A downstream customer’s view on conflict-free minerals
(see page 11)

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Dear Fellow Members and Friends,

As I write this letter here in New England, there is still lingering snow on the ground with more expected shortly. However, it’s clear spring is on the way and that’s always a time of renewed optimism. It’s clear both tantalum and niobium have rebounded, as we see capacitor demand strengthening, for example.

Your Executive Committee (or ExCom) and T.I.C. staff have been hard at work in several areas. First, under the leadership of Roland Chavasse and our desire to develop stronger relationships with our members, a monthly email update was initiated this past quarter. Your feedback on this venture would be sincerely appreciated please.

Secondly, we have a long term ongoing effort to attract and build better links with downstream consumers of both Ta and Nb. The Plantronics article in this issue, based upon Mark Alexander’s presentation in Toulouse, is reflective of this. On a related note, as we continue to seek proposed talks for our Technical Symposium in Vancouver next October, you are encouraged to volunteer and submit possible presentations please, including a focus on downstream applications.

Our Supply Chain sub-team, ExCom, and staff have spent a lot of effort this past quarter discussing and formulating a reply to the U.S. Securities and Exchange Commission (or SEC) on their request for comments about Section 1502 on conflict minerals in the Dodd-Frank act. Our response has been sent to all members and is a matter of public record (available on page 7 of this newsletter and also on the T.I.C.¹ and SEC² websites).

It is interesting to note that not just the SEC is looking at Section 1502, but also the U.S. Department of State, for instance. While it is uncertain, at this time, how the Trump administration will decide this issue, it is clear that major downstream consumers, particularly those in consumer electronics, will continue to insist that upstream supplier companies maintain proper due diligence and traceability programs. These programs will be global in nature and not just looking at central Africa.

Moreover, current OECD due diligence guidance is not just about conflict minerals, but also has a human rights component. We expect such concerns to continue to increase over time, such as issues with child labor, for example, and likely eventually including the environment as well. At this stage, while it’s still unclear where the EU will eventually end up with their proposed regulations on this issue, an important consideration for the T.I.C. is that there is harmonization of such standards around the world, so there are not different regulations in different regions, for example.

As will be discussed more fully in the next edition of the Bulletin, Roland Chavasse has recently visited Rwanda for the first time. While we are well aware that the tantalum industry’s efforts there are far from perfect, including iTSCI’s regional supply certification mechanism, we do push them to continuously improve. Your ongoing suggestions and advice on how to improve in this area are sincerely appreciated. Given the ongoing uncertain political situation in Kinshasa, DRC, we continue to monitor this closely.

Finally, we are well aware that we have to offer you value for money for your membership dues. While we have recently had more members withdraw from the organization than originally budgeted, for various reasons, we do seek to provide more benefits to you.

Sincerely yours,

David Henderson

President

¹ http://www.tanb.org/news-view/lic-comments-on-dodd-frank-1502
² https://www.sec.gov/comments/statement-013117/statement013117.htm
Director’s Letter

Dear T.I.C. Members,

The first quarter of the calendar year is always when the General Assembly machinery steps up a gear and this year is no different. Speakers and sponsors are falling into place (although some opportunities still remain if you are interested?), catering is booked for the gala dinner and plans are advancing for the accompanying persons’ tours. Planning for a conference takes many months and is the culmination of a significant team effort and at this stage in proceedings I believe the 58th General Assembly will be one to remember for all the right reasons.

Rwanda calling

As the T.I.C.’s supply chain officer and representative to iTSCI, it has long been in the pipeline for me to visit Rwanda and learn first-hand from the upstream producers their views and experiences of the tantalite-columbite supply chain. My first impressions of Rwanda are of the beauty of its landscape and open friendliness of the people.

Everyone, from the artisanal miners who showed me their mine through to senior government ministers and cabinet members (see right), has extended the hand of friendship to the T.I.C. and the wider tantalum industry and I look forward to returning again soon. A fuller report from Rwanda will feature in Bulletin N°170.

Statistically significant

Many thanks to all of our members who participated in the recent statistics questionnaire. The turnout was strong and we received a great deal of constructive feedback. The initial findings are on page 8 of this newsletter and in due course Alexey Tсораyev and his Statistics Subteam will share their strategy for the future.

Looking ahead, in the coming quarter my colleagues and I will be representing the Association at the MMTA’s conference in Dublin, Ireland, the OECD forum in Paris, France, and at the TRANSSC meeting (NORM transport) in Vienna, Austria. The T.I.C. is always keen to promote niobium and tantalum to new audiences so please let us know about events that you think we should attend. Talking of which, on March 30th I attended the grand opening of Metalysis’s new Materials Discovery Centre near Sheffield, UK, and learned a great deal about the current and future applications for metal powders; truly cutting edge technology.

Best wishes, Roland Chavasse, Director

Sponsorship opportunities at the Fifty-eighth General Assembly

Sponsorship puts your company in front of the global leaders in tantalum and niobium in a targeted and cost-effective way.

