



ANNUAL REPORT 2023



CTP

ACCREDITED RESEARCH CENTRE

Chaussée d'Antoing 55, 7500 Tournai - Belgium

EDITORIAL

*Record business
for the 7th year running!*

The Centre's **total sales** have reached **€5,704k, 11 % up on 2022** (€5,140k) and, compared with 2016, almost double the figure 7 years later!

Private sales (business support) **rose by 39%**, with around 68% of business done with companies outside Belgium, and even outside Europe.

[Collaboration with an Australian client on the processing of high-purity graphite for electric car batteries has intensified - TRL 5 scale pilot at the CTP - and partly explains this progress].

Public revenue (subsidies), meanwhile, **fell by 27% in 2023**. This can be explained by a transition in the programming of European ERDF 14-20 and ERDF 21-27 projects, but also and above all by considerable use of our research capacity (available researchers) for private industrial projects.

It should also be noted that these subsidies mainly come from projects in partnership with industry through the REMIND WALLONIA innovation platform and the GREENWIN competitiveness cluster.

The Centre's dependence on subsidies from Wallonia and indirectly from the ERDF or INTERREG is very low, which **strengthens the Centre's roots in the Walloon and international economic fabric and, consequently, its long-term viability!**

"I'd also like to take this opportunity to thank all the staff for their performance in 2023. The figures speak for themselves – thank you all!"



Stéphane Neiryck
CEO

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3 new "collaborative" projects were also won:

- ✦ The BioFACon3 project: recovery of biomass fly ash, through the WIN2WALL call for projects;
- ✦ The RED4SOLS project: remediation of heavily polluted soils using electro-dialytic techniques, under the WIN4COLLECTIVE call for projects;
- ✦ And finally, the UP_PLASTICS project: eco-design of plastics by exploiting eco-products and industrial waste from buildings under ERDF call 21-27.

These projects remain important because they enable the Centre to acquire new skills that we can then put to good use with a large number of industrialists, stakeholders in the CTP.

The 2023 balance sheet is remarkable!

Cash flow has increased by 28% (from €478k to €374k in 2022), enabling the CTP to invest in the resources (human and infrastructure) necessary for its development.

The challenges for 2024 are undoubtedly to **sustain the Centre's growth** and to **recruit new talent**, which we need more than ever to strengthen our teams.



ABOUT US

As an R&D and Innovation Centre serving companies in the environmental and materials fields, the CTP, in a circular economy approach, is pushing back the limits of the treatment and recovery of solid materials, in particular ores, industrial by-products and post-consumer waste by providing innovative and profitable solutions for the industrial world.

#FLASH INFO

Installation of **464** photovoltaic panels

Capacity **185.60 kWp**



With **over 25 years' expertise** in the field, the CTP offers a wide range of expertise and analyses to companies exploring and developing natural mineral deposits, as well as to companies processing and recycling industrial and post-consumer urban waste ("Urban Mining").

Its expertise covers not only the treatment of these 'deposits', but also and above all the recovery of materials with high added value. New 'secondary' raw materials and/or new materials are created at the CTP from these by-products.

The CTP's **mission** is to actively support companies (particularly SMEs) in their economic development by providing them with high-quality technological support, enabling them to grasp the innovations needed to guarantee them a secure future. This support takes the form of a scientific contribution through research projects and a professional and relevant service in terms of expertise and testing.

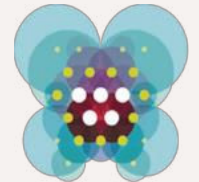
In 2025, companies that extract, manage and use primary and secondary raw materials throughout the world choose CTP as their R&D partner to construct innovative, efficient, sustainable solutions in order to supply and develop circular economy loops, helping to solve the societal challenges of resource availability and global warming.



LABELS

Chèques entreprises

The CTP is eligible for technology cheques, which are part of an integrated portfolio of aid designed to support business creation and innovation, or to promote growth and entrepreneurship. They are targeted at SMEs in Wallonia and funded jointly by Wallonia and the European Regional Development Fund through the ERDF Wallonia-2020. EU operational programme (transition zone and more developed zone). In practice, our clients can benefit from several services through this measure.



Chèques-entreprises

In the exploratory phase, our researchers carry out tests, calculations and initial analyses. This first phase can be followed by technical feasibility studies (conducting tests, optimising test protocols, laboratory tests etc.) or assistance with preparing for industrial scale-up (defining technical specifications, designing production frameworks etc.).

Until July 2023, the cheques provided 75% funding for projects up to a maximum of €60,000 excluding VAT over 3 years (i.e. €45,000 in subsidies).

As part of Wallonia's Recovery Plan, the Walloon Government wanted to strengthen the digital model that contributes to the popularity of the scheme. For this reason, it commissioned SPW-Digital to take over the tool and include it in its portfolio of solutions and services. As of 1st July 2023, funding has been increased to 50% and is now managed solely by the Walloon Region.

A total of 5 Walloon SMEs benefited from this scheme in 2023, for a total amount of €51,034 deposited and partially closed during the year.

Research tax credits

CTP has approval for the French Research Tax Credit (CIR) issued by the Ministry of Education, Teaching and Research. This means French companies qualify for grants in the form of tax deductions when undertaking Research and Development activities. **The application for renewal covers a 3-year period up to the end of 2026.** Many of our French clients make use of this measure, which supports part of their research by reducing the financial investment required in the work submitted to us.



ISO 9001 : 2015

In 2023, the CTP obtained the renewal of its ISO 9001 certificate! This is an essential label for our Centre, as it is a condition for obtaining approval as a Research Centre recognised by the Walloon Region.

This certification testifies to the company's approach to continuous improvement of its Quality Management System in order to meet the growing demands of its stakeholders.



BQA SA hereby declares that the quality management system of the company CTP, whose registered office is located Chaussée d'Antoing 55 - Tournai - Belgium, has been examined and found to comply with the ISO 9001 standard, 2015 edition.



SERVICES

Studies & Tests

The CTP offers its clients the possibility of carrying out very comprehensive studies or more routine tests. These services are based on our laboratories, our test halls and our multidisciplinary scientific team supported by our experts.

Our services revolve around the development of complete flowsheets, which are tested in the laboratory and on a pilot scale thanks to the diversity and/or exceptional nature of our equipment.

We are able to carry out ore beneficiation studies as well as the treatment, recycling, shaping, and recovery of many types of waste using the mineral processing processes best suited to the specific characteristics of the product submitted to us and to the economic viability of the project.

Research & Development

Are you looking for innovative solutions for recycling and recovering your industrial waste?

As an expert in the recycling and circularity of materials, whether of mineral or plastic origin, the Centre offers tailor-made, pragmatic studies to help you meet the challenges of dwindling resources and reducing companies' carbon footprints.

We will work in partnership with you to bring your project to fruition, from the initial stages (writing the application, finding funding and partners) through to completion and the appropriate use of the results.

Today, the CTP supports manufacturers in their R&D projects. In most cases, these projects are supported by innovation aid mechanisms set up by the Walloon Region (SPW-EER). We can cite, for example, the following types of aid:

- **WIN4EXPERTISE** for SMEs;
- **WIN4COMPANY**, industrial research or experimental development accessible to both SMEs and large companies;
- and **competitiveness cluster projects** (Greenwin and Mécatech).

Through its Research Tax Credit (CIR) accreditation, the CTP can also work with French companies undertaking R&D activities.

Contract services

With **more than 10,000 m² of test halls and a diverse range of pilot-scale equipment**, the CTP is able to meet the needs of contract work. Batches of materials ranging from a few hundred kilos to a few tonnes can be handled, depending on the treatments required.

