characterized the samples of acidic and solid waters from the mining site to determine which points are of greater interest to recover critical materials. In parallel, we designed two treatment trains to recover valuable metals from wastewater and mining waste, respectively. The first will be located at CETAQUA facilities and consists of a non-ferrous metal recovery unit followed by an adsorption module with a final crystallizer. The second will be located at THARSIS facilities and consists of a thermal waste valorization unit. These treatmnt trains are currently under construction.

2. Sustainable Silicon production

The demand for silicon has experienced rapid growth and the production of silicon and solar panels represents a carbon and energy intensive process. In this regard, RESILEX aims to address the laboratory scale verification of silicon recycling route and sustainable silicon production demonstration. NTNU is working on circular process to produce high purity silicon through aluminothermic reduction of quartz fine as an alternative to carbothermic reduction followed by refining of the produced metals utilizing as raw materials Si-kerf, sculls, slag, and silicon alloy. NTNU optimized the laboratory and medium scale production and refining processes and successfully demonstrated it at 100 kg scale.

Silicon powder.

3. Sustainable, eco-designed solar cells & modules

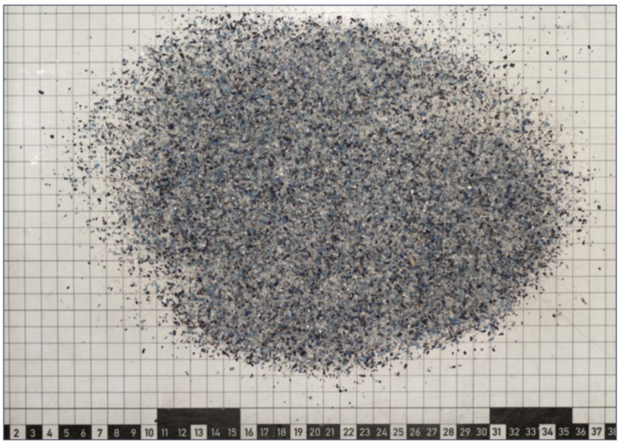
In these activities and lab tests, there has been remarkable headway in reducing the usage of indium within solar cells, largely attributable to the reduction in thickness of indium tin oxide layers.
This has contributed to enhancing the sustainability of solar cell technologies while maintaining high efficiency.
Second, the project has already made substantial strides in minimizing the utilization of silver in solar cells through the development of silver-copper coated pastes and the implementation of a copper plating process.
These innovative approaches have made it possible to reduce dependence on silver, a precious and costly resource, without compromising the performance of the solar cells.

Finally, project partners have undertaken an extensive, and still ongoing, screening of available EU providers for bio-sourced materials, polymers, and composites required for the front and back-sheet as well as for the encapsulants.
This meticulous assessment has been complemented by an exhaustive literature review, yielding detailed insights into the suitability, sustainability, and performance characteristics of these materials to build PV modules.

Manufacturing of PV panels.

4. Silicon recycling from PV modules

In RESILEX, silicon material out of Silicon cells recovered from PV panels (provided by Recma and ENVIE2E) will be used to make batteries and/or new Silicon wafers.
Achieving required grades imposes the recovered silicon to be cleaned (acid leaching under pressure at 60°C) from all impurities, like Aluminium and Iron. Indeed, batteries manufacturers require a Silicon purity > 99% and PV wafers require a purity > 99.999999%.
Preliminary tests achieved by the GeMMe laboratory (University of Liège) demonstrate the possibility to obtain a Silicon purity of 99.5%.
First tests of battery manufacturing using such purified materials were conclusive.
New separating techniques are under investigation, to recover as much Silicon as possible.
Results are very promising.



Shredded end of life PV panels.

5. Development of high efficiency Silicon composite for Li-ion batteries

Partner CLEANCARB is working on the specifications of the battery cells that the project will develop. GREEnMat at ULiege showed that high purity of Silicon can be recovered from non-encapsulated PV solar cells through leaching process. The obtained pure Silicon was successfully nano-sized and integrated in the spray drying process along with conductive additives and polymer binders leading to Si/C composites with controlled morphology and particle size. The prepared composites were used as anode active materials for Li-ion batteries (LIBs).
The results for half-cell configuration tests demonstrate specific capacities as high as 1200 mAh.g-1, a promising result for next work on full cell tests using conventional cathode materials and scale-up production of greener quality, inexpensive anode-based materials.

6. Multi-Faced impact assessment and policy recomendations

Social Impact assessment of Resilex mainly focuses on assessing the social dimension of raw material supply chain with main application in "PV modules" and "Li-ion batteries". Some Human rights violation and forced labour have been recently recognized in the Chinese sides of the PV Industry which shall be addressed for the European market. In Resilex we address the different social dimensions such as responsible sourcing, occupational safety, public acceptance.

Social-LCA approach has been implemented in this regard based on ISO standard 14040/14044 in which the European companies active in PV modules have been identified, contacted and interviewed. The relevant social sub-categories to PV industry have been shortlisted based on these sets of interviews and the next round interviews have been designed in which the activities of companies such as relationships with their employees as well as society and local communities will be investigated.

So far, we found out that the European companies' products better comply with EU environmental legislation but still due to the unbalanced supply chain, EU is much dependent to Chinese companies.
Diversification the supply to other sources as well as activating more companies in EU would improve the situation.

Regarding the Life Cycle Cost analysis of the panels that the project will develop, CEA started by defining the reference technology for the different components in the value chain of the PV module (polysilicon, wafer, cell, module). The definition of the reference was based on a benchmark of the market in 2022-2023. Then, a definition of the cost template was prepared. This template includes the data needed to evaluate the CAPEX, OPEX, Bill of material (BOM) and Labour Cost. These template will be send to the partners to be filled for the next months ».

Last but not least, RESILEX partner SolarPower Europe has started to work on the development of an open platform as a support tool for policy recommendations and stakeholder's engagement in the EU.The platform envisions to feature a knowledge hub for central repository of information, research papers and best practices; a policy section dedicated to policy-related documents developed within the project; stakeholder engagement for facilitating stakeholder interaction and a section that provides updates on relevant events and webinars.

7. Comunicating RESILEX

After the launch of the website and the Linkedin page, new materials have been made available, like the project leaflet and the Factsheet series. More material is about to be released.
Cooperation with the sister project REEsilience took off, and we are working on a joint event in October, stay tuned for more updates!
RESILEX partners have attended events such as the Battery show in Stuttgart, Intersolar in Munich and the MIXE event in Lion, bringing together promotional materials and news about the project.

Relisex team during the general assembly in Florence (2023).

8. News items

[Link to the news]

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