

## ***T.I.C. Statistics: what are they and how are they collected?***

*This explanation is based on a paper presented by Ulric Schwela, Technical Officer of the T.I.C., on October 27th 2015, as part of the Fifty-sixth General Assembly held in Penang, Malaysia.*

### **Abstract**

T.I.C. statistics are gathered and published to members every quarter, but where do they come from? What do they represent? The presentation will first outline the context from which T.I.C. statistics are collected, including a layout of reporting membership types, their interconnection, and where reporting rules are applied to avoid double counting.

What other statistics for niobium and tantalum are there besides T.I.C. figures? The presentation will outline some of the other sources of statistics, which can be seen as complementary to the T.I.C. data, such as international trade data recorded by Customs. Based on standardised international product classifications, such data can be compared, provided of course that the classifications are both matching and sufficiently detailed, and examples of comparison limitations will be given.

Finally the presentation will provide an overview of the T.I.C. data over a number of years for:

- niobium raw materials
- niobium products from processors
- tantalum raw materials
- tantalum receipts by processors
- tantalum products from processors
- tantalum receipts by capacitor makers

### **T.I.C. Statistics**

This paper covers what reporting companies are required to do and a review of the data for the discrete calendar years 2001 to 2014. Readers who are familiar with the statistics process can probably skip straight to the data, while others are encouraged to read and understand the background information in order to put the statistics data into the right context.

Member companies are provided with separate statistics reports on a quarterly basis, whereas statistics aggregated by calendar year are available to non-members on request and subject to a withholding period. Data up to a year old are only available to the T.I.C. members, therefore the figures for a full calendar year can only be released to non-members if at least one year old. The latest public release (currently 2014) may be purchased for a fee of EUR 500, while earlier calendar years are freely available.

#### **Where do T.I.C. Statistics come from?**

The T.I.C. gathers statistics data on the niobium and tantalum industries to show the main trends in the quantities of niobium and tantalum produced and consumed. These data are considered to cover the vast majority of the industry, except for tantalum primary production from 2009 onwards due to the increased proportion of production outside the membership, in particular artisanal mining. Key features of the statistics collection include:

- Data are only obtained from T.I.C. members;
- For confidentiality, members report data directly to an independent collector<sup>1</sup>;
- An aggregate report is provided by the independent collector to the T.I.C. for review;
- A final report is issued by the T.I.C. to all the member companies.

From the above it can be seen that the data accuracy relies heavily on the care and attention taken by the reporting companies. The T.I.C. provides advice to the member companies on how to complete the statistics, and members are always encouraged to contact the T.I.C. for any clarification related to the reporting process and which categories to use, however the T.I.C. may not request information that identifies individual company data.

Collection requests are issued quarterly, every January 1st, April 1st, July 1st and October 1st to facilitate a routine and timely response; results are then circulated as soon as available. The goal of the T.I.C. is to provide timely and dependable statistics to its member companies, however this relies on all members playing their part in reporting their data. By way of encouragement, there is a condition that a reporting member will only receive the final report if they first submit their own data, while 'persistent non-responders' that either don't report or are consistently late, are brought to the attention of the Executive Committee.

### **T.I.C. Member reporting process**

Essentially a company requested to submit statistics is required to:

- Report by the deadline indicated on the form (generally January 20th, April 20th, July 20th or October 20th);
- Check the reporting company lists to determine which figures to exclude<sup>2</sup>, if any;
- Check the reporting rules to ensure figures are reported in the correct units;
- Complete and submit the forms provided, even if all results are 'zero' (0);
- Send the forms directly to the independent collector (*i.e.* not to the T.I.C.).

### **What is the need for a deadline?**

Those companies that are late in submitting their forms hold up the final report for the rest of the membership; this is a disservice to the entire industry.