Our services range from coarse crushing to fine grinding, with the possibility of grading materials by screening (vibrating screen, flip flow, sieve shaker) or classification (dynamic separator, curved grid, screw classifier, hydrocycloning). We operate physical separations between components of different kinds, and can provide drying or heat treatment services at temperatures in excess of 1,000°C.



10.000 m²

of pilot halls

Reception & Administration
Physics Laboratory
Extractive Metallurgy
Laboratory

Chemistry Laboratory
Scientific staff offices

Materials Laboratory

Pilot halls
Extractive Metallurgy
& Mineral Processing

1

2

3

4-5-6





2023

KEY EVENTS



05-09-23

Official launch of Remind Wallonia

05-10-23

Marc Régnier Prize won by our colleague Soner!



11-12-23

CTP in Dubai !



AREA OF EXPERTISE



Mineral Processing's activities are essentially focused on developing processes or parts of processes using primary and secondary materials.

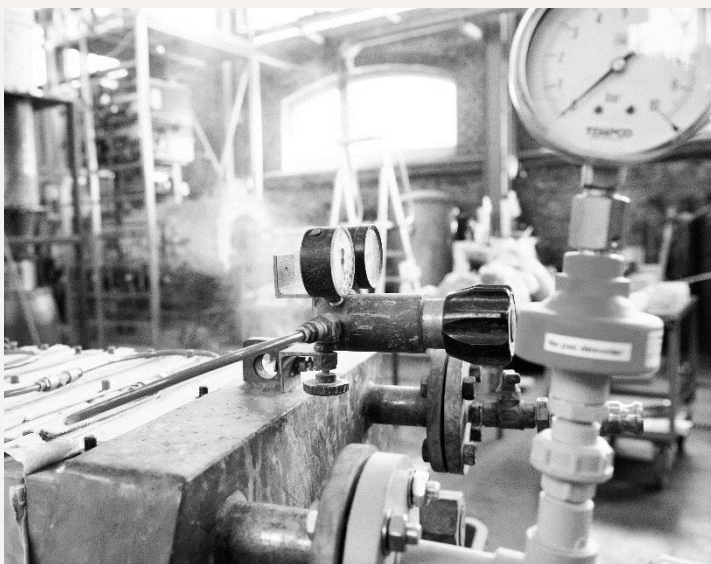
The goal is to determine which processing phases will be the most efficient and profitable and have the lowest environmental impact. The work includes material fragmentation testing, component release testing and product forming tests (pelletization, granulation etc.). Separation and concentration tests supplement the above tests.

Like last year, our work concentrated mostly on studies of secondary raw materials and also on primary raw materials. The trend among manufacturers is still to replace the primary raw materials conventionally used in their production with alternative materials or to recover high-added-value elements from their waste.

The problems encountered are increasingly challenging, however, due to the complexity of the materials or their lower content of the desired elements. Increasingly, "design for recycling" initiatives and product recyclability studies are being submitted to us for this reason.



MINERAL PROCESSING



Extractive metallurgy covers all the tests and studies carried out in order to extract and recover one or more metals from an ore or a secondary raw material.

After an initial concentration stage using physical methods, this activity is characterised by the use of wet chemical processes (hydrometallurgy) and dry chemical processes (pyrometallurgy) to extract and obtain the metal.

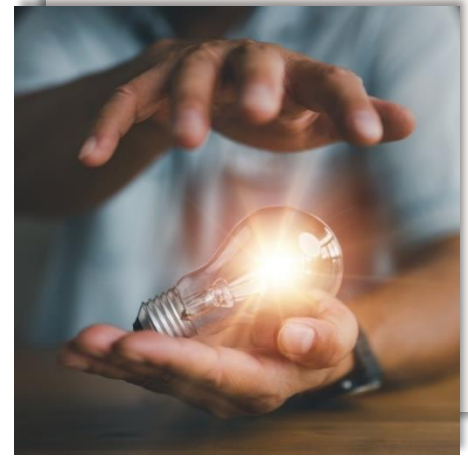
It has been growing steadily at the Centre for several years, with a highly diverse range of projects on behalf of companies both large and small, in Wallonia and abroad.

Our facilities and pilot tools offer upscaling possibilities that are highly sought-after by our clients and constitute a major advantage.

EXTRACTIVE METALLURGY



AREA OF EXPERTISE



CIRCULAR MATERIALS

As CTP specialises in processing waste and by-products, often of mineral origin, this has naturally led to a focus on recovery, particularly in the sector of construction and public works.

Materials whose particle size classifies them as gravel or sand contribute to the granular structure of materials, while fines, following chemical, thermal or mechanical processing to activate them, can be used as a partial substitute for hydraulic binders (cement, lime etc.).



LABORATORIES ANALYSIS



Our laboratories conduct chemical and physical analyses on all types of solid matrices (minerals, plastics, metals etc.) using a range of cutting-edge equipment and covering a very wide analytical spectrum.

These analyses constitute an essential service for all CTP's activity units and are central to the research we carry out. They serve the in-house needs of Mineral Processing, Extractive Metallurgy and materials studies, as well as our Industrial or Collaborative Research projects.

Moreover, our analytical expertise developed over more than 25 years is recognised by a broad client base consisting of SMEs and major groups, together with trading offices whose trust we have won, which regularly call on our services to characterise their materials for quality control or counter-analysis purposes.



COLLABORATIVE RESEARCH



<p>WIN2WAL</p>		<p>BioFACon3 NEW ECuME</p>
<p>FEDER 2014-2020</p>	  	<p>EMRADEMO2FACTORY CLOSED ECOLISER CLOSED</p>
<p>INTERREG NWE</p>		<p>NWE-REGENERATIS CLOSED CIRMAP CLOSED</p>
<p>WIN4COLLECTIVE</p>		<p>RED4SOLS NEW</p>
<p>FEDER 2021-2027</p>	  	<p>UP_PLASTICS NEW</p>
<p>CORNET</p>		<p>ReIn-E CLOSED</p>



BioFACon3 **NEW**

Treatment of biomass fly ash for use in the construction industry

Currently, fly ash from biomass combustion is commonly used in agricultural applications to improve soil alkalinity or in road construction as a filler material. Recent research has confirmed the relevance of using fly ash as a partial replacement for cement in structural concrete for buildings. However, it is also agreed that this type of SMM (secondary mineral material) can exhibit great variability both physically (particle morphology, porosity) and in its chemical or mineralogical composition, which influences its reactivity and, consequently, its recovery potential.

The BioFACon3 project aims to 'upcycle' biomass fly ash to make it compatible with cementitious matrix materials. To achieve this, it will be necessary to study the reaction mechanisms and interactions between the ash and various binders, as well as the potentially deleterious effects. Adding value to this type of fly ash will therefore require pre-treatment of the flows as well as the development of formulations adapted to the physico-chemical characteristics of this mineral material. The research project will also include environmental safety checks.

ECuME

Circular Economy and Electric Mobility: functional recycling by electro-hydraulic fragmentation, electro-leaching, and anti-solvent precipitation of lithium ion batteries

Partners: Comet Traitements, ULiège (GeMMe and GreenMat), CTP



Global warming is prompting industries and governments to turn to the production of electric vehicles to replace the current car fleets. Li-ion batteries are the driving force behind the transition to electric mobility, and are at the heart of huge industrial projects to ensure that they are produced in Europe. However, one of the fundamental keys to this potential development is

access to metals. It is in this context that the circular economy is important, as it provides a means of securing resources and alleviates the problem of the environmental management of these batteries at the end of their life.

The aim of the **ECuME** project is to propose an innovative process for recycling end-of-life Li-ion batteries, from collection to the synthesis of new active cathode materials. As part of this project, the CTP is responsible for extracting and recovering the metals contained in the black mass (the fine fraction recovered after crushing Li-ion batteries). The hydrometallurgical process developed includes leaching, purification and precipitation by adding an antisolvent. Unlike other projects where the aim is to separate all the metals completely, the objective of ECuME is to produce a mixed sulphate salt composed of nickel, cobalt, manganese and lithium, which can be reused in the production of cathode precursors for the manufacture of new Li-ion batteries.

