Recovery of Tungsten, Niobium and Tantalum occurring as by-products in mining and processing waste streams

(TARANTULA)

D8.10 Report on TARANTULA training activities targeting industrial audiences

WP number and title	WP8 – Communication and dissemination of results to stakeholders
Responsible partner	TANTALUM-NIOBIUM INTERNATIONAL STUDY CENTRE (TIC)
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Reviewer	TECNALIA
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Abbreviations and acronyms

CA	Consortium Agreement
CC	Conference Call
T.I.C	Tantalum-Niobium International Study Center
MMTA	Miner Metals Trade Association
LME	London Metal Exchange
TRANSSC	Transport safety standard committee
IAEA	International atomic Energy Agency
GA	General Assembly
PR	Periodic Report
HF	Hydrofluoric acid
ToC	Table of Content
WP	Work Package

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Executive summary

The purpose of this report is to provide feedback from the communications and workshops that the T.I.C was involved in during the TARANTULA project.

The effect of covid halted WP8 workshops. The T.I.C would have liked to have held more of these events.

The industry uses a HF digestion technique that is costly and can be hazardous to the environment if strict controls are not put in place. The industry is actively looking for another method to extract refractory metals from ores that will limit the environmental impact and the chemical costs.

The TARANTULA project, if fully implemented, would allow Europe to have a robust supply chain from ore to metals for critical minerals and metals.

It is hoped that the T.I.C can continue with the partners in TARANTULA developing new processes in enabling a new solvent extraction technology becoming commercially viable.

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1. Introduction

The T.I.C. is joined by fifteen other organisations from a range of industrial and academic backgrounds, together forming a team with considerable resources. The TARANTULA project is coordinated by Tecnalia, an applied research and technological development centre based in Spain, and a full list of consortium members can be found at the TARANTULA website https://h2020-TARANTULA.eu/.

- T.I.C.'s role in TARANTULA

The T.I.C. is a junior partner in the consortium, but plays a significant role in two key areas:

- Identification of European resources of refractory metals. There are over 3600 occurrences of W, Nb and Ta recorded in Europe. Each record will need to be checked, standardised, and incorporated into the TARANTULA database.
- Communication and dissemination of results to stakeholders. This includes developing training materials and coordinating workshops that target industrial audiences, such as T.I.C. member companies.

- About the T.I.C.

The T.I.C. was established in response to concerns within the tantalum industry regarding the lack of useful information on tantalum source materials. The initial purpose of the T.I.C. was to spread information about tantalum and to promote the common interest and welfare of the producers, especially with public and private authorities, organisations, and agencies. Since its foundation, the T.I.C. has grown to encompass niobium and all stages of the tantalum/niobium supply chains.

THE ASSOCIATION

An international, non-profit association founded in 1974 under Belgian law.

Around ninety members from over thirty countries involved with all aspects of the tantalum and niobium industry supply chain (mining, trading, processing, metal fabrication, capacitor manufacturing, recycling, other end-users such as medical, aerospace…)

Managed by an Executive Committee representing all segments of the industry.

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OUR OBJECTIVES:

Increase awareness and promote the remarkable properties of tantalum and niobium.

Organize a General Assembly of the membership in September or October each year for business and technical presentations. The location is chosen so that a tour of a member company or industry associated facility in the area may be included in the programme. Guests may attend.

Organize a longer symposium in September or October about every five years for business and technical presentations, sometimes with a tour of a member company or industry associated facility in the area.

Publish a semi-annual Bulletin, in electronic and printed format.

Collect from the members (via an independent company to ensure confidentiality), statistics on raw material production, process'rs' receipts and product shipments, and capacitor produc'rs' receipts for tantalum, while for niobium raw material production and process'rs' product shipments are collected. Report consolidated data to the membership on a quarterly basis.

Address significant issues and challenges facing its industry such as conflict miner'ls' legislation, artisanal and small-scale mining, transport of radioactive materials, ...

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2. Communication and Dissemination

T.I.C participated in the Communication and dissemination of results to stakeholders. This has been achieved mostly by working with T.I.C. members at the T.IC. conferences that are held each year in September or October of the said year.

