



Final Conference : WP3

D3.4 Management of waste form secondary resource processing: Identification, environmental evaluations. Tantalum.



Funded by the Horizon 2020 Framework programme of the European Union (Grant Agreement Number 688993)

PEDRO ACEBES (CARTIF)

MSP-REFRAM, Final Conference
Brussels, March 9-10th

CONTENTS

- 1.- European strategy regarding prevention and recycling of waste.
- 2.- European strategy regarding energy related to environment.
- 3.- Especific mining and extractive industry literature and European Commission references related to the environment.
- 4.- Especific non ferreous metals industries prevention and control.
Recommendations by the EC
- 5.- Tantalum: primary extraction environmental data
- 6.- Tantalum: Recycling/recovery process for tantalum from secondary resources
- 7.- Primary and secondary processes for Ta. Comparison.

1.- European strategy regarding prevention and recycling of waste

In December 2005, the Commission published a Communication on the Thematic ***Strategy on the Prevention and recycling of waste***

Aligned with the waste and recycling strategy, in 2005 the European Commission proposed a ***Strategy on the Sustainable Use of Natural Resources***, in order to reduce the environmental impacts associated with resources.

Integrated Product Policy (IPP)

The European Commission presented the ***Sustainable Consumption and Production and Sustainable industrial Policy (SCP/SIP) Action Plan***

After the last ***revision of the EU waste policy*** and legislation, the ***Circular Economy Approach***

A **waste prevention guideline** was developed by the Commission and published in 2012

The ***Roadmap to a Resource Efficient Europe***

2.- European strategy regarding energy related to environment

The *European Energy Roadmap*, developed in 2011

Energy targets. Source: European Energy Roadmap.

Year	2020	2030	2050
Target	<ul style="list-style-type: none">- Reduction of GHG (20%) compared to 1990 level,- 20% energy form renewable sources- 20% energy efficiency improvement	<ul style="list-style-type: none">- 40% reduction in greenhouse gas emissions- At least 27% EU energy from renewables- Increase energy efficiency by 27-30%- 15% electricity interconnection (i.e. 15% of electricity generated in the EU can be transported to other EU countries)	<ul style="list-style-type: none">- 80-95% cut in greenhouse gases compared with 1990 levels

3.- Especific mining and extractive industry literature and European Commission references related to the environment

Directive 2006/21/EC

Reduction of waste production.

Encourage the *recovery of extractive waste* by means of recycling, reusing or reclaiming wastes,

Ensure *short and long-term safe disposal of the extractive waste*,

Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities **Integrated Product Policy (IPP)**

This document is the result of the exchange of information between the European Union's member States and the mining industry, as an agreement to develop a BAT reference document after Aznalcollar and Baia Mare tailings dam bursts.

4.- Especific non ferrous metals industries prevention and control. Recommendations by the EC

Best Available Techniques (BAT) Reference Document for the Non-Ferrous Metals Industries

This document also describes several techniques for reducing the environmental impact of the installation that can be structured in three main categories:

- Management techniques
- Process integrated techniques
- Energy reduction and abatement techniques


5.- Tantalum: primary extraction environmental data

Tantalum environmental data. Source: Life cycle assessment of Metals.

Impact category	Value	Units	Consideration
Global warming potential	260	Kg CO ₂ eq / kg	Medium impact
Cumulative energy demand	4,360	MJ eq / kg	Medium impact
Terrestrial acidification	1.7	Kg SO ₂ eq / kg	Medium impact
Freshwater eutrophication	1.5 E-01	Kg P eq / kg	Medium impact
Human toxicity	1.2 E-04	CTUh/kg	Medium impact

5.- Tantalum: primary extraction environmental data

(A) Global Warming Potential (kg CO₂-eq/kg)