The research involved characterising the black mass and optimising the various stages of the process. This project will enable the CTP to develop theoretical knowledge and experimental know-how in the field of batteries.

EMRA-DEMO2FACTORY

Provision of demonstration units in the fields of materials, processes and the environment

The "EMRADEMO-CTP" project is designed to accelerate the introduction of circular economy principles in business, and particularly SMEs. This awareness-raising is achieved by providing demonstration units in the Centre, which enable waste to be transformed into a new recycled raw material.

The Centre turns a problem (waste management) into an opportunity (recycling and the creation of new materials). The general public is also being made aware of this new way of thinking about the economy through a virtual visit to these units on the internet.

During 2023, the demonstration unit enabled the CTP to expand its collaboration with the local and cross-border economic fabric.

ECOLISER

Eco-binders for soil treatment, waterproofing, and roads

Partners: CTP, INISMa, ULiège, (ArGenCo-GEO, GeMMe, LGC-PDD), CRR, Certech, Materia Nova

The aim of the **ECOLISER** project portfolio was to develop eco-friendly formulations based on secondary materials and/or industrial by-products (iron and steel slag, bottom ash, glass fines, fly ash, dredging products, etc.), which are currently unused, by offering them recovery routes in the materials sector.

The secondary material streams that received most attention were fly ash with varying levels of portlandite, bottom ash, and LRF slag, whether or not combined with activating agents.

The final year of the project, 2023, was used to validate the selected formulations by building a test trench on the CTP site. In practice, a mineralurgical pre-treatment was applied to a few hundred kilos of by-product using equipment in our pilot halls, before being mixed on the ground using a mobile unit at TRBA. With regard to the laboratory results, while the initial bearing capacity index of the soil (IPI) was less than 2%, the stabilisation solution adopted led to a significant increase in the value of this parameter, reaching 15% on the first day and 36% after 28 days. In the trench, the coefficient of compressibility of the stabilised soil was measured using the plate test and reached 12 MPa on the day it was laid, an acceptable value for use as backfill (M1 > 11 MPa according to the Qualiroutes CCT). The measurement carried out after approximately 60 days produced a value of 129 MPa, well above the minimum criterion for sub-base application (M1 > 35 MPa), which was the objective to be achieved, and which proves the binding nature of the selected by-product, and therefore its ability to induce induration.



NWE-REGENERATIS

REGENERATION of Past Metallurgical Sites and Deposits through innovative circularity for raw material

Partners: SPAQuE, MPI, CTP, BRGM, ULiège (ArGenCo), Ixsane, OVAM, Team2, TH Köln, BAV, Cranfield University, Duferco, Atrasol, JUNIA

Although most of the waste generated by the modern metallurgical industry is recycled, waste from older sites is still stored or buried because it is considered too costly to treat. Today, this waste represents a major ecological and economic challenge. The remediation of former metallurgical sites requires a new model combining the remediation of polluted soils and the exploitation of the resources they contain in order to support sustainable economic development.

NWE-REGENERATIS - polluted metallurgical site



The **NWE-REGENERATIS** project (Interreg North-West Europe), coordinated by SPAQuE, has helped to demonstrate that resources (metals, materials and land) can be recovered from Former Metallurgical Sites and Deposits. All the objectives set at the start of the project have been achieved. One of the most striking achievements has been

the development of a decision-support tool (NWE-Smartx) that guides stakeholders towards the most appropriate technologies for recovering metals and minerals, and informs them about the feasibility of their rehabilitation projects. NWE-Smartx is available as Open Source to ensure its further development through future contributions from players in the field.

Another highlight was the recovery of 2,452 tonnes of historic slag by a pilot plant installed at the Duferco site in La Louvière. This achievement demonstrates the success of the NWE-REGENERATIS approach and will undoubtedly be emulated by others.

Presentation of the project:

https://youtu.be/f1oufQ_HU6g



CIRMAP

Circular economy via customisable furniture with Recycled MAterials for public Places

CIRMAP - 3D printing



The **CIRMAP** project, which brings together a network of multi-disciplinary players, aims to manufacture customised Urban, Memorial or Garden furniture (UMJ) using 3D printing and secondary mineral materials, in particular recycled concrete sand (RFA: Recycled Fine Aggregates).

As part of this project, based on its know-how and expertise in

the field of mineral processing, the CTP took charge of the preparation of RFA streams on a pilot scale. More specifically, the CTP applied mineralogical treatment processes to the fine fraction of recycled concrete aggregates in order to obtain several batches of materials suitable for incorporation as components in original formulations intended for 3D printing.

The treatment consisted of a combination of crushing, grinding, and screening operations (to 2 mm), which were carried out on a pilot scale on quantities ranging from several hundred kg to several tonnes.

The CTP also carried out a granulometric characterisation of the fraction produced in order to adapt the parametric conditions at the level of the various operations so as to comply with the characteristics imposed by the partners in charge of the 3D printing tests.

During the project, the CTP processed a total of around 30 tonnes of RFA, and the fine fraction of RFA that the CTP supplied to the various project partners, i.e. with a grain size of less than 2 mm, was used in 3D printing trials for concrete street furniture.

RED4SOLS **NEW**

Electrodialytic remediation technique for heavily polluted soils

Partners: CTP, ULiège (GxABT-EESP)

RED4SOLS - electrodialytic extraction cell



Because of its industrial past, Wallonia has a large number of disused former industrial sites, some of whose soils contain high levels of pollutants such as heavy metals. Although certain current techniques (mineralurgy, for example) make it possible to comply with the pollutant thresholds defined by the Walloon decree

of 01/03/2018 for coarse fractions, this is not the case for fine fractions, whose sole purpose is to be disposed of in landfill sites, so no comprehensive solution currently exists. In the absence of suitable technical solutions, these sites are currently confined, which is only a temporary solution that is very costly because it requires long-term environmental monitoring. In addition, it prevents these sites from being put to any other use and therefore runs counter to the political will to set up new activities on these sites with a view to revitalising the Walloon economy.

In this context, the project aims to study an innovative treatment technique that complements current techniques, as it applies to the fines that concentrate the pollution. This is electrodialytic remediation, the applicability of which the project aims to verify, as well as its transferability on an industrial scale, in the treatment of fines from a mineralurgical process of the 'soil washing' type.

To achieve this objective, the challenge will be to improve the electrodialytic remediation cells in order to substantially reduce the residence time of the polluted soil fines in them and thus increase the treatment capacity so as to make the technology economically viable.

The project brings together the CTP, which aims to improve the electrodialytic remediation process, and GxABT-EESP (ULiège), which will study the effects of this original treatment on soil properties.



UP_PLASTICS **NEW**

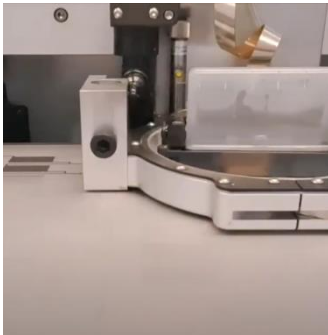
The **UP_PLASTICS** project portfolio, coordinated by UMONS, aims to develop and demonstrate the eco-design of plastics for construction and building by exploiting (i) eco-products (natural polymers, animal biomass, etc.) and (ii) industrial waste from buildings (PU foams, cables, PVC, end-of-life paints) using semi-industrial transformation methods. Within this portfolio, the CTP will focus on the transformation of by-products into secondary materials available for (re)formulation and (re)transformation into circular and functional materials for construction. The project also aims to study the mechanochemical transformation of treated flows by using specific shredders to bring about chemical and/or mineralogical transformations in the solid state of the material to encourage its reuse.