### **Why bother reporting if all the results are zero?**

If the independent collector does not receive a form, all it knows is that the form has not yet been received. It can not make the assumption that a missing form equals zero. To put it simply:

No form = Missing form  $\neq$  0

### **What if I don't submit my statistics?**

Submitting statistics forms is a duty of membership and missing forms adversely affect the overall statistics. Those companies that don't respond to the request for statistics are in turn not provided with the final report<sup>3</sup>, in other words *quid pro quo*, or as another formula:

No submitted statistics = No final report

### **What do the T.I.C. statistics represent?**

The following series of diagrams demonstrates the material flows which are represented by the T.I.C. data, and those flows that are not. Each diagram is a simplification of the companies involved in the supply chain, basically showing how Nb- or Ta-containing material flows from primary producers (the miners), *via* traders to processors, or to processors directly, and from processors to consumers (including final manufacturers and end users) downstream, and in the case of tantalum with a further intermediate step of capacitor producers.

1-The T.I.C. formerly used the accounting and auditing firm HLB Belgium, and now as of 2015 the accounting firm Miller Roskell, as an independent intermediary.

2-Volumes traded between member companies in the same segment are excluded to avoid double counting .

3-Those companies which are not given the report are informed of why this is done. No complaints about this procedure have been received.

Given the abstracted complexity at the processor level, note there is a return loop for intermediate products flowing from one processor to another, as well as return loops from the capacitor producers and consumers which represents process waste, residues and other scrap. For each of the three or four types of companies, there is also the corresponding level outside of T.I.C. membership, to demonstrate how certain material flows in or out of the membership are reflected in the T.I.C. statistics.

## Niobium diagrams

For niobium there are thus three types of reporting company, using two types of forms:

- Primary producer: reports **all raw material production** using form *Nb/RawMat*
- Trader: reports<sup>4</sup> **raw material receipts** also on *Nb/RawMat*
- Processor: reports **product shipments**<sup>5</sup> using form *Nb/Products*