Since the start of TARANTULA period, there has been five general assemblies:

- 60th General Assembly, Hong Kong, October 17th to 16th 2019
- 61st (Virtual, because of covid) General Assembly, October 12th, 2020
- 62nd General Assembly, London UK, November 14th to 17th 2021
- 63rd General Assembly, Geneva Switzerland, October 16th to 19th 2022
- 64th General. Assembly, Rio de Janeiro, Brazil, September 10th to 13th 2023

The 63rd General Assembly had a **TARANTULA project workshop** added to the conference.

Session 3 *(15:15 to 17:30)*

The workshop was opened by Dr. Lourdes Yurramendi from TECNALIA with the following paper:

Novel technologies for the recovery of tantalum and niobium from tin mining streams, by L. Yurramendi, J. Nieto and A. Siriwardana - TECNALIA Basque Research & Technology Alliance, (BRTA), Materials and Processes, J. Spooren - VITO n.v. Flemish Institute for Technological Research, Unit Sustainable Materials Management, E. Seftel and V. Tu - KU Leuven, Department of Chemistry and M. Foreman - CHALMERS University of Technology, Department of Chemistry and Chemical Engineering, Industrial Materials Recycling and Nuclear Chemistry

At each General Assembly, a conference pack is handed to attendees with information on the General Assembly presentations, booklet and the latest T.I.C. bulletin magazine.

- Annual Report booklet has a TARANTULA advert.
- The Bulletin magazine has a half page TARANTULA advert.
- An insert is also placed in the conference pack (Figure 1 and Figure 2)

This is part of the sponsorship package that we offer to members.

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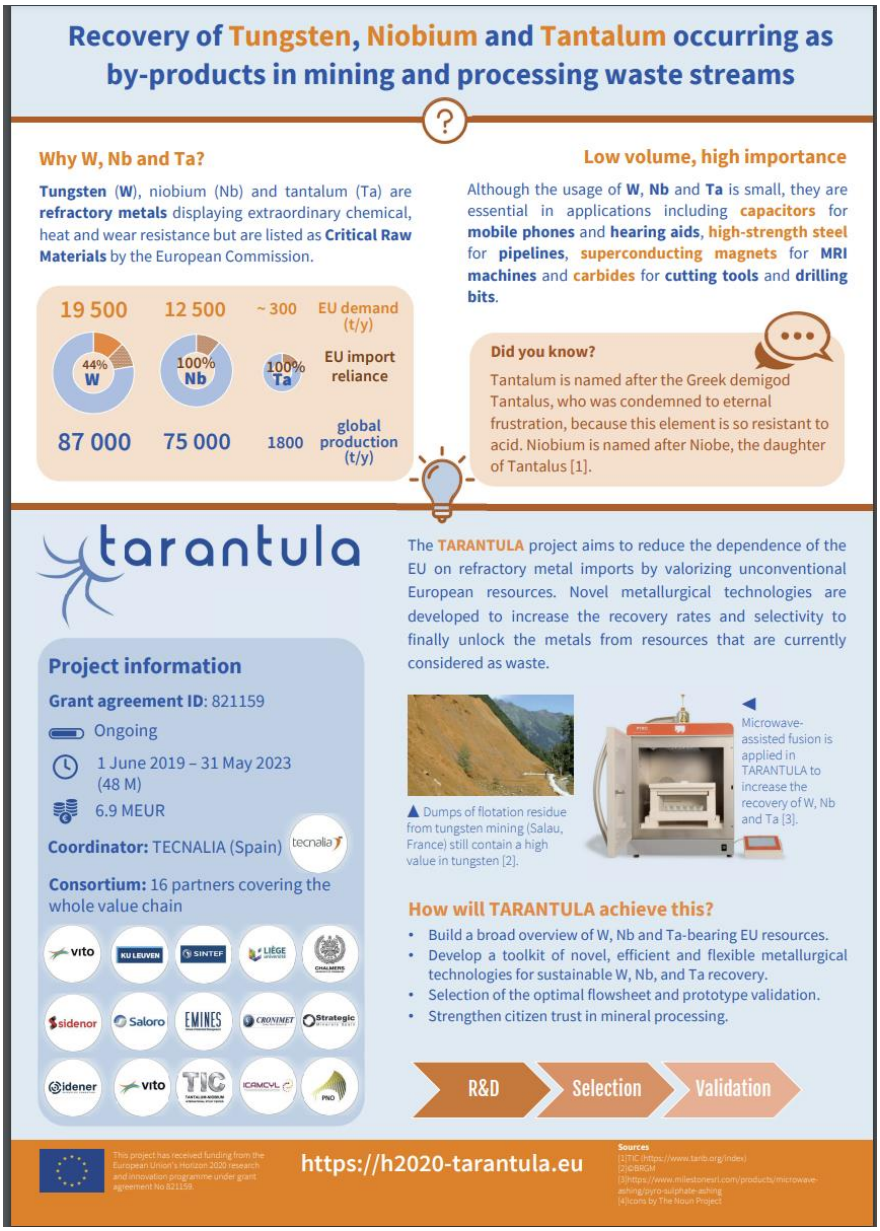

