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ISSUE 1 | MARCH 2025

REPTiS NEWSLETTER

HELLO, WORLD!

Kenan Boz (EPMA), REPTiS coordinator

Dear readers,

If you are reading this, it is probably because you are really interested in the topics of our project; be it mining, processing, powder production, titanium and its alloys, critical raw materials in general, powders for manufacturing, powder metallurgy technologies, and last but not least sustainability: this is what REPTiS is about. This newsletter will keep you updated, roughly every 6 months, about what happens in the project and around it. We strongly suggest that you subscribe on our website so that you will be informed any time a new issue is published so that you will not miss one...stay with us and support us in our journey towards a sustainable titanium powder supply chain in Europe!

And in this issue, we will explain you about the project, the production of titanium powders as it is nowadays and how we imagine it with the new process, with references to more in-depth reading if you are interested.

It is a moment when Critical Raw Materials are really key in the strategic discussions, in the EU and even in the news, especially when talking about the country our project is specifically working with, Ukraine! We hope that our project can help demonstrating the potential of innovation in mitigating the CRM issues: we want to do it for the case of titanium in the EU.

We are available for any further information, so please don't hesitate to contact us if you have any questions.

Co-funded by the European Union

Project: 101177704 HORIZON-CL4-2024-RESILIENCE-01-11

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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SUMMARY

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WHAT IS REPTiS GOING TO DO IN THE NEXT YEARS?

We started working just six months ago, on 1st September 2024, and our project has a foreseen duration of 48 months, so after four years the work will be concluded officially on 31st August 2028. But our goal is to build something that will outlast the project itself!

The plan, indeed, is to set up a new supply chain for a Critical Raw Material, Titanium metal, and more specifically in the form of Ti alloy powders for use in powder metallurgy processes. Once established, this supply chain could represent a significant alternative to obtain titanium feedstock to be used in EU by strategic industries: civil aviation, defence, space, and advanced manufacturing, especially in medical and consumer goods. If you want to read a good overview of the status of titanium in Europe, there is a big work recently published by the European Commission, carried out by the Joint Research Council [1].

We will do it by improving the existing Velta Ti process (see the relevant chapter below) that our Ukrainian partners Velta LLC and Velta RD Titan have already developed and patented.

Why this? There are many good reasons.

First of all, titanium is in the list of Critical and Strategic Raw Materials as defined by the EU. It is practically all imported. A sentence in the already mentioned document may summarise this: "*Against this backdrop, the EU's position in the titanium metal value chain is weak in terms of strategic autonomy, as it lacks domestic reserves of titanium ore and does not have any infrastructure for sponge production. Moreover, the EU's ingot production represents less than 5% of the global capacity. Due to these vulnerabilities, titanium metal was added to the EU's Critical Raw Materials list in 2020 and continues to be listed in the 2023 update (EC – DG GROW, 2023)*".

The war in Ukraine, with the disruption of some supply sources, and the bans on Russian products, have also significantly impacted the availability. But Ukraine already has a track record for import to the EU and has more potential still to be exploited. The EU has a strategic partnership with Ukraine, and our project was funded in a Horizon Europe call, HORIZON-CL4-2024-RESILIENCE-01-11, that had the main goal of boosting the cooperation with this strategic partner on Critical Raw Materials (another possibility in the call was to address Canadian raw materials sources).

The Velta titanium case was perfect for that. Our partner has a sound, zero-waste process to transform ilmenite ore into titanium (and other Fe-based by-products, and other chemicals), that will be taken to the industrial level with the objective of making it a viable alternative to the usual process for titanium and titanium alloy powders. We are addressing these topics in this issue of the REPTiS newsletter, in the section "A deeper look into...". There, you will find some more detail on the present processes, including the newly developed Velta process.

In a nutshell, this Velta process bypasses the usual smelting and atomisation processes, that are energy intensive and lengthy, with a purely chemical route, whose output is an irregular fine powder, that can be made of pure Ti or already alloyed with the relevant elements like Al, V, and any other. As produced, these powders could be used in powder metallurgical routes like metal injection moulding (MIM), possibly additive manufacturing (binder jetting or similar) and press&sinter; after a spheroidization postprocessing, they could be more suitable for laser powder bed fusion additive manufacturing as well. Everything starts from the Ilmenite (a naturally occurring iron-titanium oxide, typically approximated by the stoichiometric formula $FeTiO_3$) deposits in Ukraine, in open pit mines that Velta can still successfully run, being outside the more impacted areas of the Ukrainian territories.

The extraction and processing of the Ilmenite will be further optimised in order to achieve an even better sustainability performance, as this is not only a natural request for any activity to contribute to decarbonisation and preservation of our planet, but as it is a specific requirement of the call. To do this, our Velta partners are supported by specialists in the field from the Montanuniversität Leoben - MUL (Austria) and Tecnalia (Spain).

Then Velta will do the magic and produce the titanium alloy powders, in quantities that will increase during the project, setting up a pilot plant that will be able to achieve TRL 7, with the plan of establishing a later production site in Czech Republic.

We have then partners that have an established knowledge on metal powders, and titanium alloys made by PM, like the already mentioned Tecnalia and MUL, and the Helmholtz Centre Hereon and the Fraunhofer Institute for applied Materials – IFAM, both German. These partners will carry on the full characterisation of the powders produced, in terms of their physical characteristics, using acknowledged standards.