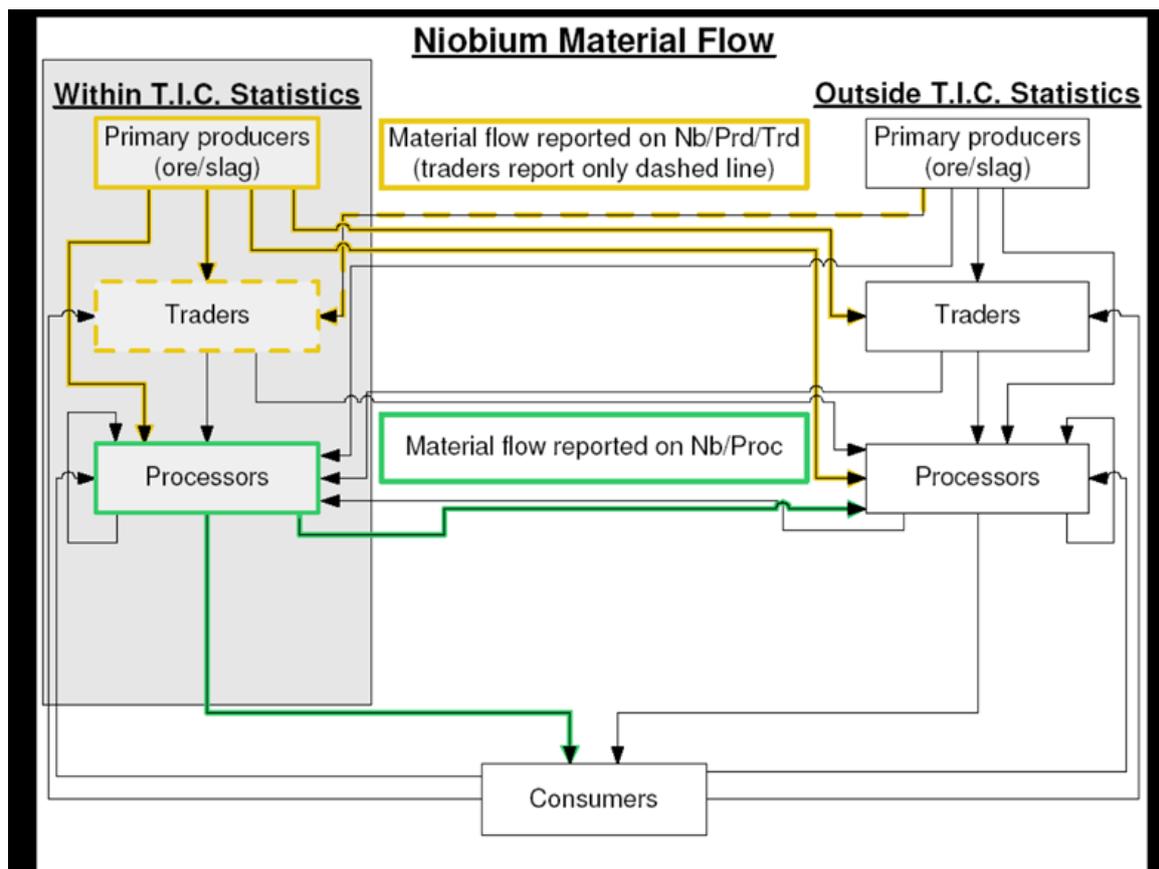


Figure 1 - Overview of niobium material flow

In this overview we see the three types of companies on the left hand side, reporting data for the coloured material flows using the correspondingly coloured form described in the centre. Each of these companies' reporting is shown separately below.

### → Niobium raw material production by primary producers

The material flow represented by the unbroken black/yellow arrow highlights the reporting by primary producers, showing how all production is reported regardless of which company it goes to, whether inside or outside of membership. The production data are reported in two separate categories:

1. Concentrates (pyrochlore, columbite) *i.e.* where niobium is the main constituent of a mineral;
2. Other Nb-containing (*e.g.* tantalite, struverite, tin slag (over 2% Nb<sub>2</sub>O<sub>5</sub>)) *i.e.* where niobium is a minority constituent in other raw materials.

4-Except not from other tantalum reporting miners or traders, in order to prevent double counting.

## Niobium raw material receipts by trading

The material flow represented by the dashed black/yellow arrow depicts the traders' connections, but only the material arriving from outside the membership is counted in T.I.C. statistics since primary production by T.I.C. members is already reported. Traders do not report receipts from T.I.C. members in order to avoid double counting. Traders only report receipts from non-member companies.

The form and categories used for reporting are the same as for primary producers:

1. Concentrates (pyrochlore, columbite)  
*i.e.* where niobium is the main constituent of a mineral;
2. Other Nb-containing (*e.g.* tantalite, struverite, tin slag (over 2% Nb<sub>2</sub>O<sub>5</sub>))  
*i.e.* where niobium is a minority constituent in other raw materials.

## Niobium product shipments by processors

Finally for niobium, the position of the processors is highlighted, showing how they report all production except that sent to other T.I.C. member processors (hence the return loop to the left of the green 'processors' box not being coloured in). Essentially T.I.C. niobium processors report only the material shipped to non-members.

The product shipment data are reported in five separate categories:

1. Niobium chemicals (*e.g.* Nb<sub>2</sub>O<sub>5</sub>, NbCl<sub>5</sub>, NbC)  
*i.e.* all grades of chemical products, whether intermediates or high grades for *e.g.* optical, Chemical Vapour Deposition, or tool making applications;
2. Niobium in vacuum-grade FeNb, NiNb  
*i.e.* the highest grades of niobium alloys, for *e.g.* master alloy and aerospace applications;
3. Niobium metal (pure) in the form of mill products, ingot, powder, scrap  
*i.e.* intermediate and final metal products for *e.g.* chemical process equipment applications;
4. Niobium alloys, such as NbTi, NbZr, NbCu, in the form of mill products, powder, scrap  
*i.e.* alloys for specialist applications including superconducting magnets;
5. HSLA grade ferro-niobium  
*i.e.* High Strength Low Alloy applications in automotive and structural steels.

## Tantalum diagrams

For tantalum the material flow is more complex, and there are four types of reporting company using four different forms in an asymmetric relationship:

- Primary producer: reports all **raw material production** using form *Ta/RawMat*
- Trader: reports<sup>6</sup> **raw material receipts** also on *Ta/RawMat*
- Processor - uses two forms:
  - \* Reports **receipts**<sup>7</sup> using form *Ta/Receipts*
  - \* Reports **product shipments**<sup>8</sup> on *Ta/Products*
- Capacitor Producer: reports all **receipts** using form *Ta/Cap*

Compared with the niobium diagram, the tantalum diagram is immediately more colourful, due to the additional step of capacitor producers, and the additional report of processors' receipts. Again these are described individually below.