Figure 1. The General Assembly conference pack insert.

Figure 2. The General Assembly conference banner used to advertise TARANTULA

As part of the outreach to members and to push the metals into innovative technology areas we do outreach at conferences other than the T.I.C. and visit members in Europe, USA, China South America, and East Asia.

Recent conferences attended with TARANTULA in mind are:

- Formnext November Frankfurt, 2021,2022&2023
- Minor Metals Trade Association conference Shefield UK,2022, Charlotte NC USA 2023
- LME week London UK 202, 2022, & 2023
- Rapid TCT Chicago USA 2023

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Feedback from the members and non-members that the T.I.C. raised some interesting points on the mapping of potential 3600 occurrences of W, Nb and Ta recorded in Europe by the TARANTULA project. Sometimes the mine sites could have been stopped or are not viable due to Class 7 issues.

TRANSCC, an IAEA body that the T.I.C has observed status on, finds that the limit for radiation for transport is 10 Bg/g. If packed in containers, then a ten times multiplier can be applied. (Appendix 3).

Also, some substances like for example arsenic can occur at higher than permitted levels and in the past mine sites had incomplete documentation.

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3. Conclusions

The most feedback from the various meetings and conferences that the T.I.C attended or staged were around the research activity in TARANTULA, i.e. Extraction and recovery of W, Nb and Ta oxides or salts.

This is because the tantalum and niobium industry have for decades worked with a solvent extraction method using hydrofluoric acid (Appendix 1).

The HF solvent method is time consuming, expensive, toxic to humans and the environment and difficult to store or dispose of safely. That is why most plants in Europe and the USA are legacy companies, which use this HF solvent method. The only new plants are in the far east.

The new methods developed by TARANTULA addressing the above issues would allow new factories to be established in Europe that would not have the burden of legislation and thus allow the EU to produce large volumes of refractory metals at a competitive price.

The T.I.C. will continue to engage with research members of post TARANTULA to hopefully prove an alternative method of solvent extraction.

That is why the Anders Gustaf Ekeberg Tantalum Prize was set up in 2018 to highlight advancements and pure research into tantalum (Appendix 2).

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4. References

MMTA https://mmta.co.uk/

T.I.C. https://www.tanb.org/index

LME Week https://www.lme.com/Events

Rapid TCT https://www.rapid3devent.com/

Formnext https://formnext.mesago.com/frankfurt/en.html

IAEA https://www.iaea.org/

TRANSSC https://www-ns.iaea.org/committees/transsc/default.asp?fd=1163&dt=0

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Appendix 1

Figure 3 shows the main routes[1] used in the SoA for the extraction and separation of Ta/Nb compounds.