To prove that the powders are a viable feedstock for powder metallurgy, we will then transfer the powders to our industrial partners, that will produce some parts that are representative of some of the important markets for PM titanium. Starting from the MIM applications, we will have Element 22 (Germany) and MIMTech Alfa (Spain), that will use the powders, with the assistance of the research centres, to produce medical and consumer goods components. We then have 2 partners for additive manufacturing: IAMG (Poland) and University West (Sweden), that will use the (presumably) spheroidised powders to fabricate parts for medical and for aerospace (also interesting for our associated partner GKN Aerospace). The parts will again be fully characterised by the industrial partners and RTDs, and their properties will be the proof for qualifying the powders as valid alternatives to atomised titanium powders.

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All this will be accomplished while tracking all the processes in terms of inputs and outputs, in order to do a full Life Cycle Assessment. Our partner IRES (Belgium) is specialised on this and will also take care of the assessment of the full spectrum of sustainability, that includes health and safety, for instance. GKN Aerospace will also support this task.

EPMA, the European Powder Metallurgy Association, is coordinating the project and also playing the role of Dissemination and Communication manager (e.g., responsible for the production of this newsletter, among other things).
To do this, we have a total grant of just above 7 M€, that will be used over the 48 months of the project.

The result will be a sound ecosystem for titanium powders, that will represent a reliable source of high-quality feedstock for the EU powder metallurgy industry and ultimately for the mentioned strategic industrial sectors.

Follow us on our website and social media, and subscribe to our newsletter in order to be always updated!

Mining of Minerals for CRM	Titanium & By-products Processing Technologies Developpement	Characterization & Validation
VELTA	VELTA RD TITAN MONTAN UNIVERSITÄT	Fraunhofer IFAM tecnal:a hereon
Re-Use & Functionality Assessment	**Sustainable Product Evaluation**	**Dissemination, Communication & Project Management**
ALFA MIM tech UNIVERSITY WEST ELEMENT 22 IAMG	IRES GKN AEROSPACE	EPMA

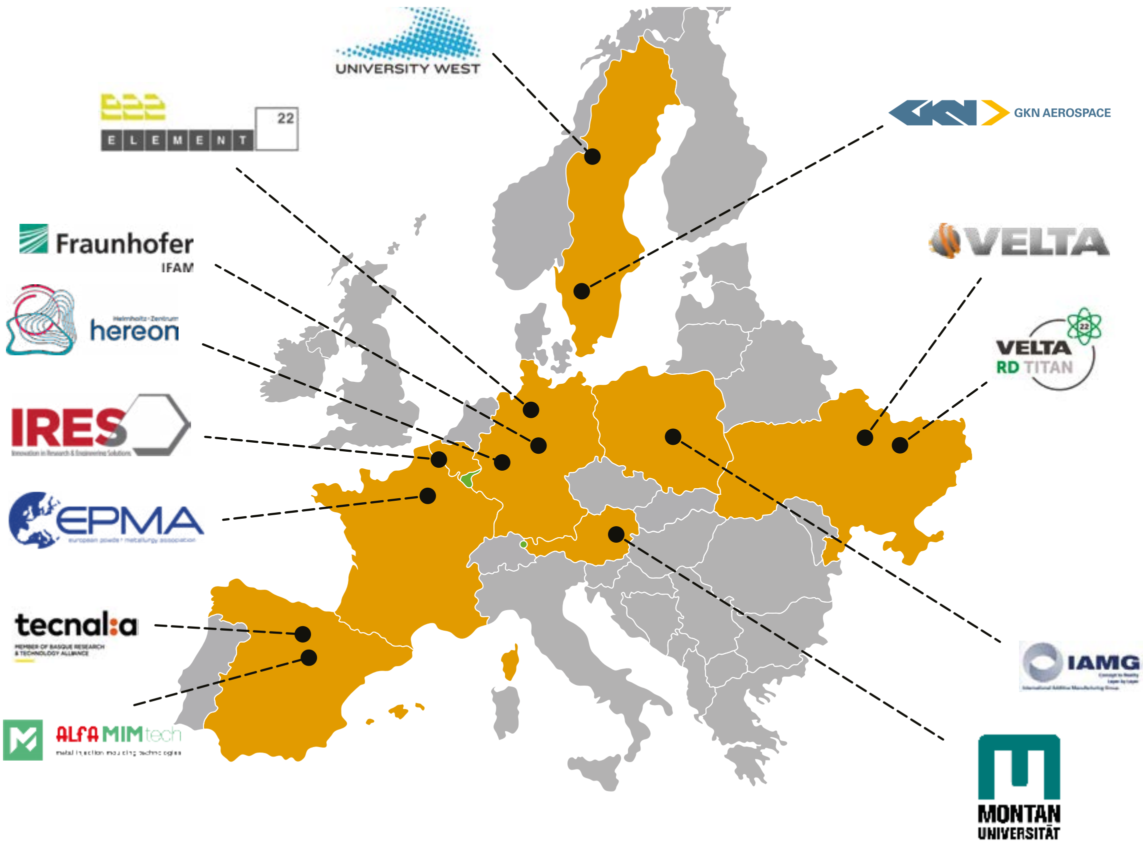

Figure 1 Overview of the REPTiS consortium, both in terms of geographical distribution and of roles.

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Review of deliverables submitted

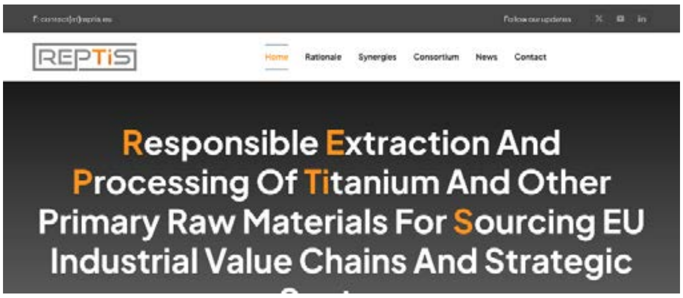
These are the deliverables submitted (for those unfamiliar with the Horizon Europe and in general with EU-funded projects, these are reports that must be sent to the funding agency; they can be public or confidential) in the first months of REPTiS. Here is a short summary of their content. Some of them are public so they will be available when approved.

