ULiège - GREEnMat
Your Partner in Metal Powder

CONTACT INFORMATION

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EXPERTISE OVERVIEW

HEADLINE

Pilot scale synthesis of metal powders + powder characterization + metal powder 3D printing

EXPERTISE

GREEnMat - a chemistry research laboratory - is specialized in the **optimized synthesis, characterization and shaping (by 3D printing) of metal (but also ceramic) powders.**

GREEnMat is the only Belgian university laboratory able **to produce at pilot scale metal powder using gas atomization at very high temperature (2100°C). This technology is suitable to produce large batches of a wide range of metal powders** (gold, silver, zinc, tin, aluminum, alloys, 17-4PH, stainless steels, platinum, …), **including highly reactive powders. The installation is equipped with coupled close atomization and free flow atomization nozzles allowing to produce powders with granulometry ranging from 10 µm to 250 µm.**

Besides its ability to produce batches of powder with a narrow particle size distribution at high yield, the process is perfect to produce pilot batches (10 kg steel by trial) for a wide range of applications. To produce very narrow and controlled particle size batches at GREEnMat, **industrial gas classification** can be performed on the powders. A precise separation of metal powder, even reactive powder (inert gas-Ar), into fine and coarse powder fractions (<25 µm) can be managed using a pilot installation (70 kg steel/h).

The laboratory is also equipped with several **pilot units** for **powder coating and testing** : a pressurized hydro/solvothermal reactor (*5 liters - 200 bars - 500°C*) and two **spray-drying installations** (***one non-aqueous and one ATEX-inert atmosphere;*** *5 liters/hour*).

Using ATEX spray-drying technology, we can granulate and **functionalize the surface of metal powder** with protective polymer coatings to avoid oxidation and reaction with water. The process has already been used with success to protect nano-sized aluminium powders.
With a pilot wet **grinding installation in ATEX** conditions (organic solvent), GREEnMat is able to treat metal powder to **transform spherical powder into flakes** and to modify powder reactivity, color and size for various applications.
GREEnMat has also an extensive expertise in **material characterization** and is equipped for the complete physico-chemical characterization of the materials (XRD, Mössbauer spectroscopy, scanning/transmission electron microscopes, TG/TDA, SEM, TEM, BET, Raman spectroscopy, etc.), even powder flowability and blend homogeneity.

GREEnMat has a specific laboratory dedicated to shaping metal powders by additive manufacturing. Two pilot-scale 3D-printers, **LPBF** (Aconity-Micro) and **binder jetting** (Desktop Metal-P1), are available on site for performing tests with the produced powders. These two printers are equipped with unique multi-material printing heads allowing the deposition of up to 3 different materials and thus design innovative multi-material parts.

With a constant commitment to facilitating the transfer of research results to the industrial world and thereby enabling their commercialization for the benefit of society, GREEnMat has developed an active intellectual property protection policy, notably through patent applications.

Today, the laboratory is currently involved in several national and European **research projects** - with a GREEnMat budget > 5.6 M€ - related to the synthesis and the development of new materials and recycling of spent materials. GREEnMat is currently involved into the "REMADE" research project (Plan de relance Wallon region) dedicated to the recycling of metal scraps into shaped powders for additive manufacturing.

Thanks to its expertise and available infrastructure, GREEnMat is your ideal partner in metal powders manufacturing to support and accelerate your research projects in the field of energy and circular economy.




Potential collaboration subjects:

- Upgrading of Fe and Al-alloys for automotive, aeronautic, medical or military compatible applications.
- Metal waste valorization into primary materials (customized metal powders) for worn parts reparation by laser cladding or plasma spray.
- Hydrogen-based reduction of iron and aluminum oxide using metal scrap. Hydrogen is produced from metal scrap via hydrolysis.
- Production of powder from metal waste for the additive manufacturing of high value parts in automotive and aeronautical industry.

- Conversion of metallic waste streams into energy containers.
  - Recycled Al waste for next generation Al-ion batteries and hydrogen production.
  - Li-ion battery electrodes from recycled metal waste
- Development of carbon-free inert anodes based on Fe-Cu-Ni alloys recovered from recycled automotive parts.
- Reduction of noble material content in dimensionally stable anodes (DSA) used in Cr and Ni electrolytic recovery from metal slag.
- New generation ceramic cermet anodes fabrication by cold-pressing or additive manufacturing
- Increasing the smelting process sustainability by using renewable energy produced from Al metal waste. On-site green fuel (hydrogen) is produced by hydrolysis of Al-waste materials.

Tackled societal problematics: urban mine valorization, integration of recycled materials into high-performance and high-value applications, reduction of primary materials, use of renewable energy in metal processing (on-site hydrogen production), lower carbon footprint of metal-based industries, reduced waste generation through reparation and remanufacturing using recycled materials, lower carbon smelting technologies, reduction of primary materials dependency, Al and steel industry decarbonization

GREEnMat contribution to your research:

- Alloy composition optimization and powder shaping for advanced coating (lase cladding or plasma spray) and processing (additive manufacturing) technologies via pilot-scale gas atomization.
- Ceramic and cermet (Fe-Ni-Cu) powders fabrication via solid-state or spray-drying liquid processes
- Metal powder physico-chemical (density, size, shape, specific surface, composition) and rheological characterization
- 3D printing of demonstrative parts
- Corrosion and mechanical fatigue (compression, flexion, abrasion) tests
- Pilot scale battery electrode fabrication from recycled waste
- Electrochemical testing in half-cell or full cells batteries
- Hydrogen production tests