 Lowest Highest

H																	He 0.9
Li 7.1	Be 122											B 1.5	C	N	O	F	Ne
Na	Mg 5.4											Al 8.2	Si	P	S	Cl	Ar
K	Ca 1.0	Sc 5,710	Ti 8.1	V 33.1	Cr 2.4	Mn 1.0	Fe 1.5	Co 8.3	Ni 6.5	Cu 2.8	Zn 3.1	Ga 205	Ge 170	As 0.3	Se 3.6	Br	Kr
Rb	Sr 3.2	Y 15.1	Zr 1.1	Nb 12.5	Mo 5.7	Tc	Ru 2,110	Rh 35,100	Pd 3,880	Ag 196	Cd 3.0	In 102	Sn 17.1	Sb 12.9	Te 21.9	I	Xe
Cs	Ba 0.2	La-Lu*	Hf 131	Ta 260	W 22.6	Re 450	Os 4,560	Ir 8,860	Pt 12,500	Au 12,500	Hg 12.1	Tl 376	Pb 1.3	Bi 58.9	Po	At	Rn
Fr	Ra	Ac-Lr**	Rf	Db	Sg	Bh	Hs	Mt									

*Group of Lanthanide	La 11.0	Ce 12.9	Pr 19.2	Nd 17.6	Pm	Sm 59.1	Eu 395	Gd 46.6	Tb 297	Dy 59.6	Ho 226	Er 48.7	Tm 649	Yb 125	Lu 896
**Group of Actinide	Ac	Th 74.9	Pa	U 90.7	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

5.- Tantalum: primary extraction environmental data

(A) Cumulative Energy Demand (MJ-eq / kg)

H																	He 67.5
Li 125	Be 1,720											B 27.3	C	N	O	F	Ne
Na	Mg 18.8											Al 131	Si	P	S	Cl	Ar
K	Ca 5.8	Sc 97,200	Ti 115	V 516	Cr 40.2	Mn 23.7	Fe 23.1	Co 128	Ni 111	Cu 53.7	Zn 52.9	Ga 3,030	Ge 2,890	As 5.0	Se 65.5	Br	Kr
Rb	Sr 48.8	Y 295	Zr 19.9	Nb 172	Mo 117	Tc	Ru 41,100	Rh 981,000	Pd 72,700	Ag 3,280	Cd 53.0	In 1,720	Sn 321	Sb 141	Te 435	I	Xe
Cs	Ba 4.0	La-Lu*	Hf 3,510	Ta 4,360	Ta 133	Re 9,040	Os 85,000	Ir 169,000	Pt 243,000	Au 208,000	Hg 179	Tl 5,160	Pb 18.9	Bi 697	Po	At	Rn
Fr	Ra	Ac-Lr**	Rf	Rf	Sg	Bh	Hs	Mt									

*Group of Lanthanide	La 215	Ce 252	Pr 376	Nd 344	Pm	Sm 1,160	Eu 7,750	Gd 914	Tb 5,820	Dy 1,170	Ho 4,400	Er 954	Tm 12,700	Yb 2,450	Lu 17,600
**Group of Actinide	Ac	Th ^a 1,260	Pa	U ^a 1,270	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