D1.1 SAMPLING PROTOCOL OF ILMENITE ORE

To guarantee accurate analysis of Critical Raw Materials within ilmenite-bearing sands, we have developed a comprehensive sampling protocol. This plan provides detailed instructions for collecting representative samples, which will be crucial for our ongoing research into residual Critical Raw Materials present in ilmenite ores. This work is foundational for producing a reliable and thorough report on these valuable resources.

D9.1 CREATION OF THE PROJECT WEBSITE, GRAPHICAL IDENTITY AND OTHER ONLINE TOOLS

To ensure effective communication, we have established as soon as possible a strong visual identity and developed key digital tools, including a website (www.REPTiS.eu) and social media (LinkedIn, X, YouTube) presence, to reach and engage our stakeholders. That is, you!



D12.1 PROJECT MANAGEMENT HANDBOOK DEFINING ADMINISTRATIVE AND FINANCIAL OPERATIONS

This document serves as a comprehensive project management plan, providing a clear roadmap for the project's execution, communication, and monitoring. It covers the following key aspects: Project Foundation (overview, objectives, key performance indicators), Organizational Structure (coordinator, General Assembly, Advisory Board, Data Management Committee), Communication and Data Sharing (methods and tools, email communications, meetings), Work Plan and Timeline (work packages and tasks, Gantt chart), Deliverables and Milestones (including the internal process for reviewing and approving), Risk Management (critical risks).

D1.2 LIST OF SPECIFICATIONS/STANDARDS FOR TITANIUM POWDER ASSESSMENT

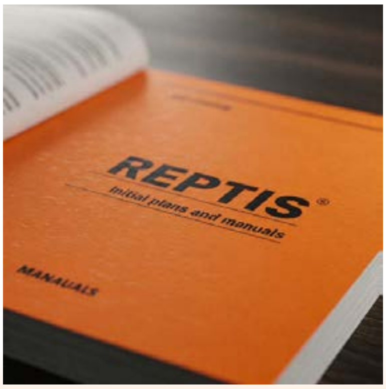
This recent report compiles the essential ASTM and ISO standards that will be used for evaluating the composition and processing capabilities of REPTiS powders, allowing us to benchmark these powders against current industry offerings. The deliverable outlines the assessment methods and specific properties required for the demonstrator case study components, too. These defined requirements will serve as the primary benchmarks for evaluations conducted in our ongoing work packages, ensuring a rigorous and standardized approach to our research.

D9.2 DISSEMINATION & COMMUNICATION PLAN

With this initial Dissemination and Communication Plan, we have formalised the framework for our ongoing outreach efforts, ensuring that our communication activities are well-coordinated and aligned with all aspects of the project. This plan outlines our procedures for publications, performance monitoring, and other relevant communication activities. To maintain its effectiveness, it will be reviewed and refined at key points throughout the project.

D12.2 QUALITY ASSURANCE PLAN OF THE PROJECT

This document outlines the REPTiS commitment to quality through its defined management system. It details the core principles, objectives, and strategies employed to ensure high standards throughout the project, via the "3P Quality Evaluation and Monitoring Model," a framework designed to assess and track project performance. It addresses the project's monitoring processes, emphasizing the importance of effective cooperation, communication, and the use of performance indicators to gauge progress and ensure successful project delivery.



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D12.3 RISK MANAGEMENT PLAN OF THE PROJECT

The core of the document focuses on risk management, detailing the processes for identifying, assessing, and planning responses to potential risks. We are working with partners in Ukraine, so as you can imagine, this is particularly important. Continuous monitoring and control are highlighted as essential for maintaining project stability, and a structured reporting system ensures that all stakeholders are kept informed. An annex provides a detailed risk register for the project.

D12.4 PROJECT DATA MANAGEMENT PLAN

The initial Data Management Plan (DMP) is a crucial tool for ensuring data integrity and accessibility. This plan establishes guidelines for data collection, generation, and sharing, adhering to the FAIR principles. It's a dynamic document, set to evolve alongside the project. A dedicated Data Management Committee will oversee the DMP, ensuring its guidelines are followed and regularly updated. Partners are responsible for reporting any data-related changes. This proactive approach maintains the plan's relevance and accuracy, fostering transparency and collaboration. Thus, project's data will be reliable and reusable.

We are available, if possible, to give you more information (on the non-confidential parts, of course!)!

Internal meetings

KICK-OFF MEETING OF REPTIS - CHANTILLY (FRANCE)

On 13th September 2024, the consortium met for the first time in Chantilly, France, hosted by the coordinator EPMA.

Figure 2 A French dinner was a good way to build the REPTiS team!

Figure 3 The Consortium reviewing the project activities at the Kickoff meeting in Chantilly, in September 2024.

Figure 4 The partners present at the REPTiS kickoff meeting in Chantilly (France).

After a good start at the table of a French restaurant the night before, the partners convened in an equipped meeting room that allowed the meeting to be held hybrid, with some consortium members connected remotely. Also, our project officer from the funding agency HaDEA had the chance to address the group, explaining the basics of the required formalities to fulfil the obligations of the grant agreement.

All activities, with more emphasis on those starting right away, were duly discussed, and a few decisions were taken on the most urgent aspects.

The sunny green area of the Centre Guilleminot was the best background for the first group picture.

