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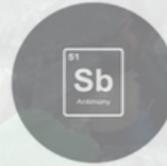
LIFE PlasPLUS is a project within the European Union's LIFE programme for Environment and Resource Efficiency.



With €1.43M EU support and a total budget of €3.17M.



Aims to improve the recycling of high-purity secondary thermoplastic and enhance a circular value chain



Recover Antimony, a critical raw material, coming from plastic waste in EoL and WEEE sectors.



Run by a consortium of 5 partners, covering the full value chain from recycling to car manufacturing

Welcome to our fourth LIFE PlasPLUS Newsletter.

The LIFE PlasPLUS project revisits the concept of recycling with its holistic approach to simultaneously close the loop for two traditionally siloed material value chains, plastics and minerals, by producing high purity recycled thermoplastics and antimony.

June 20th
register to
LIFE PLasPLUS
final event (p.5)

5 EU PARTNERS

The project is run by a consortium of five EU partners covering the full value chain from recycling to car manufacturing as illustrated below.



Waste sorting and valorisation



Research and development



Production of antimony



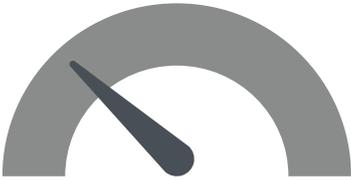
Plastic compounding



Car manufacturing

3 STEPS

1
Production of high purity thermoplastics



2
Automated multi-class sensor-based sorting and separation of FR Plastics (FRP)



3
Recycling of by-product Sb through catalytic conversion and hydrometallurgy



FROM JULY 2019 TO JUNE 2023



2019 **2020** **2021** **2022** **2023** **june**

PROJECT NEWS

Visit at Centro Ricerche Fiat in Torino

On June 13 2022 the second monitoring visit took place in Centro Ricerche Fiat in Torino. Consortium partners presented to NEEMO agency, in charge of monitoring LIFE projects for EU Commission, project results.



It was the opportunity to visit the CRF facilities and take part in the demonstration of the injection of a car component (part of the glovebox) made of 100% recycled Filled PP (FPP).

It is a major milestone of the project.



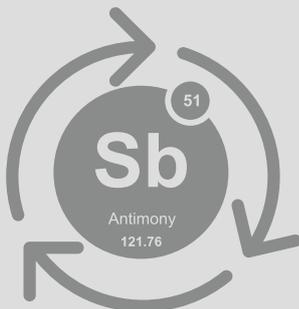
PROJECT NEWS

Industrial validation of LIFE PlasPLUS products in the automotive and EEE sectors

In the last year of the project (June 2022 – May 2023) the project entered in **the industrial validation of LIFE PlasPLUS products in the automotive and EEE sectors**. A car interior component, a FIAT 500 glove box made of 100% recycled FPP was demonstrated to be fully compliant with Stellantis technical requirements.



Two recycling routes for antimony

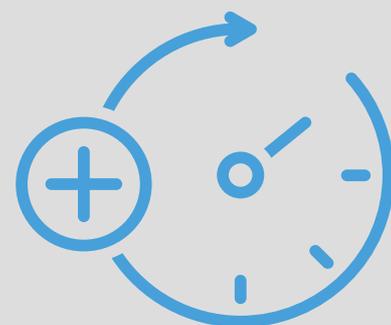


On the antimony recovery side, **two recycling routes were tested and validated**



Project extension

During this visit, decision was taken to **extend the project by 6 month**. This demand was introduced and accepted in September 2022 by European Commission, leading to a project end 30th of June 2023 and a final event the 20th June 2023.



PROJECT NEWS

Final dissemination event 20th June

With visit of Comet recycling facilities

The final dissemination, exploitation and networking conference will be held the **20th of June 2023 in Mons, Belgium.**

On the **agenda** : presentation of project results, keynote speakers on the fast evolving circular plastic ecosystem, visit of Comet Traitements recycling facilities an parallel sessions to discuss the impact of circular plastics and recycled antimony in the targeted markets.

Free registration



JUNE

TUE
20

EVENT PROGRAM

CLOSING CONFERENCE LIFE PLASPLUS PROJECT

- Circular EU plastics ecosystem overview
- Upcycling purified ABS, PP & PS into automotive components & EEE sector
- Creating EU antimony circular value chain
- Which implementation for LIFE PlasPLUS results

VISIT OF THE GROUPE COMET FACILITIES

This project has received funding from the European Union's LIFE Programme for Environment and Resource Efficiency under grant agreement No. LIFE18 ENV/BE/000368.