ReIn-E

Recyclable Integrated Electronics

Partners: CTP, SIRRIS, Hahn-Schickard, INM

ReIn-E - inkjet printing



The **ReIn-E** project was a European CORNET-type research project conducted in partnership with SIRRIS and 2 German research institutes. It looked at the design of electronic parts that integrate the electronics and circuits directly into the polymer (IMSE technology - In Mould Structural Electronics). This technology enables new designs and reduces the

weight and quantity of materials used, but can also make it more difficult to recover metals at the end of their life. The project responds to this risk by testing an eco-design that includes an intermediate layer between the electronics and the polymer, which should make it easier to separate them and thus recover the metals. The CTP has compared different grinding and separation methods (electrostatic separation, densimetric separation or morphological classification) depending on the design of these new components, making it possible to establish a functional recycling scheme and design recommendations for improving the recyclability of these future electronic components.

Presentation of the project:

<https://youtu.be/C-7of0bgynQ>



FOCUS

The analytical capabilities of our laboratories

Chemistry Laboratory

The analysis laboratories carry out chemical and physical characterisation of various solid matrices such as minerals, plastics and metals. To do this, the CTP has a wide range of equipment (ICP-OES, XRF, XRD, ATG, COT, C-S, etc.). Our unique know-how, acquired over the last 25 years, enables us to provide an appropriate and precise response to the analytical challenges regularly posed by our customers. What's more, just as the CTP's projects evolve with the times, so does the chemical analysis laboratory. Since recycling Li-ion batteries is now a major challenge, the CTP was keen to develop effective and rapid black mass characterisation techniques. Although all the elements present in black mass can now be measured in our laboratories, we are continuing our analytical developments and aim to extend our research to the analysis of organic compounds.

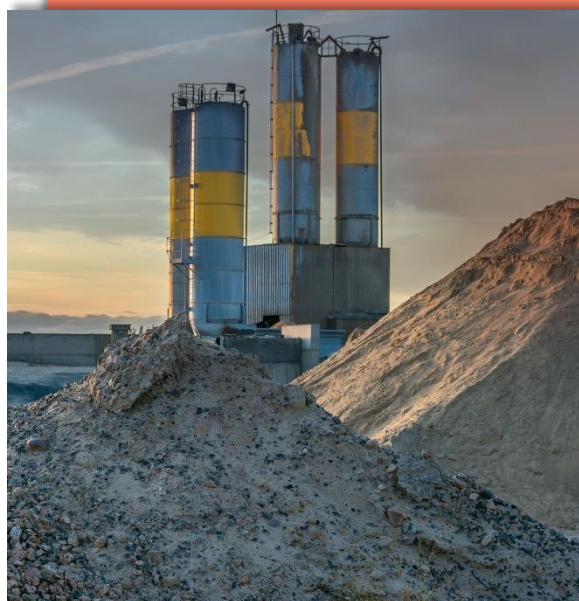
Materials Laboratory

The recovery of industrial waste and by-products, most of which are mineral in nature, is one of the CTP's core business activities. In this context, the Centre has acquired particular expertise in the development of circular materials based on these wastes and by-products, which thus become secondary materials (SM). This expertise is mainly focused on the recovery of these materials in the form of materials for the construction and public works sector. To support this approach, the CTP has equipped itself with a high-performance 'Materials' laboratory (LAMA) capable of carrying out the various tests inherent in the use of SM in the building and public works sector:

- ◆ pre-treatment and characterisation of secondary materials;
- ◆ use of these materials;
- ◆ study of workability by means of consistency tests and measurement of rheological behaviour;
- ◆ measuring of the setting time;
- ◆ mechanical characterisation (moduli of elasticity: E and G, flexural and compressive strength, resistance to mechanical impact and cracking, etc.)
- ◆ leaching tests with analysis of solutions to ensure compliance with environmental standards.



INDUSTRIAL RESEARCH



<p>PNRR Plan National pour la Relance et la Résilience</p>    	<p>CARBOC CGROUT CIBER IRMA RECOB2 NEW WASTES2CEM WASTES2MAT CISTEMEEC</p>
<p>WIN4COMPANY </p>	<p>ATHENA NEW</p>
<p>REVERSE METALLURGY </p>	<p>PLASMETREC CLOSED</p>
<p>PLAN DE RELANCE WALLON « Déchets Ressources »</p>  	<p>VALOCELL</p>
<p>C-WALity </p>	<p>APEROFIN CLOSED RESA CLOSED</p>
<p>GREENWIN </p>	<p>COSMOCEM MINERAL LOOP</p>



CARBOC

Capture and storage of CO₂ by carbonation of bottom ash and concrete with reduced cement content

Partners: ULiège (PEPs, GeMMe), CTP, Remind, Roosens Bétons, TRBA, Ipalle

CARBOC - carbonation test on mortars



The various technical options initially envisaged for the **CARBOC** project were deployed during 2023. The research team has put in place a testing methodology that enables several CO₂ capture and sequestration scenarios to be tested through the application of material formulations such as paving stones or ready-mix

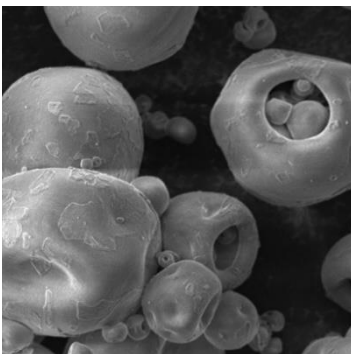
concrete. One of the major challenges of the project lies in its industrial transferability, and in particular the relatively short application times for the carbonation technology studied, to ensure that it remains economically realistic. The addition of further carbonatable phases through the incorporation of industrial by-products has also been envisaged and, in this respect, the CTP is working on the development of a procedure for treating secondary materials in order to eliminate deleterious elements for a 'materials' application while retaining sufficient sequestration potential with regard to CO₂. The initial results have been very encouraging, and efforts will continue, in particular to provide the project partners with the quantities of pre-treated materials needed to produce materials with a reduced carbon footprint.

C-GROUT

Pre-treatment of waste and by-products of mineral origin with a view to their integration into material formulations intended mainly for the offshore wind industry

Partners: CTP, ULiège (PEPs), UCLouvain, Remind, Euroquartz, Lessine

C-GROUT - CSH nanoparticles



The **C-GROUT** project was initiated as part of the REMIND platform, which is accelerating the circular economy in Wallonia. More specifically, it concerns the development of complex grouts or mixes for concrete, both low-performance (filling materials) and high- and ultra-high-performance (structural materials) for use in offshore applications. The aim is for these grouts or

complex mixes to stand out from those of their main competitors by incorporating pre-treated secondary mineral materials (SMM) (industrial waste and by-products) into their compositions, with a view to both the environment and the economy, by increasing circularity and optimising production costs. The availability of SMM-based materials with different properties and rheological behaviour will enable the Euroquartz partner to offer a global approach to manufacturers in the sector.

One of the main challenges is to select SMM, whose quality can vary widely depending on the application, i.e. filler grouts or Ultra High Performance Concrete (UHPC) grouts

In order to make the best choice for the development of new SMM-based materials depending on the type of offshore application, the project is applying a rational eco-selection process based on the definition of performance indices that will be established on the basis of technical, economic and environmental properties derived from Life Cycle Assessment (LCA).

As part of the C-GROUT project, the CTP is contributing its expertise in the following areas in particular:

- processing and recovery of secondary mineral materials so that they can be incorporated into offshore mix formulations without adversely affecting their performance in terms of rheology, mechanical strength, anti-washout behaviour, chemical resistance, etc;
- optimising formulations for SMM-based offshore grouts.