6.- Tantalum: Recycling/recovery process for tantalum from secondary resources

ESTIMATION OF MASS AND ENERGY FLOW DIAGRAMS OF THE COMPLETE RECOVERY TECHNIQUE FOR TANTALUM

PhD-researcher, M.Sc.(Tech), Dmitry Safonov

Professor, D.Sc.(Tech), Antti Häkkinen

Separation Technology

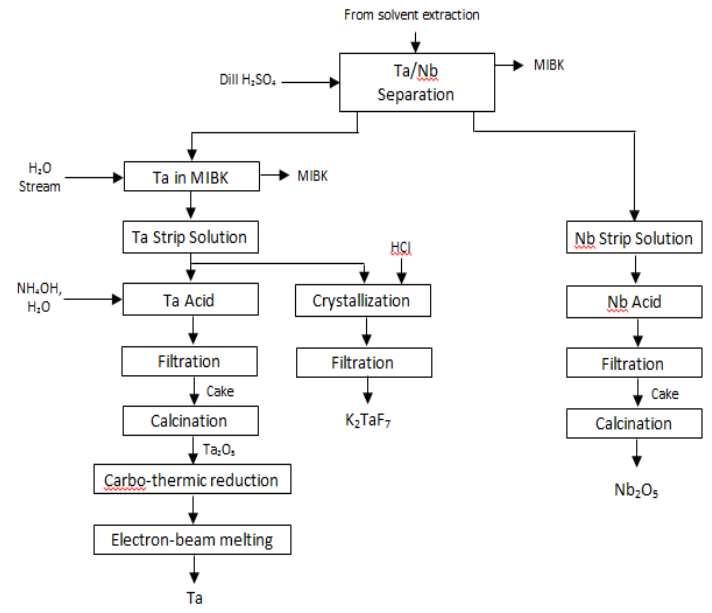
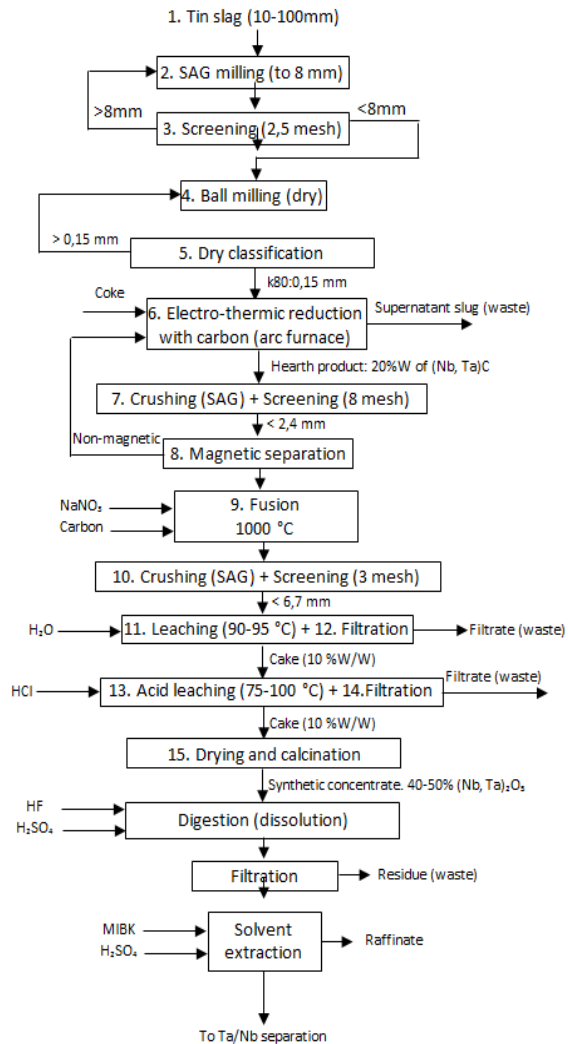
LUT School of Engineering Science