PROJECT NEWS

STEP 1 PRODUCTION OF HIGH PURITY THERMOPLASTIC



High purity thermoplastics production & upcycling in end products

This step being the first one in the project value chain, it has been the one first implemented and is now fully achieved and fulfills project objectives with the demonstration at industrial scale of the production of purified thermoplastics : **1.355 tons of purified secondary plastics (FPP & ABS at 98% purity, PS 95% purity) have been produced and sold to Comet Traitements' compounder customers.**



It was demonstrated that desired quantities and qualities of recycled thermoplastics can be obtained with the tribo-electric unit commissioned by Comet and now in operation.

In particular the products were shown to be **fully compliant with RoHS regulations**

The last project period, from start 2022 to May 2023 was devoted to the production and validation of LIFE PlasPLUS tailored **intermediate and final products in the automotive and EEE sectors.**

The methodology was to :

1

Start from the design new compounds incorporating recycled plastics from shredder residues.

It was based on the **material specifications sheets for the automotive and EEE sector.** Two PP compounds for semi-structural parts interior and/or exterior were selected and two for ABS regrinds.

CHARACTERISTICS		UNIT OF MEASURE	PP 60.35	PP 65.40 ■	TEST METHOD	
			Mineral (calc) filled copolymer 20 to 26% high flow rate	20 to 30%		
PHYSICAL	Volume	g/cm ³	1.05 to 1.10	1.11 to 1.17	Std. 60430/00 ISO 1183 Method A	
	Coefficient of linear thermal expansion	10 ⁻⁶ /°C	50 to 70		Std. 60060	
	Mold shrinkage ±	%	0.7 to 1.2		UNI 4286	
	Fluidity index A	g/10 min	10 to 20	4 to 10	Std. 90567 (condit. C) ISO 1133 (condit. M)	
Calcination residual		%	18 to 27	23 to 32	Std. 50435 ISO 3451/1	
MECHANICAL	Tensile stress (min.)	Elongation	5%	20	15	ISO 527 (Specimen Type 1B, speed = 50 mm/min)
		Max. load		23	20	
	Flexural modulus of elasticity (min.)	at -30 °C	N/mm ²	---	5300	ISO 178 (speed = 2 mm/min)
		at 23 °C		2200	2500	
		at 60 °C		1000	1050	
		at 80 °C		600	600	
	Flexural strength (min.)	at -30 °C	---	70		
		at 23 °C	35	35		
		at 60 °C	10	10		
	I200 resilience with notch (min.)	at 23 °C	kJ/m ²	3.5	4	7
at 0 °C		3		3	3.5	
at -30 °C		2		2	2.5	
Falling dart impact resistance (min.) Δ	at 0 °C	J/m ²	3.5	5	7	Std. 50424
	at 0 °C		1.5	2	4	
	at -30 °C		---	---	---	
THERMAL	Distortion temperature under load (load = 1.8 MPa) (min.)	°C	60	60	60	ISO 75
			64	67	67	
	Vicat softening temperature (5 min.)	°C	>150			Std. 60066 ISO 306 VST B50
Thermal oxidation	h				Std. 60432/00 ISO 4577	
Resistance to combustion	-	In compliance with specifications indicated on drawing or relevant part standards			Std. 7-G2000	

Example of selected specification sheet – PP for automotive sector application

PROJECT NEWS

STEP 1 PRODUCTION OF HIGH PURITY THERMOPLASTIC



High purity thermoplastics production & upcycling in end products

2

Perform the compounding in order to fulfill the compliance with spec sheets requirements.

Comet Traitements supplied large scale samples to the consortium's compounder : Seriplast.

Two tons of FPP Regrind and 2 tons of ABS Regrind were shipped to Seriplast



FPP Comet regrind

Seriplast adjusted the main parameters of their extrusion process equipment (feeding system, temperature gradient, throughput, others) to produce new compounds.

It was possible for Seriplast to produce a compound made of 100% recycled FPP with the main mechanical properties being attained.

This greatly surpasses the **project's objective of 40% reduction** in the use of virgin plastic for the manufacture of new products.