6-Except not from other tantalum reporting miners or traders, in order to prevent double counting.

7-Except not receipts from other tantalum reporting processors, in order to prevent double counting.

8-Except not shipments to other tantalum reporting processors, in order to prevent double counting.

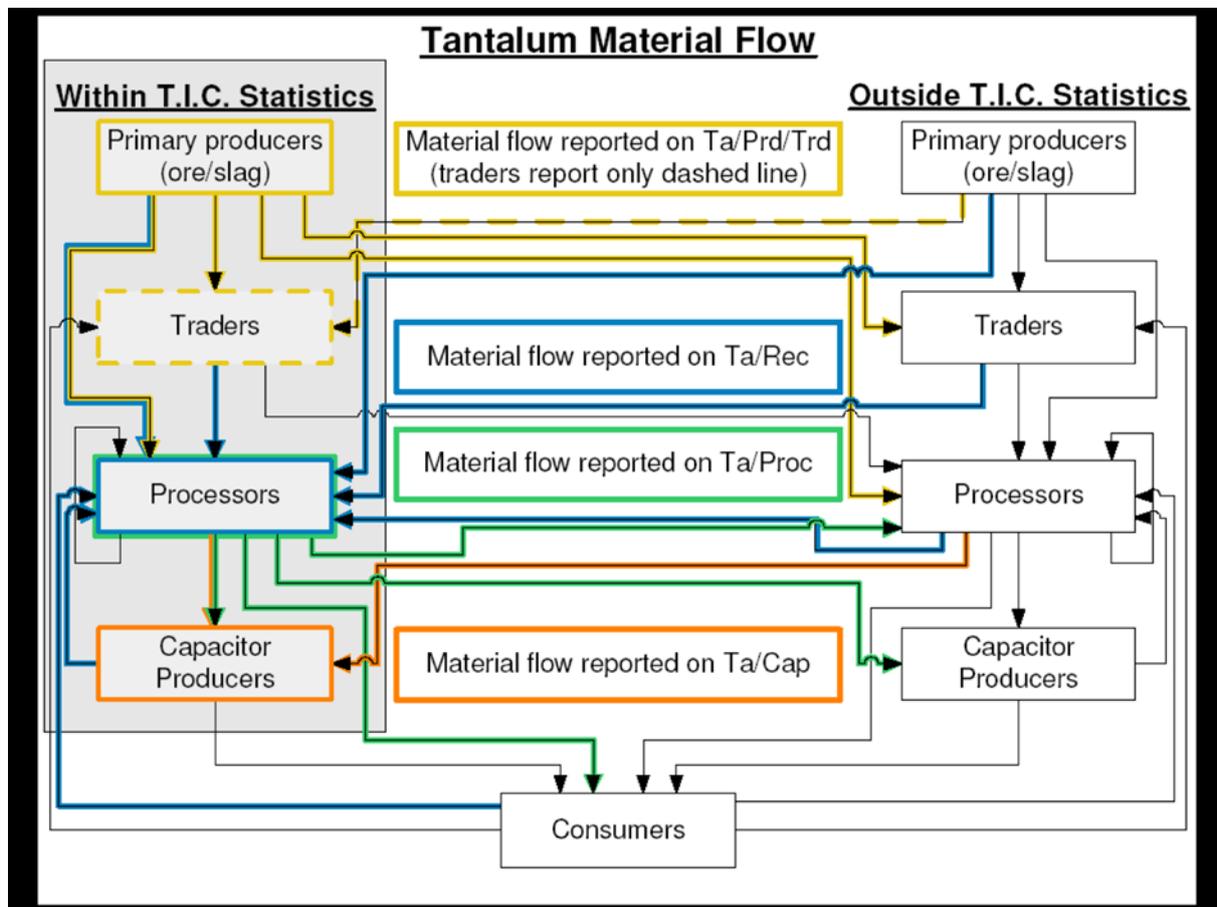


Figure 2 - Overview of tantalum material flow

➔ **Tantalum raw material production by primary producers**

The reporting principle for tantalum primary producers is identical to that for niobium, *i.e.* that *all* production is reported regardless of which company it goes to, whether inside or outside of membership.