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SECOND GENERAL MEETING OF REPTIS - PRAGUE (CZECH REPUBLIC)

The second general project meeting took place on 11-12 March 2025 in Prague, Czech Republic. The host of this general assembly was Velta: being not feasible to host us in Ukraine, the partner involved its Czech subsidiary in the capital, and a suitable meeting room was found at the WorkLounge Diamant, in downtown Prague.

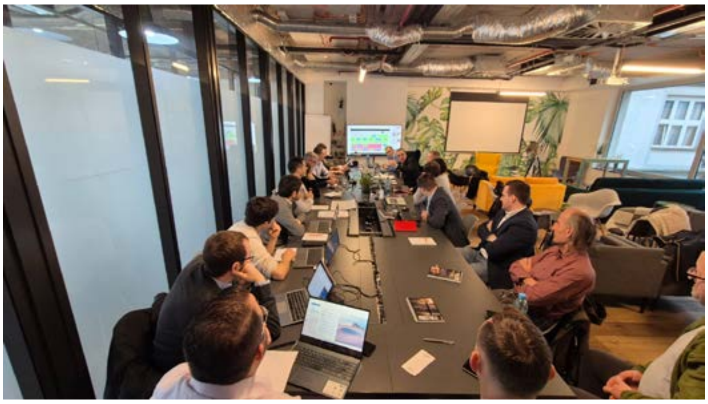

Figure 5 Prague: the consortium during the discussion on the work programme

On the days, a review of the whole project activities was made. Clearly focusing on the initial work in the mining and processing work packages, there was also time to review the risk assessment, that is particularly critical in a project involving Ukrainian partners for reasons that we believe do not need explanations.

On the night of the 11th, a nice consortium dinner was held in the Garden's restaurant.

Figure 6 The REPTiS consortium group picture, with Wenceslas Square in the background

The next transnational meeting is at the moment planned to happen around end September, or October, in Dresden, with the support of Fraunhofer IFAM.

A DEEPER LOOK INTO...

In this section consortium partners will give you regularly some technical info that you can use as a start to dive deeper into some important topics related to the REPTiS project.

The first contribution is an introduction to Titanium alloys and their manufacturing, with some insights on the present methods to obtain powders, and was prepared by our PM RTD partners Tecnalia, Hereon and Fraunhofer.

The second contribution comes from our key partner VELTA and goes in more details, explaining the differences between their process for Ti alloy powders, that is the base upon which REPTiS is built, and the Kroll + EIGA process.

Deeper Look 01 - Titanium Powder: The Key to Sustainable Production of High-Performance Titanium Alloys

IMPORTANCE OF TITANIUM ALLOYS.

Titanium alloys have emerged as a crucial material in modern industry, particularly in the aerospace and biomedical sectors, where high-performance and reliability are essential. Their exceptional mechanical properties, including high strength-to-weight ratio, corrosion resistance, and biocompatibility, make them an ideal choice for a wide range of applications. In aerospace, titanium alloys are used in aircraft and spacecraft components due to their ability to withstand high temperatures and stresses. In the biomedical field, they are employed in implants, surgical instruments, and medical devices, thanks to their excellent biocompatibility and resistance to corrosion in bodily fluids. Moreover, the increasing demand for high-performance materials in the consumer goods sector has led to the use of titanium alloys in sports equipment, luxury watches, and other premium products, where their unique combination of properties offers a distinct competitive advantage.

MANUFACTURING OF TITANIUM ALLOYS

Conventional titanium alloy production has traditionally relied on routes based on melting and casting, which involve complex, multi-stage processes. However, titanium's highly reactive nature and difficulty in being processed through conventional hot-working techniques, such as forging and rolling, make these methods challenging. In contrast, powder metallurgy (PM) offers significant advantages,

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including precise control over composition and microstructure. PM processes, such as Additive Manufacturing (AM) and Metal Injection Molding (MIM), are gaining traction as promising alternatives for producing titanium parts. For instance, AM has been successfully employed in the aerospace industry to produce complex titanium components, such as engine components and satellite parts, with reduced material waste. Similarly, MIM has been used in the medical sector to fabricate intricate titanium implants, such as hip replacements and spinal implants, with improved precision and surface finish. Conventional powder metallurgy (PM) processes have also been widely used to produce porous titanium components. One common approach is the use of space holders, such as sodium chloride or wax, that are mixed with titanium powder and then removed during the sintering process, leaving behind a porous structure.

FABRICATION OF TITANIUM POWDERS BY CONVENTIONAL ROUTES AND OPPORTUNITIES FOR IMPROVEMENT

Despite the advantages of powder metallurgy, one of the major limitations of this approach is the production of high-quality titanium powder itself. The cost of titanium powder can be prohibitively high, which significantly increases the overall production cost of PM components.

To produce high-quality spherical titanium powder, used in applications such as additive manufacturing and metal injection molding (MIM), the production process involves several stages. The first step is to reduce the mineral to titanium sponge, for which two main processes have been developed: the Kroll and the Hunter processes. The Kroll process involves the reduction of titanium tetrachloride ($TiCl_4$) with magnesium (Mg) to produce titanium sponge, while the Hunter process uses sodium (Na) to reduce $TiCl_4$ to titanium sponge. The next step is to atomize the material using the Electrode Induction Melting Gas Atomization (EIGA) process. In this process, the titanium sponge is melted and then atomized using high-pressure gas, such as argon, to produce spherical powder particles. The EIGA process allows for precise control over the powder particle size and shape, resulting in high-quality spherical titanium powder suitable for use in demanding applications.