Seriplast compound : 100% recycled FPP

PROJECT NEWS

STEP 1 PRODUCTION OF HIGH PURITY THERMOPLASTIC



High purity thermoplastics production & upcycling in end products

For ABS, it was decided to target a compound made of a mix of ABS and PC (Polycarbonate) to obtain similar properties as a commercial compound used for car interior parts. Different composition were tested, with various mix of virgin vs recycled ABS.

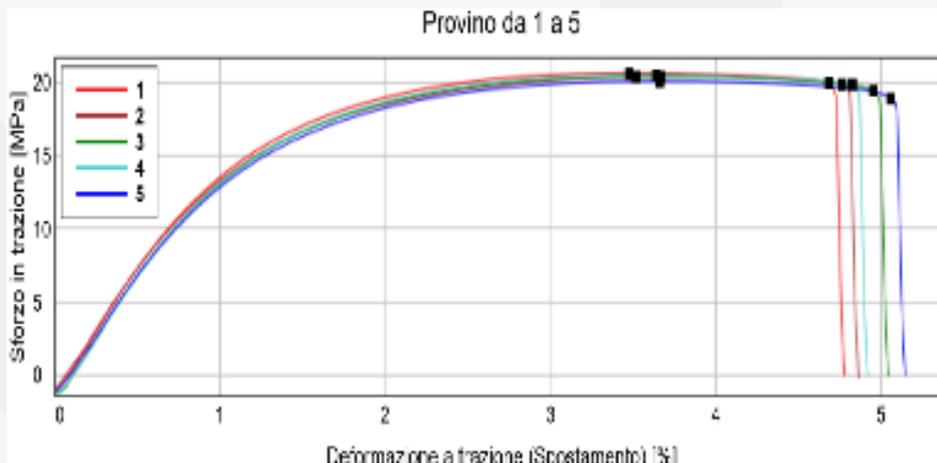
Use of recycled ABS from Comet in combination with both virgin ABS and glass fibers was positively demonstrated.

3 Validation of the compound compliance with spec sheet

Seriplast carried out several analytical tests in the lab to assess the compounds' mechanical characteristics (e.g. MFI, VICAT, IZOD, Flexural Modulus, Traction Test ...). It ended up with **a full validation of the compounds compliance.**

Properties	ISO	UM	55246 PP 60.35	FPP COMPOUND FPP 60.35 R
MFI	ISO1133	g/10min	15-25	20
Ash Content	ISO3451	%	18-27	26.4
Density	ISO1183	g/cm ³	1.05-1.10	1.09
IZOD	ISO 180	kJ/m ²	3.5	4.69
Flexural Modulus	ISO 178	MPa	2200	2384,5
Flexural Strength	ISO 178	Mpa	35	35.5
Tensile Strength (elongation at break)	ISO 527	%	20	5
Tensile Strength (max load)	ISO 527	MPa	23	23
VICAT	ISO 306	°C	64	68.8

Quality
validated ✓



Finally compound batches of 200 kg, were produced and shipped to CRF.

PROJECT NEWS

STEP 1 PRODUCTION OF HIGH PURITY THERMOPLASTIC



High purity thermoplastics production & upcycling in end products

4 Injection molding of interior part and validation of mechanical properties

CRF selected and produced **2 different car interior parts** :

- A **glove box** – FIAT 500 - based on FPP compounds made of Comet 100% recycled FPP regrinds
- **Speaker adaptors** based on ABS – PC – Glass fibers compound.



Injected part

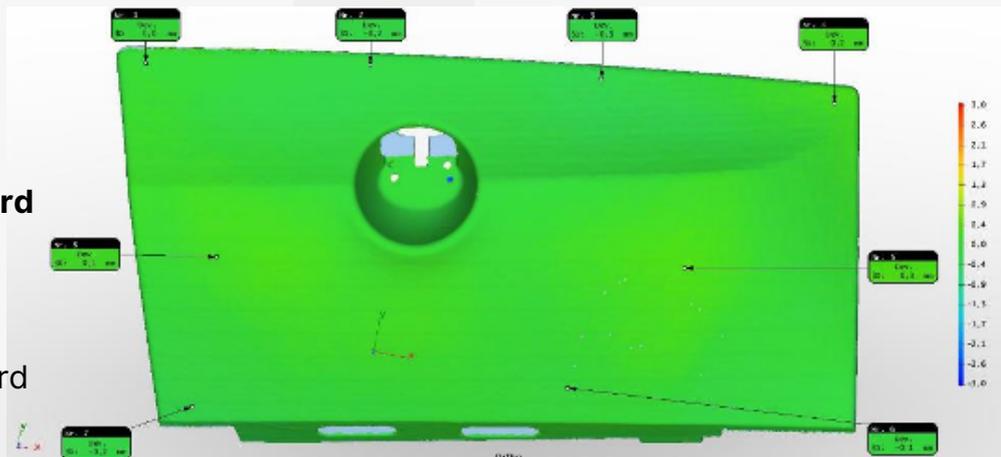


Validation set-up

The injection moulding process was optimized to guarantee aesthetical, functional and dimensional properties. Achieved surface quality showed to be acceptable.