Tantalum production material flows (represented by the solid black/yellow line) are reported in three separate categories:

1. Tin slag (over 2% Ta<sub>2</sub>O<sub>5</sub>)  
*i.e.* where tantalum reports in the slag by-product from tin smelting;
2. Ta concentrate (all where Ta is primary)  
*i.e.* where tantalum is the main constituent of a mineral concentrate;
3. Other concentrates (columbite, struverite *etc.*)  
*i.e.* where tantalum is a minority constituent in other mineral concentrates.

➔ **Tantalum raw material receipts by trading**

The dashed black/yellow arrow depicts the traders' connections; only the material arriving from outside the membership is coloured. As primary production by T.I.C. members is already reported, traders do not report receipts from T.I.C. members in order to avoid double counting. Traders only report receipts from non-member companies.

The form and categories used are the same as for primary producers:

1. Tin slag (over 2% Ta<sub>2</sub>O<sub>5</sub>)  
*i.e.* where tantalum reports in the slag by-product from tin smelting;
2. Ta concentrate (all where Ta is primary)  
*i.e.* where tantalum is the main constituent of a mineral concentrate;
3. Other concentrates (columbite, struverite *etc.*)  
*i.e.* where tantalum is a minority constituent in other mineral concentrates.

## Tantalum receipts by processors

For tantalum processors, there are two reporting steps, the first one shown by blue arrows represents their receipts except that from other T.I.C. member processors (hence the return loop to the left of the blue-green 'processors' box not being coloured in).

The receipts data are reported in two separate categories:

1. Primary raw materials (*e.g.* tantalite, columbite, struverite, tin slag, synthetic concentrates)  
*i.e.* any raw material<sup>9</sup> containing tantalum;
2. Secondary materials (*e.g.* Ta<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>TaF<sub>7</sub>, scrap)  
*i.e.* intermediate products and scrap from other processors or downstream companies.

## Tantalum product shipments by processors

The second reporting step for tantalum processors is shown by green arrows; for all their product shipments except those to other T.I.C. member processors (hence the return loop to the left of the blue-green 'processors' box not being coloured in).

The product shipment data are reported in six separate categories:

1. Tantalum chemicals (*e.g.* Ta<sub>2</sub>O<sub>5</sub>, TaCl<sub>5</sub>, K<sub>2</sub>TaF<sub>7</sub>)  
*i.e.* all grades of chemical products, whether intermediates such as K<sub>2</sub>TaF<sub>7</sub> (a.k.a. 'K-salt') or high grades for *e.g.* optical, Chemical Vapour Deposition, or tool making applications;
2. Tantalum carbide (TaC)  
*i.e.* carbide for tool making applications;
3. Capacitor-grade tantalum powder  
*i.e.* high grade powder specifically formulated for the production of tantalum capacitors;
4. Tantalum ingot  
*i.e.* as an intermediate for mill products, or for *e.g.* master alloy and aerospace applications;
5. Mill products of tantalum  
*i.e.* various forms of tantalum including bar, powder, rod and tube for *e.g.* chemical process equipment applications, or wire for the production of tantalum capacitors;
6. Metallurgical-grade powder, unwrought metal, scrap, other  
*i.e.* various intermediate products.

## Tantalum receipts by capacitor producers

Finally for tantalum there is the additional step of capacitor producers, showing how they report *all* receipts regardless of where it originates (black/orange arrows).

The capacitor producers report receipts data in three separate categories:

1. Tantalum powder  
*i.e.* high grade powder specifically formulated for the production of tantalum capacitors;
2. Tantalum wire  
*i.e.* mill products in the form of wire for the production of tantalum capacitors;
3. Mill products (except wire)  
*i.e.* all other mill products related to the production of tantalum capacitors, such as furnace parts, holding strips, sinter trays *etc.*

<sup>9</sup>Note this category includes "synthetic concentrates", which are produced from tin slag or recycled scrap.