Figure 7 Conventional routes for the fabrication of titanium spherical powders

The process is highly energy-intensive, requiring large amounts of electricity to power the smelting, melting, and atomization steps. This results in a substantial carbon footprint and contributes to greenhouse gas emissions, making it a significant environmental concern. Additionally, the production of titanium sponge generates large amounts of waste, including chlorides and other chemicals, which must be neutralized and disposed of in landfills. This not only poses an environmental risk but also incurs significant costs for waste management and disposal. Furthermore, the atomization process involves melting and pulverizing the titanium metal, which is a complex and inefficient step that can result in significant losses of valuable material. The yields of usable powder can be as low as 50%, with the remaining material being sent back for re-melting or discarded as scrap.

There are several processes under development to substitute the Kroll process for producing titanium sponge, as well as alternative methods to produce spherical powders from the sponge, but none of them have yet reached the popularity of the conventional combination described above.

For the production of irregular titanium powders, the most relevant technique is the Hydride-Dehydride (HDH) Process. HDH involves hydrogenation of titanium sponge to form brittle hydrides, which are then milled and dehydrogenated to produce titanium powder. This method is cost-effective but results in powders with limited flowability and tap density.

Please, find additional information about conventional and non-conventional processes in the references of this article (references [2] to [7]), and in the Deeper Look 02 below.

SUMMARY

The development of more sustainable and cost-effective titanium powder production methods is essential to reduce the environmental impact and increase the competitiveness of PM titanium components. The REPTIS project proposes one promising alternative based on the Velta Ti process that will be explained in this newsletter.

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Deeper Look 02 - A Revolution in Titanium Powder Production: Velta Ti Process vs conventional Kroll+EIGA

INTRODUCTION

Titanium is a vital metal for numerous industries, including aerospace, medical implants, and advanced manufacturing, due to its exceptional properties. The combination of the Kroll process and Electrode Induction Melting Gas Atomization (EIGA) has been widely used and remains a leading technology for producing high-quality spherical titanium powders, especially for additive manufacturing and aerospace applications [8] . However, the innovative Velta Ti Process offers a sustainable, cost-effective, and environmentally friendly alternative that significantly improves on the limitations of the traditional approach.

UNDERSTANDING THE KROLL+EIGA PROCESS

The Kroll+EIGA process begins with the production of titanium sponge from ilmenite concentrate. This multi-step method involves high-temperature chlorination to produce titanium tetrachloride ($TiCl_4$), followed by reduction with molten magnesium to form titanium sponge. The sponge is then repeatedly melted and alloyed in vacuum arc remelting (VAR) furnaces to ensure homogeneity. The final step involves EIGA, where electrodes made from titanium alloys are melted and atomized into spherical powders under inert gas.

While reliable, this process has several drawbacks:

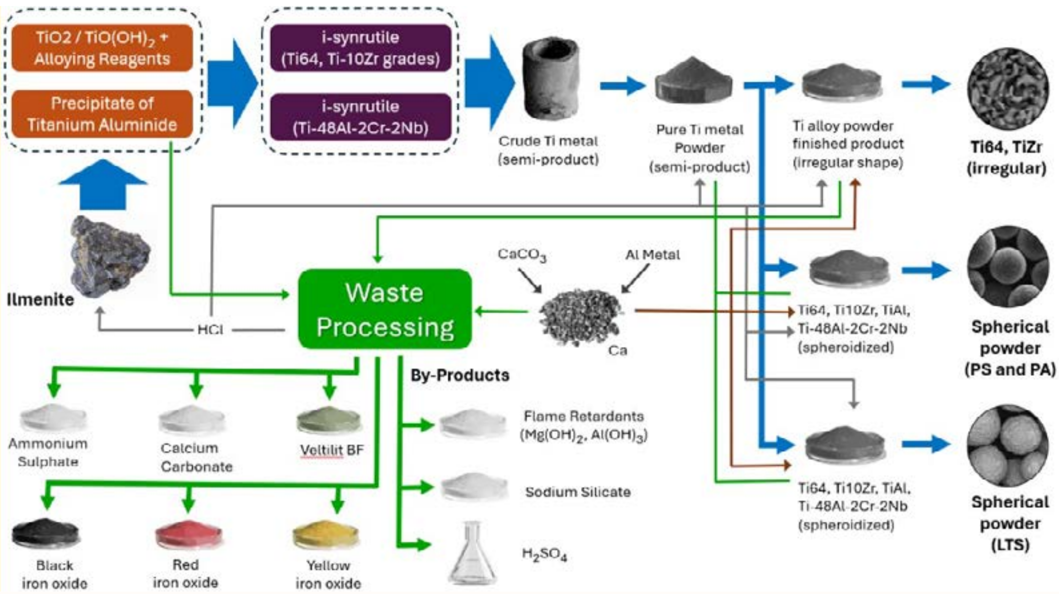
- Energy-Intensive: The production of titanium sponge and subsequent EIGA atomization require significant energy inputs, with specific energy consumption(SEC) reaching 101–110 MWh/ton for spherical powders like Ti64 alloys.
- Carbon Footprint: Despite advancements, the carbon emissions for titanium alloy powders remain high, especially when using standard energy sources. For example, the carbon footprint of Ti CP and Ti64 powders ranges from 44 to 84 tons of CO_2per ton, depending on the electricity type [9].
- Byproduct Challenges: Large amounts of byproducts, such as chlorides and other chemical waste, add to environmental concerns.