Quality validated ✓

The parts were validated under **thermo-mechanical Stellantis standard procedures**. Deformations appeared to be inside the standard limits.



PROJECT NEWS

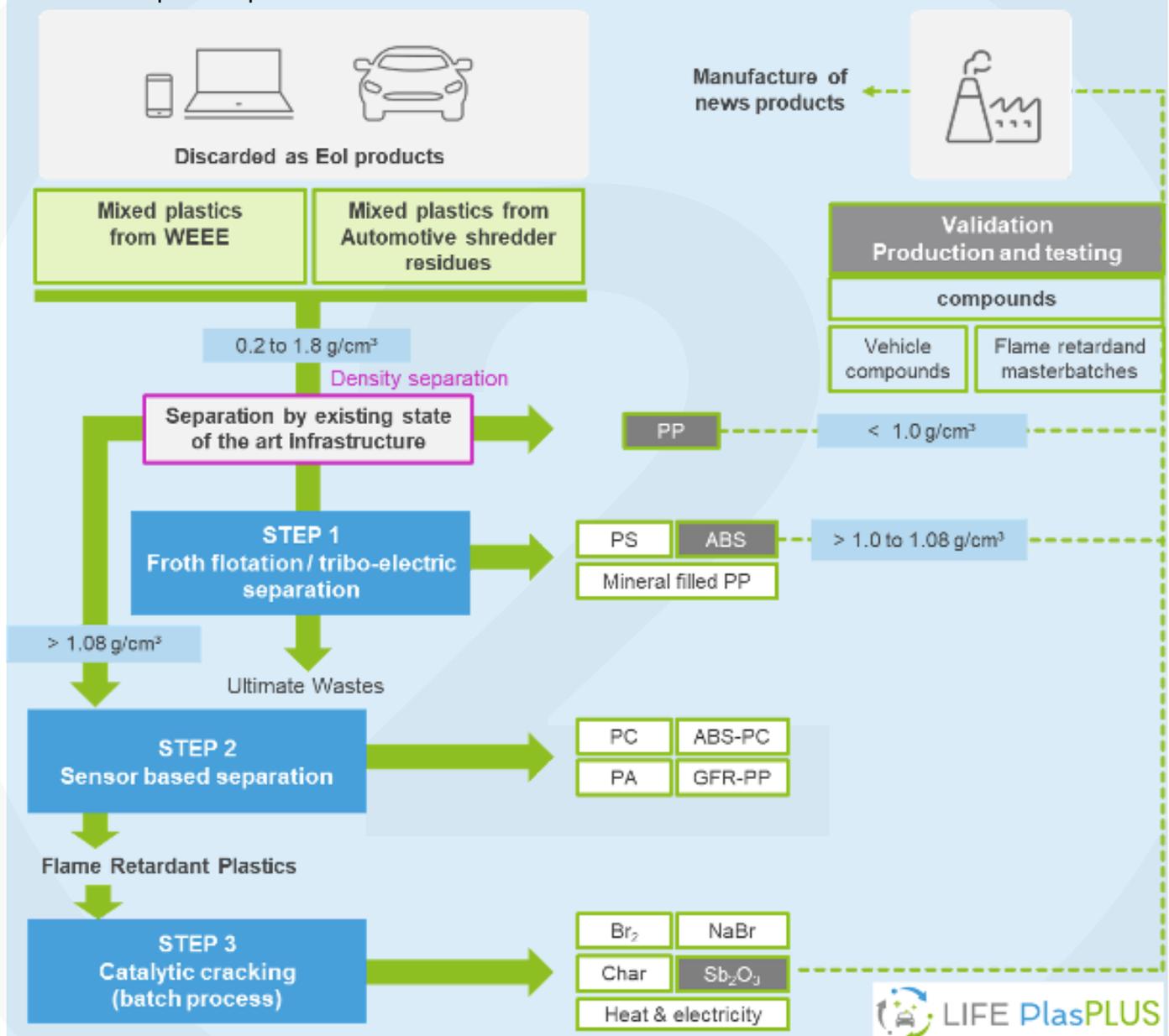
STEP 2 AUTOMATED MULTI-CLASS SENSOR-BASED SORTING AND SEPARATION OF FLAME RETARDANT PLASTIC (FRP)