During the first year of the project (R&D phase), the CTP obtained very promising results for both low and high performance grouts. Indeed, with the exception of cement, all the other natural/growing raw materials were substituted by their SMM equivalents. It turned out that the results in terms of workability and mechanical properties were equivalent or even better for most of the formulations incorporating SMM.

CIBER

Circularity of pre-cast concrete

Partners: CTP, ULiège (PEPs, GeMMe), UCLouvain Remind, Wanty, Cogetrina Logistics, Roosens Bétons

CIBER - Demolition of a commercial building



To cope with the high consumption of natural aggregates in the construction sector, the increasing use of recycled aggregates is becoming a necessity. To this end, Wanty and Dufour, who have recently developed a process for recycling deconstruction flows as part of the research carried out with the CTP (SOVALMIN and OPTIDEMO projects), will be working with Roosens to improve the quality of the aggregates produced so that they can be used in higher added-value outlets such as prefabricated concrete for large-scale structural components (bridge decks, lintels, filler blocks, floors, modular deconstructable blocks).

After receiving deconstruction materials, the CTP carried out the various stages of screening, air separation, washing and optical sorting simulation required to produce concrete aggregates of a quality comparable to that of the future Wanty and Dufour processing line. These aggregates are supplied to the project partners to enable the development of concrete formulations incorporating secondary aggregates. The CTP is also involved in studying the reprocessing of these materials, in particular by selective grinding, to improve their qualities (particularly in terms of porosity) and thus increase their recovery potential.



IRMA

Manufacture of non-combustible insulating materials and refractory materials by recovering inert industrial waste, deconstruction waste and other recycled resources

Partners: Remind, Ipsis, Vinci, CTP, Buildwise, ULiège (PEPs), UCLouvain

The aim of the IRMA project is to develop new insulating, non-combustible and refractory products:

- Competitive in terms of cost and technical features,
- Using inert mineral waste from industry and the dismantling sector,
- Thanks to a process developed and patented by Ipsis.

The CTP is involved in the preparation of secondary mineral materials. The materials are supplied by Remind and Vinci.



IRMA - Rock wool aggregates

The pre-treatments were successfully carried out on most of the secondary materials selected. These have proved to be compatible with the Ipsis process and, once the formulations have been perfected, porous materials can be obtained that meet the requirements for some of the project's target applications. The performance of the porous materials is assessed by

Buildwise. The potential of the products is also determined on the basis of life cycle analysis and the carbon footprint. This study is being carried out jointly by the partners Remind, ULiège-PEPs, UCLouvain and Buildwise.

RECQB2 NEW

Manufacture of an innovative circular dry screed panel made from recycled materials, combining cellulose fibres, mineral fibres, crushed sand and basic agents.

Partners: Remind, Knauf, Cogetrina Logistics, CTP, Buildwise, UCLouvain, ULiège (PEPs)



RECQB2 - Vibrocompaction test

The aim of the RECQB2 project is to develop a new circular material for the manufacture of dry screeds. The target markets are renovation and timber-frame construction.

The dry screed panel will be made from waste paper, crushed sand and a binder phase formulated from industrial by-products (fly ash,

slag, etc.). Secondary materials will be supplied by Cogetrina Logistics and Remind's industrial partners.

The CTP is involved in the characterisation and preparation of the secondary materials, as well as in the development of the binder. UCLouvain is responsible for manufacturing the material and characterising it in partnership with Buildwise. Knauf will define the panel's design constraints and validate the implementation process by setting up a pilot unit. Assembly techniques will be optimised to enable quick and easy assembly/disassembly and reuse.

At the same time, a study to establish and minimise the product's environmental impact will be carried out jointly by ULiège-PEPs and UCLouvain.

WASTES2CEM

Alternative circular binder based on slag and fly ash

Partners: Remind, CCB, Duferco Wallonie, DC Environment, CTP, ULiège (PEPs), UCLouvain



WASTES2CEM - on-site fly ash sampling

At present, the main challenge facing Walloon cement manufacturers is to remain competitive in the face of competition from imported clinker and to meet their commitments to reduce CO₂ emissions.

In this context, the WASTES2CEM project proposes two approaches:

- The first is to minimise the environmental impact of clinker by incorporating secondary mineral materials into the raw meal;
- The second involves reducing the clinker content of cement by adding reactive additions derived from industrial by-products.

The secondary materials studied came from historical deposits. Initially, they were assessed by the CTP. Appropriate treatment procedures were then put in place to meet the specifications of cement manufacturers, depending on the recycling route envisaged. Subsequently, the CTP will help to carry out clinkerisation tests on a laboratory and pilot scale, as well as characterising the new cements.

Presentation of the project:

<https://www.youtube.com/watch?v=jeD7avmUj98>

WASTES2MAT

Alternative ettringite-based circular binder

Partners: Remind, CTP, ULiège ((PEPs, Géotechnologie), Sedisol, SWDE, Ipalle

Several Walloon companies, including Sedisol, SWDE and IPALLE, are facing difficulties when it comes to managing their waste. It turns out that



WASTES2MAT - sub-base material

the pooling of some of these wastes leads to the formation of a particular hydraulic phase that can be used as a binder in the synthesis of materials with limited bearing capacity, such as re-excavable self-compacting materials (RSCM) or sub-base materials. More specifically, these materials have great potential for development because,

although they meet a real need, they are currently little used in the Walloon Region. In addition, the phase synthesised stabilises the inorganic pollutants present in the waste and captures a large number of water molecules, thereby helping to stiffen the materials.



The aim of this project is therefore to develop eco-materials whose load-bearing capacity is provided by this particular phase. The originality of the project is further enhanced by the fact that the reagents used to synthesise this phase are all of secondary origin, which will make it possible to avoid their disposal in landfill sites.

The CTP will be involved in this project in the characterisation of secondary mineral materials, as well as in the development phase of the eco-material based on these materials and containing the specific hydraulic phase. The eco-material will serve as the basis for the formulation of RSCM and sub-base materials by another partner. Initial results have shown strong potential for use in sub-base materials.

ATHENA NEW

Recycling secondary zinc-bearing materials to produce low-carbon zinc oxide

The aim of this project is to develop an innovative route, unique in the world, for recycling secondary zinc materials using secondary reagents and, subsequently, to develop a new pilot-scale production process (TRL 4 to 5).

PLASMETREC

Production of zinc salts

After studying and comparing a multitude of hydrometallurgical processes for the production of technical zinc oxide on a laboratory scale, the project led to the development of an innovative process in which each stage was optimised. The advantages of this process lie in the quality of the oxide produced, its robustness and its competitive costs.

CISTEMEEC

Industrial Entity Value Chains, Energy Transition, Electric Mobility and Circular Economy

Partners: Comet Traitements, Hydrometal, CRM, CTP, Citius engineering, John Cockerill, Reverse Metallurgy, Sagacity, ULiège (GREENMat, PEPs, GeMME)



CISTEMEEC – ground samples

The **CISTEMEEC** project aims to provide solutions for the reuse and recycling of end-of-life electric mobility equipment. Several prototypes and demonstrators will be built in order to accelerate the deployment of Walloon industries so that they become players in the recycling of this type of material.

The CTP is involved in the project to recycle the Li-ion batteries contained in electric vehicles such as bicycles, scooters and cars. As conventional mechanical shredding leads to incomplete release of certain cell components, the CTP is looking into alternative shredding methods. In 2025, a prototype is due to be assembled, enabling more complete recovery of black mass (the active material in batteries) from end-of-life Li-ion batteries. The CTP is also contributing to the development of a hydrometallurgical process aimed at synthesising metallic cathode precursors from this black mass.

VALOCELL

Recycling and recovery of cellular masonry blocks

Partners: CTP, industrial partners

VALOCELL - concrete block containing aerated concrete crushed material



The aim of the project is to develop a comprehensive system for collecting, sorting and recovering cellular concrete masonry blocks from non-incinerable bulky waste from the construction sector. By isolating them from deconstruction flows such as rubble and plasterboard in particular, these blocks will be 'upcycled' into value-added concrete formulations after treatment and functionalisation.