THE VELTA TI PROCESS: AN INNOVATIVE ALTERNATIVE

The Velta Ti Process disrupts the status quo by offering an entirely different pathway to titanium powder production. Starting with ilmenite concentrate, the process integrates hydrometallurgical and metallothermic techniques to produce titanium powders directly, bypassing the sponge production step entirely. Additionally, it incorporates spheroidization methods like Plasma Spheroidization (PS), Plasma Atomization (PA), Gas Atomization (GA) and innovative Low-Temperature Spheroidization (LTS) [10], as well as near-spherical powders technology (NSPT) [11] .

Key advantages include:

- Reduced Energy Consumption: Compared to Kroll+EIGA, the Velta Ti Process lowers specific energy consumption by up to 63% for irregular / near-spherical powders and 33–63% for spherical powders, depending on the alloy and spheroidization technique.
- Significant Carbon Footprint reduction: The carbon footprint reductions are dramatic. For instance, using electricity with medium carbon footprint, the process achieves up to 80-83% lower emissions for irregular / near-spherical Ti64 powders and for spherical powders using the LTS technique. With electricity with low carbon footprint, the process can even achieve net-negative carbon emissions.
- Zero-Waste Philosophy: Velta's process eliminates solid and liquid waste by transforming byproducts into valuable outputs, such as calcium carbonate, iron oxide pigments, ammonium sulphate, magnesium hydroxide, aluminium hydroxide, sodium silicate etc.



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DEVELOPMENT AND EUROPEAN RELEVANCE

The Velta Ti Process was developed by a team of Ukrainian scientists and chemical engineers from Velta RD Titan over seven years of intensive research, backed by a $7+ million investment into scientific innovation. Its development aligns with the European Union's strategic objectives for reducing carbon emissions, minimizing waste, and enhancing resource efficiency. Given Europe's critical dependence on titanium for strategic industries, adopting this process supports the EU's goals for industrial resilience and sustainability.

TECHNOLOGICAL AND ECONOMIC BENEFITS

1. Sustainability: The Velta Ti Process aligns with global green initiatives by drastically reducing environmental impacts. For example, its near-zero liquid discharge (Near-ZLD) / zero liquid discharge (ZLD) [12] system ensures all liquid waste is recycled or repurposed.

2. Cost Efficiency: The elimination of intermediate steps, such as sponge production, reduces the overall production cost of titanium powders. Combined with waste valorisation, this makes the process economically attractive.

3. Enhanced Powder Quality: The process provides better control over particle size distribution and alloying element homogeneity, ensuring superior properties for advanced applications like additive manufacturing.

COMPARING OUTPUTS*

Feature	Kroll+EIGA Process	Velta Ti Process
Energy Use (MWh/ton)	101–110	39–72**
Carbon Footprint ($t\ CO_2$/ton)***	44–48	8-21****
Waste Management	Chloride byproducts, significant waste	Zero waste, valuable byproducts
Powder Quality	Spherical, wide PSD*****	Irregular / near-spherical or spherical, PSD is controlled depending on the needs.

* Calculated for Grades 1-4, Grades 5, 23.
** Depending on the spheroidization method, irregular/near-spherical powders, as well as spherical powders obtained by the LTS method, have values between 39 and 41 MWh/ton.
*** Assumes electricity with medium carbon footprint.
**** Depending on the spheroidization method, irregular/near-spherical powders, as well as spherical powders obtained by the LTS method, have values between 8 and 9 t CO_2/ton.
***** PSD – Particle Size Distribution.

PIONEERING INNOVATION

The development of the Velta Ti Process highlights Ukraine's contribution to global technological advancement. With two U.S. patents granted and a third pending, this innovation demonstrates the power of research and development in addressing critical industrial challenges. By enabling nearly carbon-neutral titanium powder production, it offers a timely solution for combating climate change and advancing sustainable manufacturing.

CONCLUSION

The Velta Ti Process is more than just an alternative; it is a breakthrough in titanium powder production. By addressing the energy, environmental, and economic shortcomings of the traditional Kroll+EIGA method, Velta Ti sets a new benchmark for sustainability and efficiency. With its potential to revolutionize industries reliant on high-performance titanium powders, this innovative process underscores the importance of integrating advanced technology with environmental responsibility.

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REPTIS CONSORTIUM SHOWCASE

In every newsletter, we will present you some of the partners. We start this time with EPMA, the Coordinator!

European Powder Metallurgy Association AISBL - EPMA (www.epma.com)

Figure 8 The European Powder Metallurgy Congress & Exhibition organised by EPMA

The European Powder Metallurgy Association (EPMA), founded in Brussels in 1989, is a non-profit organization representing the global powder metallurgy (PM) industry. It encompasses all aspects of PM, from metal powder production to the creation of finished parts through various processes like press & sinter, isostatic pressing, metal injection moulding, metal additive manufacturing, and FAST sintering.

EPMA's mission is to champion and advance the European PM community by connecting industry and research. Its approximately 250 members (as of 2024) span the entire PM supply chain, including powder producers, feedstock suppliers, part manufacturers, end-users, equipment producers, service providers, consultants, and research institutions. The EPMA actively supports its members through various initiatives, including its Sectoral and Working Groups (such as the EuroMIM group for Metal Injection Moulding and EuroAM for Additive Manufacturing). Key activities include:

- Organizing the annual European PM Congress & Exhibition (EuroPM series), which becomes the global WorldPM event every six years (the next will be in 2028).
- Hosting numerous PM technical seminars and workshops throughout Europe.
- Collecting and analysing European PM market data and trends.
- Providing training opportunities, such as the EPMA Summer School and Young Engineers scheme.
- Monitoring EU regulations impacting the PM sector (e.g., REACH).
- Participating in EU-funded R&D projects: e.g., Horizon Europe's REPTiS, and Erasmus+ projects.
- Coordinating collaborative member projects ("Club Projects") to foster European R&D.
- Running competitions (e.g., PM Master's and PhD Thesis Competitions) and awarding achievements (e.g., Distinguished Service Award, Fellowship Award).