Extraction of Flame Retardant Plastics

In the framework of the LPP project, Université de Liège adapted the PICKIT technology, a robotic sorting line with real-time multi-sensors acquisition, to identify and extract Flame Retardant Plastics ("FRP") containing elements such as Br and Sb by modifying its LIBS-based detection system.

Extraction of FRP was targeted on Comet's heavy plastic fraction 'Drainaplus' which is the commercial name for the Comet's non-recyclable plastics with a density over 1.08 g/cm. This plastic fraction enriched in FRP is obtained by density separation in Comet's plastic plant.



STEP 2 AUTOMATED MULTI-CLASS SENSOR-BASED SORTING AND SEPARATION OF FLAME RETARDANT PLASTIC (FRP)



Extraction of Flame Retardant Plastics

The adaptation of the PICK-IT technology to plastic turned out to be much more complicated than anticipated to identify and isolate flame-retardant plastics (FRP), due to surface contamination by magnetic particles.



Industrial progress independent of LIFE PlasPLUS, resulted in the emergence of an XRF technology to separate FRP from WEEE and ELV waste plastic streams. To align itself on these new developments, the LPP partners relied on the REDWAVE XRF sorting technology. Two XRF sorting campaigns were successfully conducted in February 2021 and April 2022 to produce 1.2 tons of high-grade bearing Sb plastic.

Research activities however progressed on PICKIT, led to several findings, with potential exploitation. PICKIT system is able to differentiate and sort Printed Circuit Board (PCB) cards out of the FRP streams. PCB contains a significant amount of copper and precious metals that could be valorised.

PROJECT NEWS

STEP 3

RECYCLING OF BY-PRODUCT ANTIMONY (SB) THROUGH CATALYTIC CONVERSION AND HYDROMETALLURGY

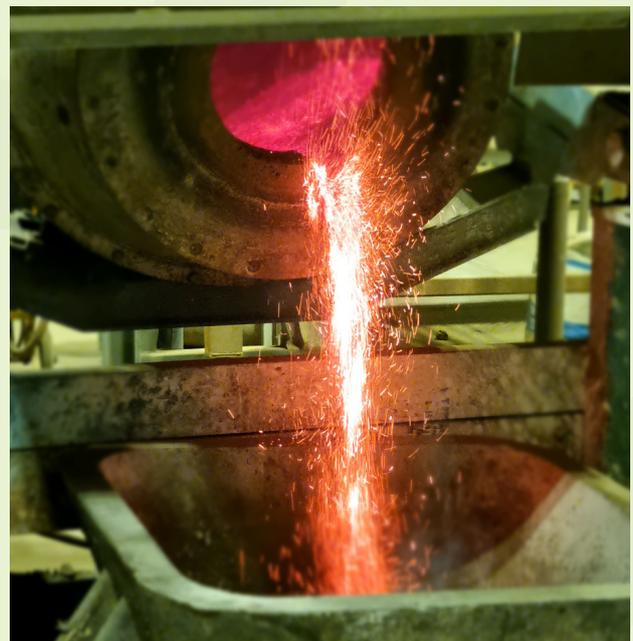
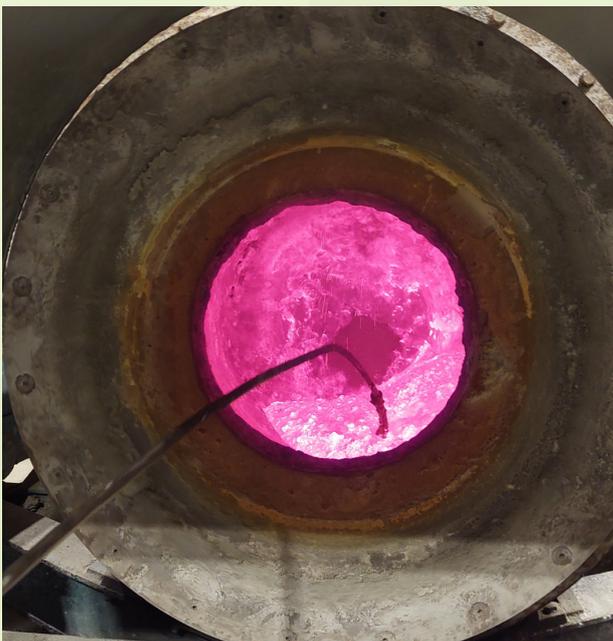