The CTP will be testing various dry sorting and separation techniques to isolate cellular concretes from non-incinerable waste. The crushing techniques needed to incorporate cellular concretes into concrete formulations have been successfully studied by the CTP.

Article published:

<https://www.recyclepro.be/fr/article/la-filiere-de-valorisation-se-met-en-place/>



APEROFIN

Improving the Road Performance of FINes from Recycling

Partners: Hublet Ets, CRR, CTP

APEROFIN – Implementation of the trench test panel



Through the **Aperofin** project, Hublet called on the expertise of CTP and CRR to find ways of recovering the fine fractions of the materials they process at their deconstruction materials collection and recycling centres.

The two research centres worked together to study the characteristics of these material flows in terms of both

their composition and their geotechnical behaviour on a laboratory scale. The aim was to develop a road base material for light traffic and a cement-treated fine material for use as trench backfill. The laboratory study enabled formulations to be defined and, in June 2023, an experimental batch was implemented on the manufacturer's site. This pilot-scale implementation enabled the material's performance to be assessed and it was verified that the performance criteria required for its recovery were achievable.



RESA

Highly cost efficient REfractory SAnd Filler for low carbon steel ladles - New, more cost-competitive filler materials for low carbon steel ladles

Conducted in collaboration with INISMa, this CWALity project was aimed at studying the use of alternative chromite sands, or sands with lower qualities, for the constitution of plugging masses for the steel ladle casting channel. These alternative materials can provide a competitive advantage in terms of price, but also in terms of diversifying supplies in the context of securing critical materials in Europe.

The quality standards for capping compounds are nevertheless very demanding, so the CTP has been involved in studying the treatments needed to give alternative chromites the qualities required to make capping compounds that meet the standards. The phase of testing the thermal and mechanical properties of these new masses has made it possible to define new formulations for certain commercial mixes, partially integrating these alternative chromites on a laboratory scale.

COSMOCEM

Partners: CBR, Tradecowall, Duferco Wallonie, SBMI, Lessine, Technord, CTP, CRIC, ULiège (PEPs)



The **CosmoCem** project is a Marshall Plan project accredited by the Greenwin cluster. Its ambition is to transform Walloon industrial waste and by-products into new mineral additions for cement. These additives would constitute an alternative secondary raw material able ultimately to replace thermal power plant fly ash and blast furnace slag,

whose production is constantly decreasing.

In this project, the role of the CTP is to select the most appropriate activation method (mechanical or thermal) depending on the nature of the secondary materials.

At this stage of the research, the technical feasibility of both treatment methods has been demonstrated on a laboratory scale. While thermal treatment is more specifically dedicated to clayey materials, mechanical activation can be applied to a wider range of secondary materials.

Phase II of the project has now begun and consists of validating the laboratory results by setting up pilot units. The effectiveness of the activation treatments applied will be verified on the basis of mechanical and rheological tests.

MINERAL LOOP

Capture and sequestration of Industrial Entity CO₂ by carbonation of mineral waste

Partners: CTP, ULiège (PEPs, GeMMe), Carmeuse Europe, Lessine, Revatech, Tradecowall



With a view to developing a circular economy for mineral waste streams, the **Mineral Loop** project aims to design, develop, install and operate an industrial pilot plant for transforming mineral waste into secondary products that can be reused in various application sectors. The processes to be implemented will be based, among other things, on the principle of

carbonation, i.e., the capture and fixation of CO₂ in alkaline mineral materials that have been stabilised and reconditioned in this way. The partners pre-selected potentially carbonatable streams and the CTP's work consisted in assessing the capacity of these mineral materials to fix CO₂. This assessment involves studies in static mode and then in dynamic mode, the efficiencies of which are determined by physico-chemical and mineralogical characterisations, also carried out by the CTP.

In 2023, the operating conditions needed to obtain the carbonation potential of the pre-selected materials, taking into account the targeted applications, were identified and optimised on a laboratory scale. The work carried out at the end of the year consisted in assessing the industrial transferability before validating the results on a pilot scale, which should take place in 2024.



FOCUS

Ecoliser, a test platform available

The CTP, which has already been active for several years in the field of soil stabilisation, both mechanically and chemically, has been able to strengthen its field of expertise through the ECOLISER research programme. This programme, co-funded by Wallonia and the European Union, began in 2016 and ended in 2023.

Accompanied by 7 partners (INISMa, Certech, Materia Nova, ULB-4Mat, ULiège-GeMMe, ULiège-PEPs and ULiège-AGenCo-GEO³), the Centre has worked in particular on improving the bearing capacity of soils by incorporating industrial by-products that are not currently used (ash from combustion of thermal power stations or biomass, iron and steel by-products, etc.), possibly with the addition of a basic agent to increase their reactivity.

The approach was as follows:

- Physico-chemical and mineralogical characterisation of by-products;
- Mineralogical treatment of materials;
- Assessing the performance of by-product/soil mixtures and measuring mechanical performance;
- Validation of the best-performing mixes through implementation and monitoring in experimental trenches.

In order to carry out the validation stage, the CTP has built an experimental trench that completes the range of tests it was already able to carry out on a laboratory scale limited to a few kilos of material. This sufficiently large trench (13 m³) makes it possible to test the behaviour of larger quantities of material and to obtain more representative results than those obtained in the laboratory. Soil stabilisation solutions can be assessed both in terms of mechanical performance and environmental safety, since the facility is equipped with a system for collecting percolation water for analysis and on-site meteorological surveys.

Article published: <https://www.fediex.be/upload/quadraria-mag-16-fediex-xkcuqp.pdf>