Lappeenranta University of Technology

Skinnarilankatu 34, 53850 Lappeenranta, FINLAND

Tel: +358 40 354 3218, E-mail: Antti.Hakkinen@lut.fi

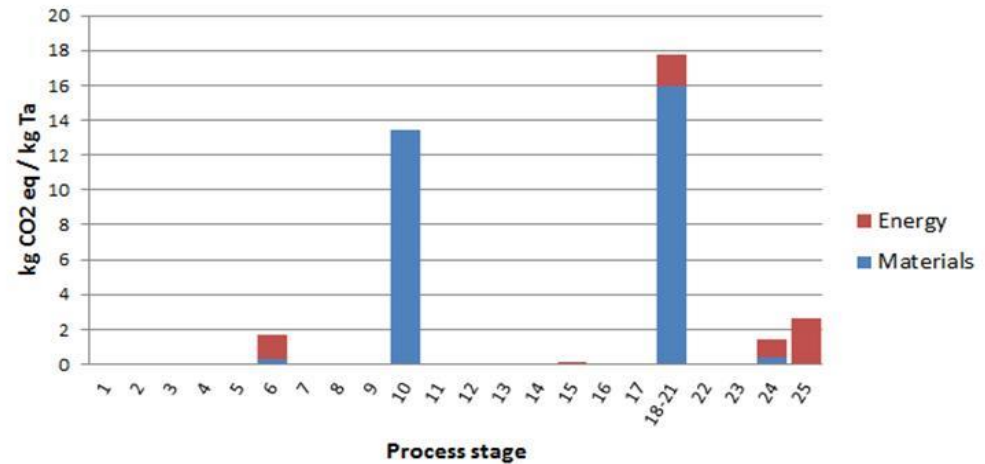
6.- Tantalum: Recycling/recovery process for tantalum from secondary resources



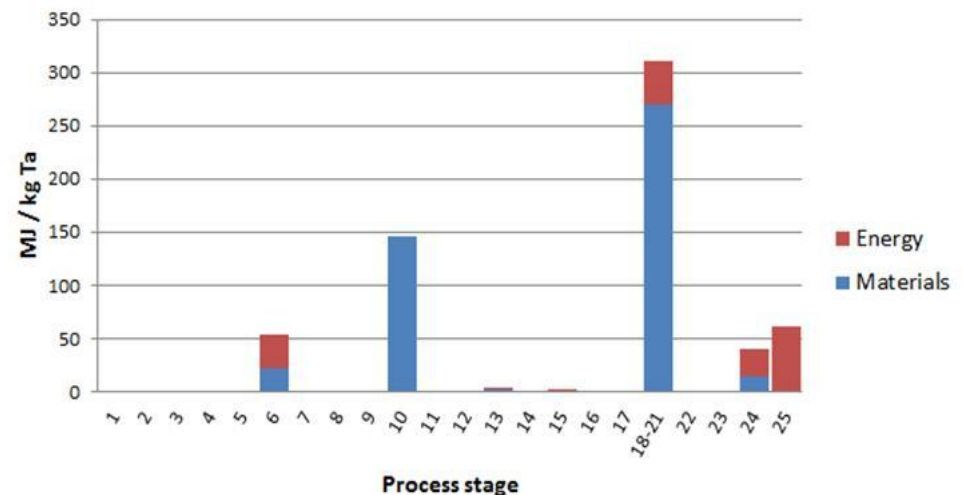
6.- Tantalum: Recycling/recovery process for tantalum from secondary resources

1	Input slag material
2	SAG milling of tin slag
3	Screening (2,5 mesh)
4	Ball milling (dry)
5	Dry classification
6	Electro-thermic reduction with carbon (arc furnace)
7	Crushing of the hearth product
8	Screening
9	Magnetic separation
10	Fusion with NaNO ₃
11	Crushing of the cooled fusion mass
12	Screening
13	Water leaching
14	Filtration after water leaching
15	Mineral acid leaching
16	Filtration after mineral acid leaching
17	Drying and calcination
18-21	Solution / Solvent extraction /Stripping / Precipitation
22	Tantalum oxide filtration
23	Drying and calcination
24	Carbo-thermic reduction
25	Electron-beam melting

Global warming potential (1 kg of Ta)



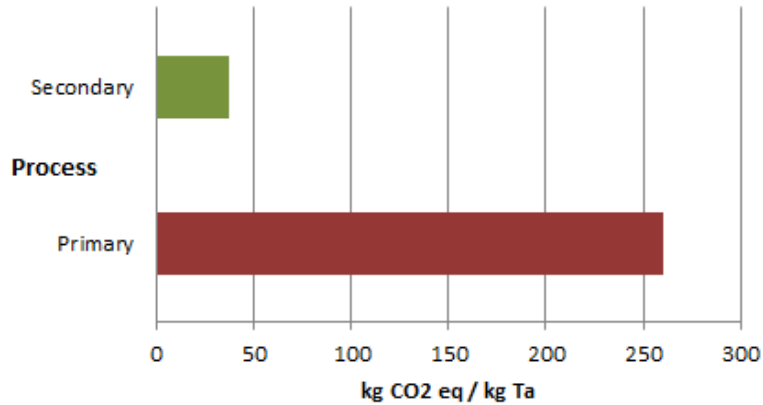
Cumulative energy demand (1 kg of Ta)