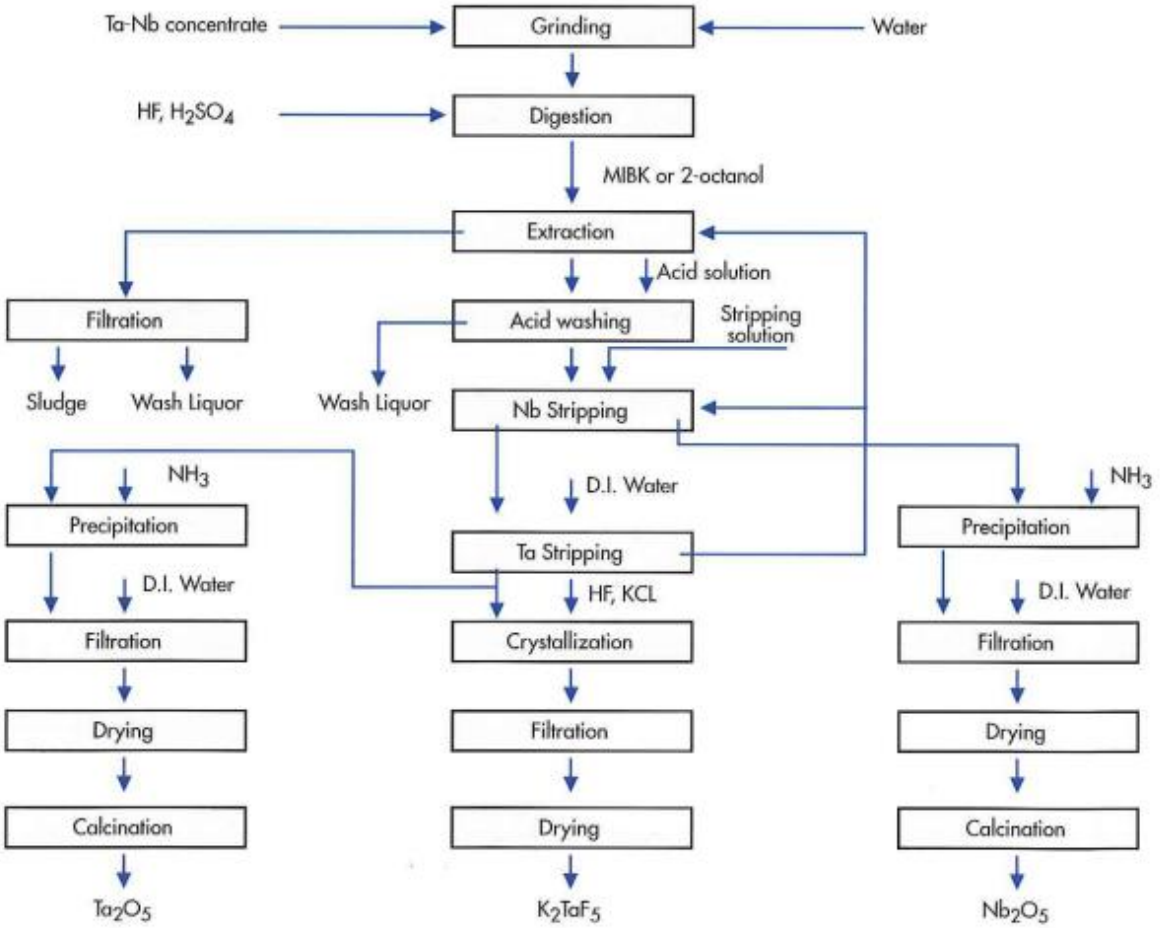

Figure 3. Solvent extraction and separation of Ta/Nb compounds

[1] Ref: T.I.C. Bulletin Number 93 March 1998

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Appendix 2

The T.I.C. Anders Gustaf Ekeberg Tantalum Prize (Figure 4)

Recognising excellence in tantalum research and innovation

The Anders Gustaf Ekeberg Tantalum Prize ('Ekeberg Prize') is an annually awarded by the T.I.C. for excellence in tantalum research and innovation*. The Ekeberg Prize, first awarded in 2018, increases awareness of the many unique properties of tantalum products and the applications in which they excel.

The Prize has been named after the discoverer of tantalum and will be awarded to the lead author(s) of the published paper, book or patent that is judged by an independent panel of experts to have made the greatest contribution to understanding the processing, properties or applications of tantalum. The prize is sponsored by the T.I.C. and is central to its efforts to publicise the many exceptional benefits afforded by this element.