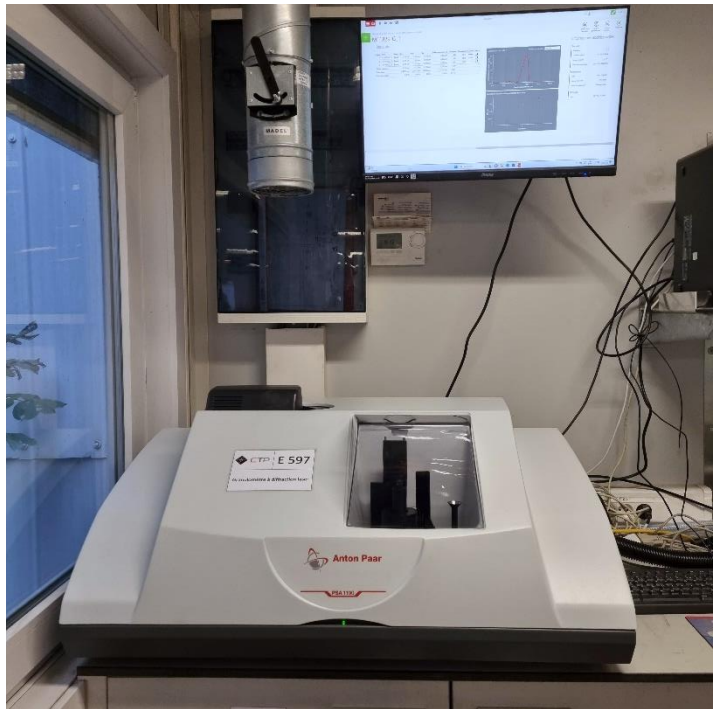


NOTABLE EQUIPMENT

Our Materials Laboratory has acquired a new laser granulometer

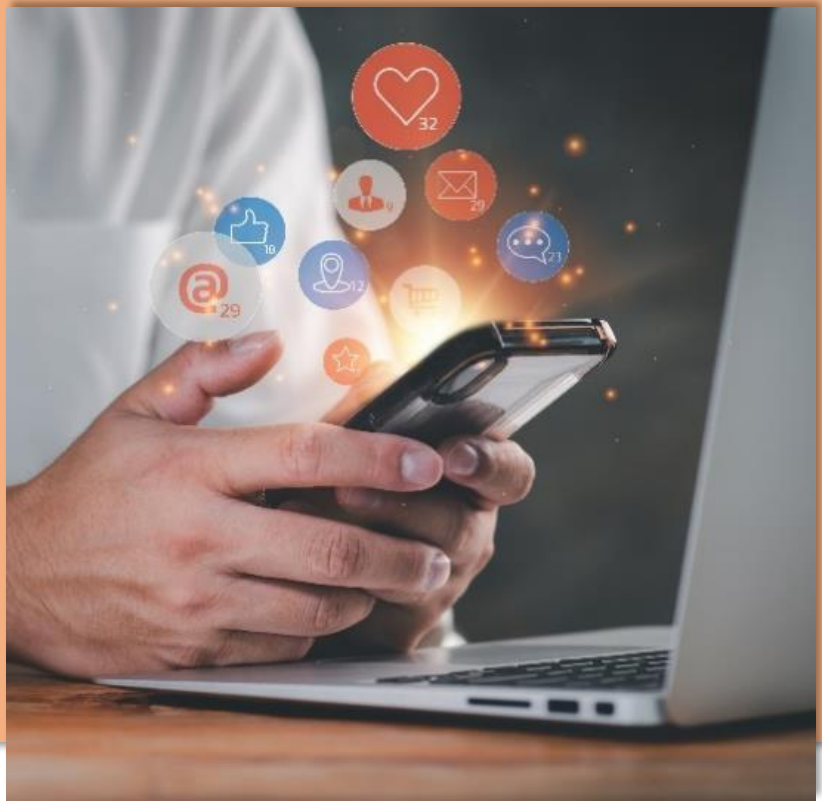
The CTP recently acquired a laser diffraction granulometer capable of determining the particle size distribution of fine powders, covering a particle size range from 0.1 to 2,500 μm . This equipment is particularly versatile, since measurements can be taken in a wet environment (water or organic solvent) or in a dry environment, with dispersion options in the latter case, either in an air stream or in free fall. This equipment can be used to characterise our customers' products, whether mineral (cement, fly ash, gypsum, etc.) or organic (sugars, graphite, etc.).

It is proving to be an essential tool in the "Materials" recovery of waste and by-products used as secondary materials (SM). The fineness of the particle size will determine the properties of certain MS that can potentially be used in the construction sector, such as their contribution to hydraulic setting or water demand.



COMMUNICATION

+500
followers



2023, a return to our roots!

A breath of fresh air has come to the CTP but it seemed logical, in creating our new logo, to keep in mind the origins of the centre and therefore pay homage to our very first logo. The upward-pointing triangle representing the waste embankment and the downward-pointing triangle representing the mines.



CTP

A more modern image of the Centre that is still familiar, characterised by a highly graphic rhombus representing the idea of the nugget to be captured within the raw material. The very foundations of our work at the CTP in the various areas of expertise: **Mineral Processing, Extractive Metallurgy, Circular Materials** and **laboratory analyses**.

In 2023, the Communications Department will therefore be focusing primarily on setting up the various distribution media and, in particular, transforming its website, which will go live in April 2024.





SHAREHOLDINGS



sa
labotour

Specialist in the characterisation of road and construction products



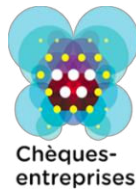
Reverse Mineral Industry in Wallonia is a **platform of industrial, technological and scientific excellence**, accelerating the circular economy in Wallonia



Provides governance for the **"Reverse Metallurgy"** project, the aim of which is to create an internationally recognised platform of industrial, technological and scientific excellence in reverse metallurgy in Wallonia, creating added value and jobs.



WAPI
2040
animation territoriale
de la Wallonie picarde



WIN4C
Stratégie de Spécialisation
Intelligente



PUBLICATIONS & EVENTS

Fairs & Exhibitions

2023-05-12 - Workshop NWE-REGENERATIS, NICOLE SPRING, Paris, France

2023-05-25 - Forum Attractivité, Job Day, Quai de l'entrepôt, Ath

2023-06-20 - Participation in Life PLAS Plus Event, Mons

2023-10-3 and 4 - "En route vers le Zéro Déchet dans la construction" ("Towards Zero Waste in construction"), CFR de Bouge, Namur

2023-10-10 and 11 – Stand at Pollutec Lyon, Parc des expositions de Lyon, France

2023-12-13 and 14 - Circular Wallonia Days, Business Village Ecolys, Suarlée, Namur

Publications

"Mineral Processing Techniques Dedicated to the Recycling of River Sediments to Produce Raw Materials for Construction Sector" - *Mining* 2023, 3(1), 54-76 – Mathieu Henry, Laurence Haouche and Bruno Lemièr
>>><https://doi.org/10.3390/mining3010003>

"Making polymers and finding plaster" - *Recyclage & Valorisation* - Prix Marc Régnier de la SIM - June 2023, no 81, 20-21 - Soner Cinar

"Geophysical investigation of a slag heap for resource quantification" *Journal of Environmental Management* 349, 2024 - Itzel Isunza Manrique, Thomas Hermans, David Caterina, Damien Jougnot, Benoît Mignon, Antoine Masse, Frederic Nguyen
>>><https://www.sciencedirect.com/science/article/pii/S0301479723021540?via%3Dihub>

Courses

- ◆ **Mineralurgy at the service of the environment**
Chemistry Master's degree in Polymer and Environmental Materials Engineering - Université des Sciences et Technologies de Lille - November & December 2023
- ◆ **Plastics recycling**
Chemistry Master's degree in Polymer and Environmental Materials Engineering - Université des Sciences et Technologies de Lille - November & December 2023