In the REPTiS project, EPMA serves as coordinator, overseeing both the proposal and implementation phases. Leveraging its extensive network, EPMA also acts as Dissemination and Communication Manager, utilizing its connections within EuroMIM, EuroAM, and other groups to disseminate project information, encourage international collaboration, and ensure project success.

DISSEMINATION AND COMMUNICATION

EURO PM2024 CONGRESS & EXHIBITION | EPMA european powder metallurgy association | 29 Sep - 2 Oct 2024 MALMÖ

EURO PM2024

In the yearly congress for Powder Metallurgy organised by EPMA, the Euro PM2024 in Malmö, Sweden (29 September – 2 October 2024), REPTiS was present with a booth and a speech in a session. The participation was organised in record time, as the exhibition started yet in the first month of activity of the project, so all materials had to be conceived, finalised, produced and shipped very quickly in order to meet the deadline. On the other hand, for a project focused on powder metallurgy like REPTiS, taking part in the biggest European conference on powder metallurgy, putting together all possible application sectors of the Titanium powders to be developed in the project, from MIM to AM, Press&Sinter, HIP, and so on, was a clear priority.

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The booth was close to other projects (the common partner being EPMA), START and RESQTOOL. It showcased informative posters and a roller banner, an introductive rolling video and some samples from the Velta Ti Process, that could be used to illustrate the foreseen activities and results.

On Tuesday 1st October, groups of young engineers and students from the EPMA's Young Engineers programme visited the REPTiS both, and A. Yarovinsky of Velta gave them a short summary of the project approach and expected results and impact.

Figure 9 The REPTiS booth attracted visits, including the Young Engineers that toured the exhibition.

On the same day, in the Special Interest Seminar "Advances in MIM Materials and Processes", V. Kruzhanov (PM Consulting) introduced the project and the Velta Ti process in the talk "Advanced VELTA Titanium Powder and its MIM Application" stimulating questions from the audience.

REPTiS will definitely exhibit in all next editions of EuroPM, so preparation is already underway for Euro PM2025 in Glasgow (UK), 14-17 September 2025. We have big plans for that event, that we will soon advertise on our media.

Raw Materials Week 2024

Brussels recently hosted the annual Raw Materials Week, a key event organized by the European Commission's DG Grow. This long-standing gathering, held this past December at the La Plaza Hotel and explicitly dedicated to the themes connected to the recently introduced Critical Raw Materials Act [13], has become a pivotal forum for discussions surrounding raw materials in Europe. This year, from December 9th to 13th, REPTiS partners seized the opportunity to connect with a wide array of stakeholders and share insights into our project's progress.

A highlight for REPTiS was our participation in a special side event hosted by the START project [14] at the nearby Marivaux Hotel. This session, titled "Supporting the Critical Raw Materials Act: Research Projects in the European Union", brought together eight EU research projects to discuss their contributions to the Act's goals. This type of clustering event is a hallmark of Raw Materials Week, facilitating collaboration and knowledge exchange. Our consortium member, Artem Yarovinsky from Velta Mining, presented REPTiS's innovative approach in a talk titled "REPTiS: sustainable Ti alloy powder supply chain from Ukraine to meet the EU demand for CRMs".

Artem also contributed to a lively and engaging round table discussion, which extended well beyond its scheduled time due to the participants' interest. It was a productive session, demonstrating the high level of interest in critical raw materials. We extend our sincere gratitude to the START project for their kind invitation and for organizing such a valuable event.

REPTiS Clustering efforts

Since the start, REPTiS immediately began to look for synergies with similar projects and initiatives. It is somehow in the DNA of the project, as the call for proposals where REPTiS was funded stated explicitly that "T*he actions in this call should also be pursued with a view on developments in the call "HORIZON-CL4-2023/2024-RESILIENCE-01-02: Innovative technologies for sustainable and decarbonised extraction" in terms of industrial viability, safety and environmental impacts*". The call RESILIENCE-01-02 was funded in 2023 and activated 5 projects, whose goal was to reach a TRL (Technology Readiness Level) of 3 to 5, whereas in our call the requirement is to reach TRL 6-7. Thus, this other call is more at a basic research level, and the idea is that their work could stimulate more industrialised processes in the 2 projects funded in our call.

We immediately started contacting these projects and had meetings with most of them. Compared to usual clustering efforts, that may be limited to joint Dissemination and Communication, the need here is to establish links between the relevant technical partners, so that they can exchange information and make progresses. Table 1 lists the projects that we are going to work with: we have added the links to the relevant page on the CORDIS website, where you can find Information about them, and their proper websites. You are all invited to check them out!

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TITLE	ACRONYM	PROJECT ID	LINKS	COORDINATOR
Decarbonized Titanium Recovery from Aluminium and Titanium Production Residues	EURO-TITAN	101135077	https://cordis.europa.eu/project/id/101135077 https://www.euro-titan.eu/	TECHNISCHE UNIVERSITAT CLAUSTHAL
Sustainable, decarbonised vanadium, titanium and iron extraction from Europe's low-grade vanadium-bearing titanomagnetite deposits	AVANTIS	101137552	https://cordis.europa.eu/project/id/101137552 https://avantis-horizon.eu/	KATHOLIEKE UNIVERSITEIT LEUVEN
Ecosystem for the Innovative Resource Recovery and Complex Ore Extraction	XTRACT	101138432	https://cordis.europa.eu/project/id/101138432 https://xtract-project.eu/	TECHNISCHE UNIVERSITAET BERGAKADEMIE FREIBERG
Unlocking the supply of rare earth elements in Europe through responsible, sustainable and decarbonised innovative technologies	REESOURCE	101138460	https://cordis.europa.eu/project/id/101138460 https://www.reesource.eu/	INSTITUTT FOR ENERGITEKNIKK
Autonomous Exploration and Extraction of Deep Mineral Deposits	PERSEPHONE	101138451	https://cordis.europa.eu/project/id/101138451 https://www.persephone-mining.eu/	LULEA TEKNISKA UNIVERSITET

Table 1 The projects funded in the call "HORIZON-CL4-2023/2024-RESILIENCE-01-02", that REPTiS has contacted for technical clustering.