Comet Traitements characterized and performed the catalytic conversion of the first batch of FRP which delivered 300 kg of Sb bearing Char at a grade of 4% Sb for an approximate equivalent of 12 kg of Sb metal contained. **Further catalytic cracking will produce enough Sb-Char for Université de Liège's metallurgical activities and production of Flame Retardant masterbatch by Campine.**



Université de Liège identified an oxidative hydrometallurgical route to produce the Antimony Trioxide for Campine.

In parallel, Campine suggested a direct Sb injection route for the Sb-Char which could be used "as-is" for its reducing chemical properties. A direct benefit is that the carbon fraction contained in the Sb-Char is being used instead of being discarded and the Sb fraction is reintroduced in the industrial cycle without having to incur the use of water, reagents and energy in the hydrometallurgical process.



NEWS & EVENTS

Recent news and events

Join us during the LIFE PlasPLUS Final event on 20 June 2023 !

This project dissemination event will take place in Mons. The aim is to present **project's results and exchange on the way circular plastics and antimony recycling will impact the automotive and EEE sector**. Speakers from **Plastics Europe, Plastics Recycler Europe, EURIC, Stellantis and Campine** will present the state of play of European circular plastic eco-system. A special attention will be dedicated to the future ELV directive. A visit of Comet recycling facilities is planned.



LIFE PlasPLUS
FINALEVENT

MONS
JUNE 20

EVENTPROGRAM

TUE
20

CLOSING CONFERENCE
LIFE PLASPLUS



VISIT OF
GROUPE COMET
FACILITIES

The project has received funding from the European Union's LIFE Programme for Environment and Resource Efficiency under grant agreement No. LIFE/10/201/001/001

LIFE PlasPLUS final video

Project official video has been upgraded to present in detail de LIFE PlasPLUS project in the context of circular economy.



LIFE PlasPlus : Meeting the challenge of separating c...

Regarder ... Partager

SOFIA LAMO
SERIPLAST

My role at LIFE PlasPlus is to create new compounds from recycled materials

Regarder sur  YouTube



NEWS & EVENTS

Plastic Matters Denuo 27/09/2022 - Brussels

This event was organized by DENUO the Belgian waste industry federation, with a specific focus on automotive waste stream and circularity. In this networking event, Comet presented the LIFE PlasPLUS project in details. This led to interesting exchanges with participants.



LIFE PlasPLUS: presentation at second VALBREE conference on “Opportunities and challenges in plastics recycling” in Mons, Belgium, on 28 September 2022



The conference was organized in the frame of the Interreg VALBREE who is focused on Recovery of plastic waste from electrical and electronic equipment containing brominated flame retardants.

ULiege, Philippe Giaro was invited to present the LIFE PlasPLUS project. It was the opportunity to disseminate the results to EEE sector actors present.

SPE ADDITIVES & COLOR EUROPE CONFERENCE 2023 10 March 2023 - Brussels

The biannual SPE conference took place in Brussels in 2023, is dedicated to the latest in state-of-the-art additives, pigments & dyes and master batches for plastics, and connect with the entire industry value chain, from raw material and equipment suppliers to OEMs (Original Equipment Manufacturers).

Comet together with the research center CERTECH were invited to present their latest developments in upcycling of plastics waste from shredder residues. It was the opportunity to present PLasPLUS project and network with attendees.



NEWS & EVENTS

“Sorting, Sampling and Characterization” seminar 10 November 2022 by Flanders Metals Valley (FMV) on the Veolia site in Gent

The seminar titled “Sorting, Sampling and Characterization” was organized on 10 November 2022 by Flanders Metals Valley (FMV) on the Veolia site in Gent, Belgium.

FMV is a catalyst for a vibrant, climate-neutral and circular metallurgical cluster in Flanders, dynamically embedded in an international industrial ecosystem uniting stakeholders with a focus on the circularity of metals.



Our colleagues, Robert Baudinet, R&D Engineer at the GeMMe (Université de Liège), and Lara Dirx, Project Engineer at Campine were on site to provide an update to a panel of experts on the LIFE PlasPLUS project, and more specifically the PICKIT technology focused on robotic sorting.

