

Incubation Forum for Circular Economy in European Defence
(IF CEED)

Project idea

Circularity of titanium using recycled source materials for Additive Manufacturing



Context

The properties of titanium make it an ideal material for lightweight armouring in various applications. However, its scarcity and the need to source it from outside the European Union (EU) results in high prices and supply risks.

Titanium offers high ballistic protection for applications ranging from body armour and helmets to tanks and aircrafts.

This material and its semi-finished products are sourced exclusively from other countries outside the EU (e.g., the U.S., Japan, Russia, China). Furthermore, recycling capacity is still mainly available outside the EU. Therefore, an EU circular approach would reduce the EU's dependency on external sources for this Critical Raw Material, while reducing the environmental impact of extraction and transport. Moreover, titanium armour, especially when it comes to more

complex shaped components, is very expensive due to the very high price of the material and the amount of scrap generated by conventional production processes. As a result, armour manufacturers are falling back on materials that are specifically heavier and cheaper, i.e. steel.

Additive Manufacturing (AM), by using recycled materials, can reduce the consumption of imported first-use materials and the associated costs, as it allows near net-shape manufacturing (the resulting part is close to the final shape). The ability to source materials locally via recycling and elaboration of semi-finished products for AM would bring further economic benefits, associated with reducing the carbon footprint throughout the product life cycle.

To exploit this potential, secondary materials need to be qualified to allow their actual use in targeted applications.

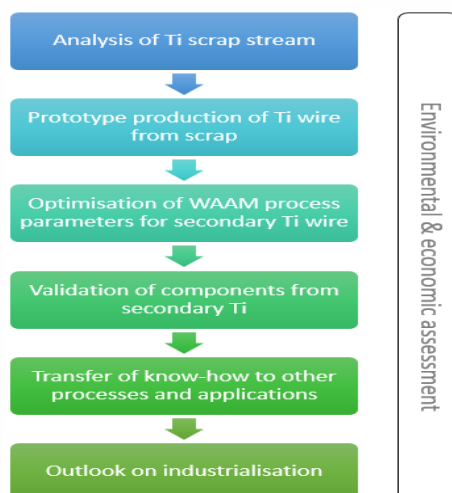
Objectives

The objective of this project idea is to **validate and demonstrate in a military environment the performance of armour manufactured by Wire Arc Additive Manufacturing (WAAM) using Titanium wire from titanium scrap.**

The **specific objectives** of the project idea are to:

- Analyse the titanium scrap stream.
- Develop and validate titanium wire obtained from scrap and optimise the WAAM process for secondary materials.
- Manufacture armour components from secondary titanium and test their performance and suitability.
- Carry out an economic and environmental assessment.
- Pave the way to industrialisation and transfer to other applications, such as the aeronautics industry.

Methodology



Stakeholders

- Entities engaged in the IF CEED Project Circles “Critical Raw Materials” and “Circular Additive Manufacturing”
- Ministries of Defence, Industry, Research-and-Technology Organisations

Timeline

The foreseen project duration is 36 months.

Expected Outcome

- Specifications for qualified titanium wire for WAAM obtained from scrap
- Report on the performance of printed armour components manufactured by WAAM for the recycled wire developed
- Economic and environmental analysis of the circular value chain
- Analysis of potential applications beyond armour and defence
- Analysis of the pathway to scale-up

Operational Benefits

- Improving the supply of titanium parts for the armed forces
- Supply/availability of AM-able titanium for deployed missions
- Widening the use of Additive Manufacturing technology within the armed forces
- Mission self-sufficiency

Budget & funding

Type of project: Collaborative project

Budget: EUR 7 500 000 - 10 000 000