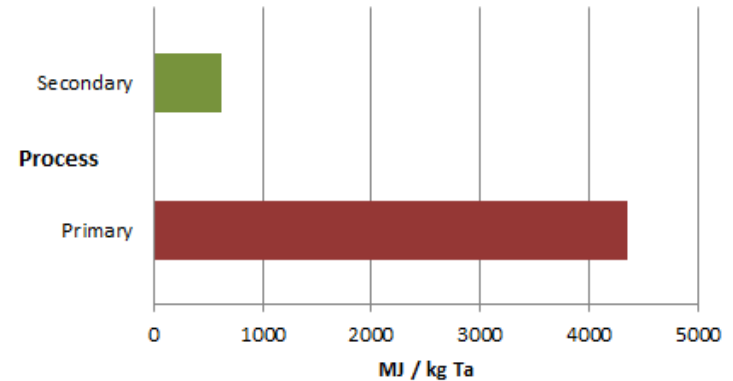
Only mass and energy inputs in the recovery process, no waste

6.- Primary and secondary processes for Ta. Comparison.

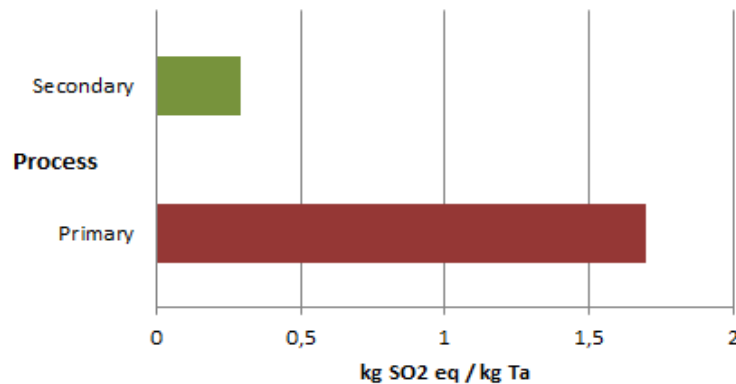
Global warming



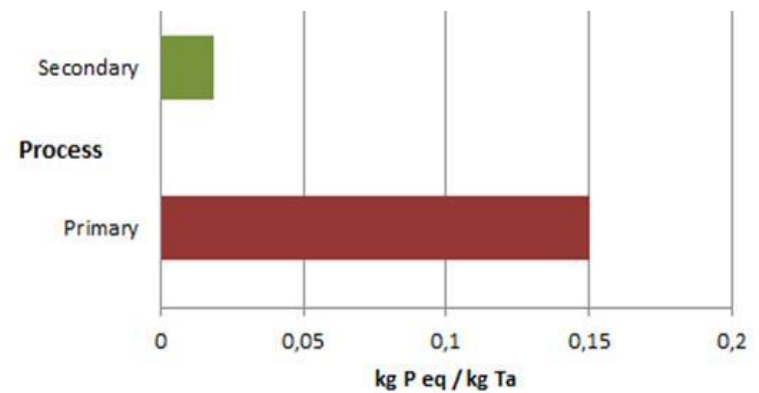
Cumulative energy demand



Terrestrial acidification



Freshwater eutrophization



Only mass and energy inputs in the recovery process, no waste

THANKS FOR YOUR ATTENTION!!

Further information: Alberto Moral

E-mail: albmor@cartif.es

<http://www.cartif.com>



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