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DUFOUR Group
President CTP



Thomas PARDOEN
Professor UCLouvain - Advisor of
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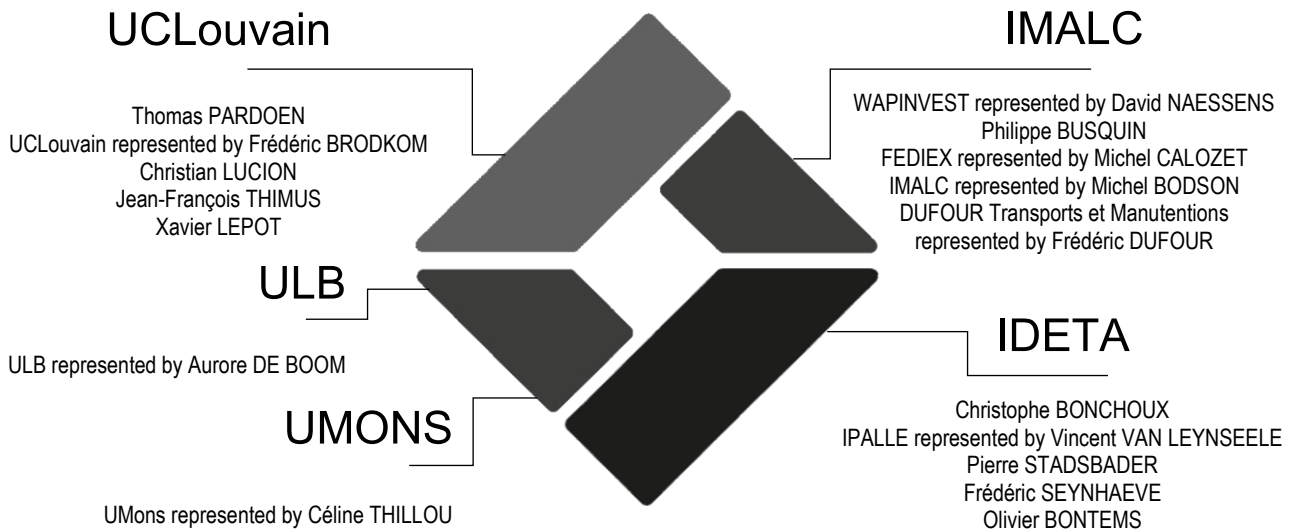
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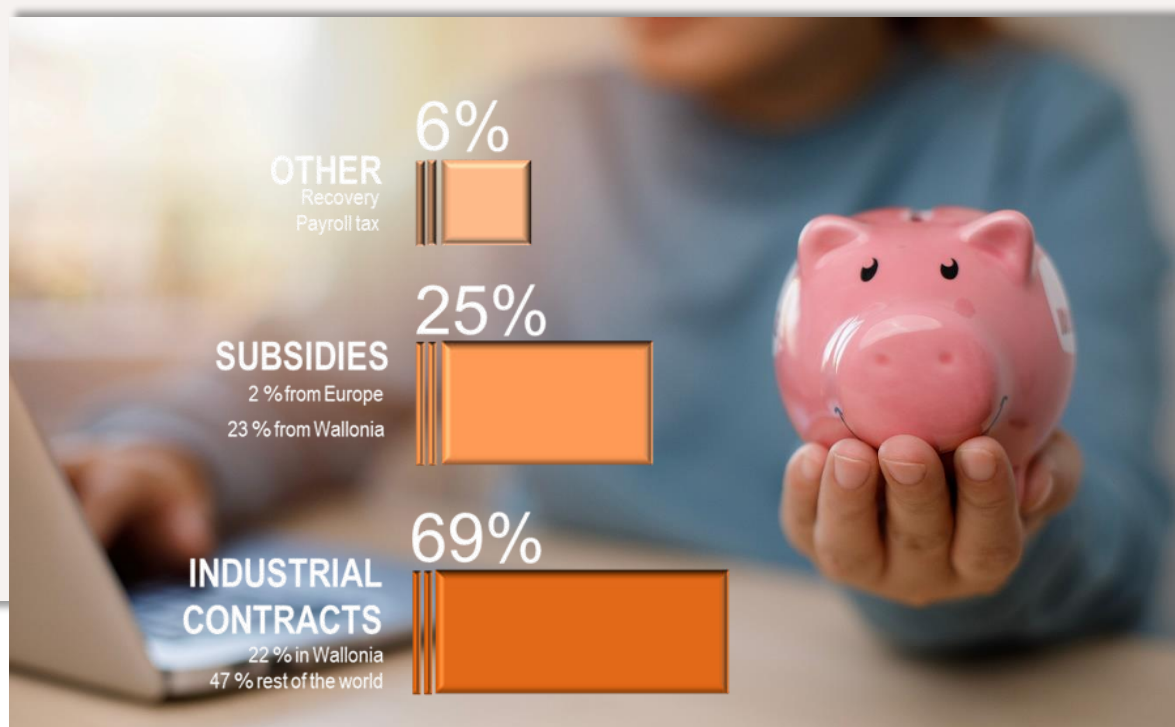


Board of Directors

Annual General Meeting



BALANCE SHEET 2023



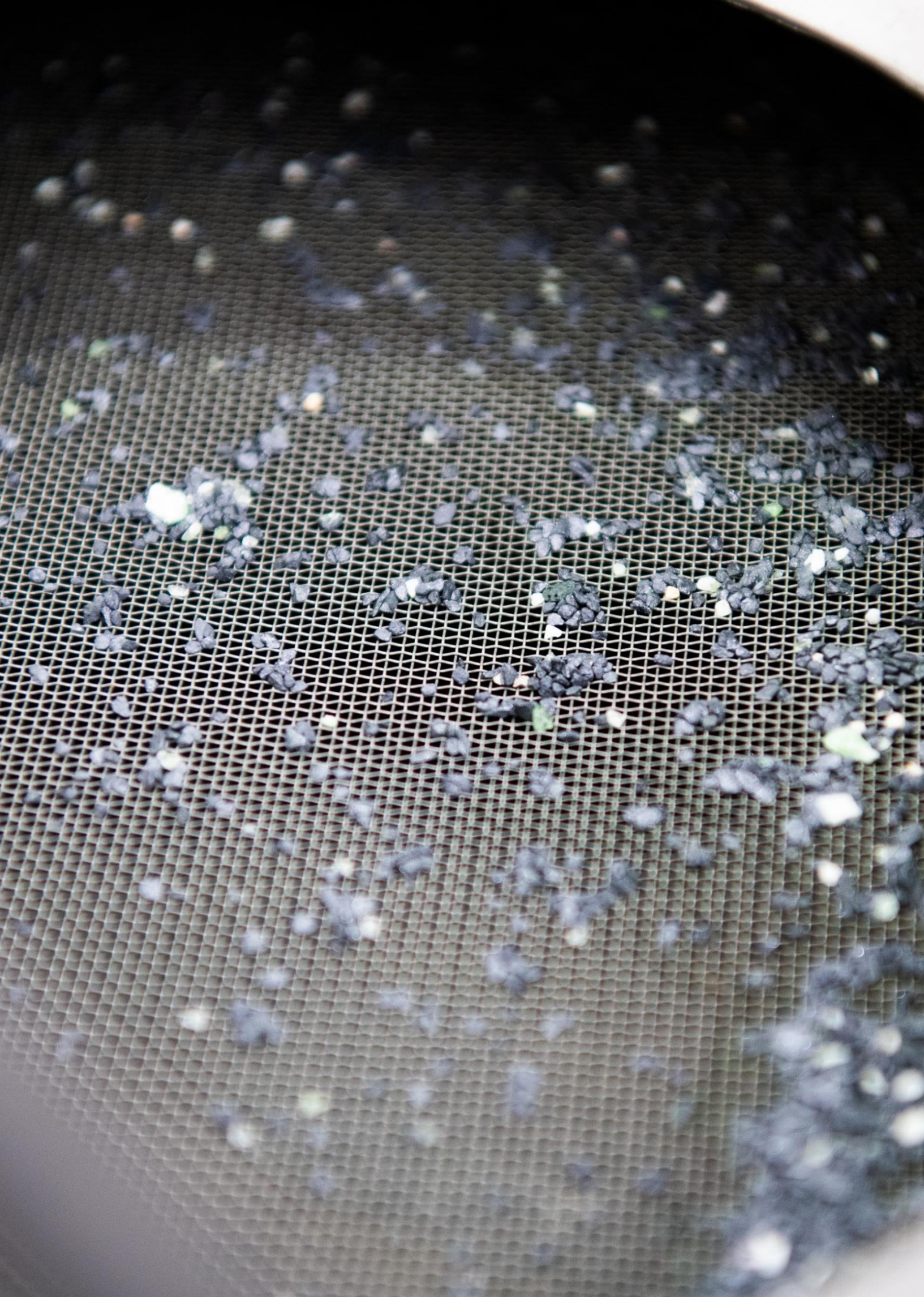
2023 2022



Assets		
Client invoices	3.937	2.860
Operating subsidies	1.417	1.947
Other assets	356	337
TOTAL	5.710	5.144
Liabilities		
Supplies	333	459
Misc. Services and goods	1.708	1.326
Staff	3.048	2.928
Depreciation, provisions and write-downs	192	226
Other liabilities	161	54
TOTAL	5.442	4.993
Cash flow		
	460	373
Investments		
	130	808

Investment subsidies (equipment and buildings)







CTP

CENTRE TERRE & PIERRE ASBL

ACCREDITED RESEARCH CENTRE

Chaussée d'Antoing 55, 7500 Tournai - Belgium

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