## Summary of what T.I.C. statistics represent:

- For both niobium and tantalum:
  - \* Primary producers report *all* raw material production
  - \* Traders report receipts from non-members only
- For niobium only:
  - \* Processors report product shipments, except not to other member processors
- For tantalum only:
  - \* Processors report receipts *and* product shipments, except not receipts from or shipments to other member processors
  - \* Capacitor producers report *all* receipts

## What other statistics are there?

Customs agencies in each country compile data on imports and exports in order for their governments to levy relevant taxes. Data are compiled according to commodity specific codes, where the first six digits are in accordance with an international Harmonised System. Eight- or eleven-digit codes are country specific and are often not comparable between countries.

Examples of countries compiling relevant data, with links to Customs authorities or trade databases from where such statistics data can be obtained, are listed below:

Country or Region	Website	Notes
Australia	<a href="http://abs.gov.au">abs.gov.au</a>	2615.90.30 withheld (commercial confidentiality)
Western Australia	<a href="http://dmp.wa.gov.au">dmp.wa.gov.au</a>	Provides tantalite tonnage up to 2008
Brazil	<a href="http://dnpm.gov.br">dnpm.gov.br</a>	
Canada	<a href="http://ic.gc.ca">ic.gc.ca</a>	Shows exports in USD for 261590 or 720293 FeNb
China	<a href="http://english.customs.gov.cn">english.customs.gov.cn</a>	
DR Congo	<a href="http://douanes.gouv.cd">douanes.gouv.cd</a>	
Ethiopia	<a href="http://csa.gov.et">csa.gov.et</a>	
European Union	<a href="http://madb.europa.eu">madb.europa.eu</a>	Covers all 28 EU member states
Japan	<a href="http://mof.go.jp">mof.go.jp</a>	
Kazakhstan	<a href="http://kyzylorda.stat.gov.kz/eng">kyzylorda.stat.gov.kz/eng</a> or <a href="http://stat.kz/">stat.kz/</a>	
Malaysia	<a href="http://customs.gov.my">customs.gov.my</a>	
Russia	<a href="http://russian-customs.org">russian-customs.org</a>	
Rwanda	<a href="http://rra.gov.rw">rra.gov.rw</a>	
Thailand	<a href="http://search.customs.go.th">search.customs.go.th</a>	2615.9000.001 / 2615.9000.002
United Nations	<a href="http://comtrade.un.org">comtrade.un.org</a>	For all countries in the world, where data available; often less detail than individual countries
USA	<a href="http://dataweb.usitc.gov">dataweb.usitc.gov</a>	

The functionality or 'user friendliness' of these sites varies greatly, with some being easily searchable and providing a good level of detail, while some are not freely searchable by the public.

## Are these comparable?

There are limitations due to Harmonised System codes not always being sufficiently specific, especially in the case of 261590 which includes three metals: tantalum, niobium and vanadium. In many cases this makes it almost impossible to determine the volume of Ta and/or Nb. While some countries provide greater detail by using 8- or 11-digit codes, these are not comparable between countries.

Customs data may not be easily accessible, or data may be presented in different units such as weight or monetary value. In both cases assumptions have to be made as to being gross weight and the average grade, as well as the historical market price, in order to obtain the nett weight contained.

Given these and potentially other issues, care must necessarily be applied in using such data. Nevertheless these additional sources of data constitute a potentially useful source of information. **TIC**

### Comment on 'gaps' in tantalum statistics

At various points in the text, references are made or implied as to 'gaps' in the T.I.C. tantalum statistics, *i.e.* that the data are incomplete due to the absence of a number of companies from the membership, even if the data are considered to cover, in most cases, the majority of the volume of tantalum.

Where is this 'missing' tantalum then? It's out there, only it can not be included in the T.I.C. data as these are based entirely on figures reported by the T.I.C. members, and the T.I.C. can and should not make any adjustment to the members' figures.

Nevertheless the author may attempt a personal opinion. The areas where there are believed to be gaps in the T.I.C. statistics are, with the author's personal percentage estimate:

- tantalum raw material production, a gap up to 30% of the actual volume
- tantalum capacitor producers' receipts, a gap up to 35% of the actual volume

While the gap in raw material production has reduced somewhat, it remains significant. There is very little in the way of industrial mining by non-members, therefore most of the 'missing' material is believed to be from artisanal mining.

There is also a considerable gap in capacitor producer receipts, mainly due to various capacitor producers that remain outside of the membership.

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