As mentioned, another project was funded in our call, but started later, only in December 2024: it is the project BLOOM, as listed in Table 2.

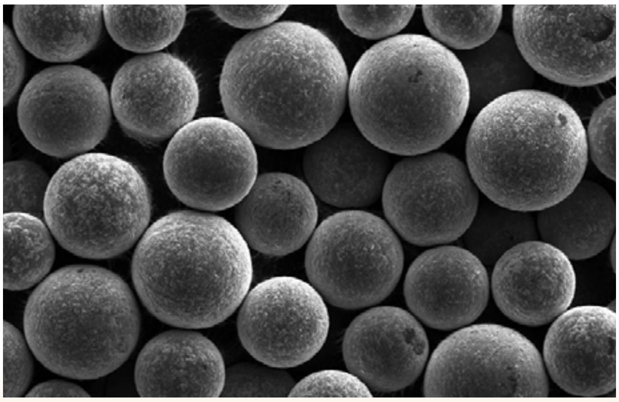
TITLE	ACRONYM	PROJECT ID	LINKS	COORDINATOR
Liberation analysis for optimizing extraction and processing of CRMS	BLOOM	101177962	https://cordis.europa.eu/project/id/101177962 (project website not yet available)	UNIVERSITAT POLITECNICA DE CATALUNYA

Table 2 The REPTiS "brother" project BLOOM, funded in the same call HORIZON-CL4-2023/2024-RESILIENCE-01-11 in 2024.

With BLOOM, we already met and agreed that, having the same approach to clustering and in particular the same "contractual" requirement, our clustering efforts will be coordinated as much as possible. This is in compliance of the spirit of using clustering to achieve synergies and, ultimately, efficiency.
With one project, REESOURCE, we already shared the participation in another clustering event organised at the Raw Materials Week 2024, as explained above. But there will be events organised by us, BLOOM and the other project, and, most importantly, we want to work together in the next years!

UPCOMING EVENTS

REPTiS is also preparing other participations in events in the next months. We hope you will be able to catch up with us there!
Keep in touch with our website and social media to know more!



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Entering the REPTiS Community is easy and safe!
You can find us on our website **www.reptis.eu**
There you can subscribe to this newsletter and all important news by filling the form that is proposed to you when you click "SUBSCRIBE" in the "Contacts" page. You will be inserted in our mailing list, that we will treat confidentially and from which you can opt out any time.

We are also active on the following social media:

LinkedIn:	**https://www.linkedin.com/company/reptis/**
X (you know, Twitter):	**https://x.com/REPTiS_Project**
YouTube:	**https://www.youtube.com/@REPTiS_HE**

If you look for our Open Access documents, check Zenodo! There REPTiS has a community that can be reached at this link https://zenodo.org/communities/reptis, where all our Open Access material will be available for decades to come!

If you need to get in touch personally, you can also address your E-Mails to our coordinator Kenan Boz, kboz@epma.com

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[8] Apart from Kroll + EIGA, there are other combinations involving titanium obtained through the Kroll process for the production of spherical powders. Below are some of the most common ones:

- Kroll + PREP (Plasma Rotating Electrode Process) – The plasma rotating electrode process allows for the production of high-quality spherical powders, particularly for additive manufacturing, but it is more energy-intensive.
- Kroll + Plasma Atomization (PA) – This process uses plasma atomization, enabling the production of powders with a narrow particle size distribution and minimal impurities.
- Kroll + Gas Atomization (GA) – Gas atomization is also used to produce powders with a narrow particle size distribution, although the sphericity quality may be lower compared to plasma-based methods.
- Kroll + VIGA (Vacuum Induction Melting Gas Atomization) – a process where titanium produced via the Kroll method is melted under vacuum and atomized with inert gas, offering cost-effective production of spherical powders with good purity and sphericity, but a broader particle size distribution compared to plasma-based methods.

[9] The provided figures are given for electricity with a medium and high carbon footprint.

[10] LTS is a spheroidization method being developed by Velta RD Titan as part of the Velta Ti Process, with its advantages to be demonstrated within REPTiS.

[11] NSPT is designed as part of Velta Ti Process for the production of near-spherical fine titanium and titanium alloy powders, with particle sizes typically ranging from 0 to 30 μm.

[12] Two approaches can be applied: Near ZLD (Near Zero Liquid Discharge) and ZLD (Zero Liquid Discharge). In the case of the Near ZLD approach, the only liquid waste is the concentrate from the production of demineralized water (filtration quality), which is water with a high salt content. In the case of the ZLD approach, no liquid wastewater is generated, thanks to processing of reverse osmosis concentrate into demineralized water and dry salts depending on the initial chemical composition of the raw water, where the salts can be further used as by-products, for example, as an anti-icing agent (de-icer) and other useful products.

[13] https://single-market-economy.ec.europa.eu/sectors/raw-materials/week_en

[14] https://www.start-heproject.com/clustering-rm-workshop/

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