The long-term future of the tantalum market will depend on technology-driven innovations and winners of the Anders Gustaf Ekeberg Tantalum Prize will be acknowledged as true leaders in this field. The lead author(s) will be invited to give a presentation on their work at a General Assembly, where they will also receive a medal made of tantalum and a certificate of award presented by the T.I.C. President. They will also be interviewed in our newsletter, the Bulletin.

Figure 4. Anders Gustaf Ekeberg Tantalum Prize

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Appendix 3

Denial of Shipment (DoS): Difficulties in tantalum raw materials transport, and potential solutions

5 May 2021

This paper was given by Ulric Schwela on behalf of the T.I.C. at the IAEA Technical Meeting on Denials of Shipment held online from March 23rd to 26th 2021. Mr Schwela was the T.I.C.'s Technical Officer2005-2016 and is currently the Managing Director of Salus Mineralis Ltd, a specialist NORM transport consultancy which regularly works with the T.I.C. on NORM issues (he can be contacted at us@salusmineralis.com). The T.I.C. invests a lot of effort working with regulators and other stakeholders on issues concerning Naturally Occurring Radioactive Materials (NORM) and Denial of Shipment.

This article was first published in the April 2021 edition of the Bulletin, the T.I.C.'s quarterly journal.

Executive Summary

Tantalum is a non-radioactive metal, present in rocks and ores that can be radioactive due to naturally occurring thorium and uranium. These raw materials require transport to facilities that have the specialist technology to extract the non-radioactive tantalum. Most transport is by land and sea in large freight containers (Figure 5), by air, and materials above 10 Bq/g require transport as Class 7 Dangerous Goods. Maritime transport of Class 7 is no longer viable for most companies, due to fewer carriers accepting Class 7 for transport, and on fewer routes. The main reason for non-acceptance of Class 7 for transport is the financial risk to carriers of transporting a niche product that may see an entire container ship being delayed or rerouted due to a sudden refusal to accept it for transit or transhipment at a planned port of call, once the ship is already underway. Despite Class 7 being a premium product commanding a premium freight charge, the increased fee is far less than the financial cost of a delay or rerouting. Further, the transport of Class 7 (radioactive materials) suffers from an image problem, with the perception that these materials are somehow inherently more dangerous than other classes of dangerous goods (explosive, flammable, oxidising), whereas in fact the transport of radioactive materials has an excellent and enviable safety record.

A number of undesirable consequences have arisen because of these transport difficulties:

1) Almost all consignor of tantalum raw materials no longer even attempts to ship Class 7, and instead dilutes the radioactivity concentration to <10 Bq/g by blending with low grade materials, in order to be able to transport as general goods reliably.

2) A few consignors use air freight despite the significantly increased cost, the benefit being fast and reliable delivery.

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3) A number of companies (that are not T.I.C. members), feel the necessity to consider shipping raw materials by sea as misdeclared cargo, in contravention of the transport regulations that govern road transport and international maritime transport, with the tacit acceptance of key stakeholders along the supply chain.

Nos. 1) and 2) represent less economical or sustainable transport solutions, with increased carbon footprint for the quantity of valuable metal transported. No. 3) is not only an offence, but also puts transport workers at potentially greater risk, and could damage other goods such as photosensitive material if the carrier is not informed and cannot take appropriate precautions. Also, no. 3) is an anti-competitive distortion of the market, as the receiving companies can obtain higher grade material at lower transport costs. The recommendations are that resources should be allocated on a permanent basis to maintain awareness of denial of shipment issues through effective communication and inclusion in training programmes, with a view to promoting harmonisation in the implementation of transport regulations in different states, and thus create a level regulatory and competitive playing field for the economic benefit of all.

Figure 5. The majority of tantalite shipments are transported in ocean-going containers: (left) tantalite in drums, on pallets, loaded in freight container on a truck, and (right) an ocean-going container ship (photos: T.I.C. and Shutterstock)

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