Plastic Innovation Forum 15/03/2023 - Brussels

COMET attended this clustering event. It has been the opportunity to meet coordinators and partners of EU project in the field of circular plastic as well as associations like Plastic Recyclers Europe. Mutual contacts have been taken to enable future cross fertilisation, collaborations and impacting.



Elemetal LIFE project 31/05/2023, Rotterdam

The GeMMe research group of the University of Liège is pleased to report its participation to the Elemetal symposium, in Rotterdam, Netherlands on 31 May 2023. Our colleague Fanny Lambert, Team Leader Hydrometallurgy, was on site to present our latest research results on the valorization of the antimony (Sb) value chain developed within the context of the LIFE PlasPLUS project.



Elemetal focuses on upcycling non-ferrous metals from secondary waste streams through hydrometallurgical and physical separation processes. Elemetal believes in a world that moves towards sustainable use of energy and raw materials, creating a circular economy enabling the infinite use of raw materials.

The event is part of the LIFE communication and dissemination strategy and our colleague Fanny presented alongside topics covering such raw materials as copper, zinc and cement.

NEWS & EVENTS

8th edition of the Going Green CARE INNOVATION symposium, Vienna, Austria. May 9th to 11th

The GeMMe research group of the Université de Liège participated to the 8th edition of the Going Green CARE INNOVATION symposium, in Vienna, Austria. From May 9th to 11th leading industrialists, research directors, environmental experts and scientists brought us up to date on sustainable initiatives and the development of eco-efficient electronics, in one of the world's leading and most prominent congress on such topics.



Our colleague Miguel Simão, R&D Engineer at the GeMMe, was on site to present our latest research results on the valorization of the antimony value chain developed within the context of the LIFE PlasPLUS project.

The main topics of Miguel's presentation:

- The latest developments in a Sulfide-Alkaline leaching system as a means to recycle antimony, a critical raw material, from the flame-retardant plastics found in ELV and WEEE. By generating sulfide ions in alkaline solutions, up to 70% of Sb contained in flame retardant plastics can be extracted and then precipitated as $\text{NaSb}(\text{OH})_6$.
- State of the art technologies to recycle high-quality secondary thermoplastics from ELV and WEEE, such as PP, PS, ABS, and FPP.

Plastics Recycling Show Europe 2023 10-11 MAY 2023 AMSTERDAM

Comet Traitements attended the Plastic Recycling Show in Amsterdam, Netherlands held on 10-11 May 2023. Our colleague Hervé Demoulin, Project Manager of the plastic division at Comet, was on site to network with the participants which included some of the biggest names in recycled materials, recycling machinery and services.



B2B

During the period, in view of future exploitation of the project results, assess the market demand and better understand the new emerging circular value chain business models, LIFE PlasPlus partners took contact with value chain actors, during conferences but also directly in B2B meetings. Several stakeholders took themselves contacts with Comet to better know the technology development available and discuss potential collaborations.

Following stakeholders were met in B2B : **Ecologic, Plastic Recylers Europe, Plastics Europe, EURIC, Total Energies, Compounders and Tier 1 e.g. Forvia, Borealis, OEMs (Volvo, BMW)**

INDUSTRY ASSOCIATIONS

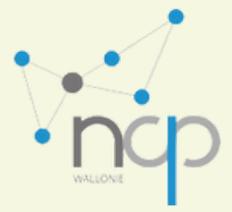
A listing of all industry organizations through which the project beneficiaries are undertaking collaborations was provided in the midterm report as is presented here below.



Wallonia internationally recognized Platform for industrial, technological and scientific excellence in the field of metals recycling.



Network of companies in the plastics industry in Wallonia



National Contact Point for involvement in European Research and Innovation projects



Walloon competitiveness cluster in mechanical engineering

.AGORIA

Belgian Federation for the technology industry



Producing millions of plastics part per year available to perform industrial trials on new compounds



comet traitements



Company dealing with specialties compounding recycled ABS materials



CRF



Campine

International Antimony Association



propplast

PLASTICS INNOVATION POLE

Research organization and services for plastic materials



Organisation supporting the innovation in textile and plastics



Italian institute of plastic



Association representing manufacturing companies



Institute of promotion of recycled plastic



Consorzium ECOPOLIETILENE



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LIFE PlasPLUS