Opportunities available include the Gala Dinner, cocktail receptions, networking breakfasts and lunches.

Sponsorship packages are available on a first-come, first-served basis so book early to avoid disappointment.

Contact director@tanb.org for details.
European Union conflict mineral regulation to be approved

On March 16th 2017, the European Parliament (the body of elected MEP politicians) approved a draft European Union (EU) regulation to prevent the minerals trade from funding conflict and human rights violations by 558 votes to 17. Following this decision the European Council (the institution that comprises the EU member states’ governments) will be asked to approve the legislation, a process that is expected to be complete by June 2017.

The new EU legislation covers tin, tungsten, tantalum, gold (3TG) minerals from conflict-affected and high-risk areas and has been in development since 2015. The legislation is in line with OECD’s *Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (Third Edition)* and importers will be expected to follow the five-step framework per the guidance.

It requires risk assessments and reporting by all but the smallest companies for all 3TG minerals and metals smelted in EU countries or imported to the EU from those countries determined to be of high risk (a list that has not yet been finalised). Larger manufacturers shall also be required to disclose how they plan to monitor their sources to comply with the rules.

The main elements of the legislation are as follows:

- **Countries of origin:**

  Although it had been expected that the new EU legislation would not limit itself geographically or by specifying particular elements both of these expectations have been dashed. A group of experts is currently creating a list of higher-risk countries which will form the initial focus of the legislation, although this list is expected to have regular revisions in the future as the landscape of risks evolves.

- **Material scope:**

  Initially the legislation will cover tantalum (Ta), tin (Sn), tungsten (W) and gold (Au), but it is expected that this list will increase in time.

- **Mandatory checks for importers:**

  Due diligence checks, in accordance with OECD guidelines, should be mandatory for importers of 3TG from conflict and high-risk areas. Importers shall also keep documentation demonstrating their respective compliance with those obligations, including the results of the independent third-party audits.

- **Small importer exemption:**

  Small importers will be exempt from mandatory checks. Thresholds are set out in the annex of the full document¹.

- **Scrap and recycled material:**

  In line with the OECD’s due diligence guidance, materials that are demonstrably scrap and recycled materials are exempt unless they are mixed with non-scrap raw materials.

- **Review clause:**

  Two years after the date of application of this regulation and every three years thereafter, the European Commission (the EU’s executive branch) should review the functioning and the effectiveness of this regulation and the latest impact of the scheme on the ground. It may also have to propose additional mandatory measures should the application of due diligence by companies prove unsatisfactory.
• Recognition of existing supply chain due diligence schemes:

Governments of EU countries, industry associations and groupings of interested organisations having due diligence schemes in place (‘scheme owners’) may apply to the Commission to have the supply chain due diligence schemes that are developed and overseen by them recognised by the Commission. That application shall be supported by adequate evidence and information. Privately, representatives from the Commission have told the T.I.C. that they are aware that the tantalum industry has already demonstrated considerable leadership in due diligence procedures and conflict-free auditing, and that existing industry schemes have a useful contribution to make (see Bulletin N°165). It is the current intention of the iTSCI Programme, the Conflict-Free Sourcing Initiative (CFSI) and BSP to apply for recognition of their programmes. The T.I.C. is following this aspect of the regulation particularly closely.

• Third-party audits:

Third-party audits will include information on all of EU importers’ activities, processes and systems used to implement supply chain due diligence regarding minerals or metals, including their management system, risk management and disclosure of information. The audit shall also include recommendations to the importer as to how to improve its due diligence practices and must respect the audit principles as laid down in the OECD Due Diligence Guidelines.

• Disclosure obligations:

European Union importers of minerals or metals shall make available to the Member State competent authorities the reports of any third-party audit or evidence of conformity with a supply chain due diligence scheme recognised by the Commission. They shall also make available to their immediate downstream purchasers all information gained and maintained pursuant to their supply chain due diligence with due regard for business confidentiality and other competitive concerns.

Looking ahead

Once the European Council has approved the deal, it will be published in the EU's “Official Journal” 2 and passed into law.

Later this year the Commission is expected to publish its list of high-risk countries and also a so-called "white list" of global smelters and refiners which it knows source responsibly. Simultaneously, EU member states will start to appoint their competent authorities; the bodies responsible for ensuring compliance by companies and also for determining penalties for non-compliance. It is recommended that organisations involved in the 3TG industries ask member states to appropriately fund and train their respective competent authorities in supply chain issues and due diligence procedures.

Due diligence obligations will apply from January 1st 2021 to allow member states time to appoint and prepare their competent authorities and allow producers and importers to become familiar with their obligations.

Although it is too early to say with certainty whether the extensive due diligence procedures and conflict-free auditing standards that have already been established within the tantalum industry will satisfy the new regulation, sources in Brussels suggest that such a scenario is likely, at least to an extent. As the situation develops a further update will be circulated to T.I.C. members.

This article has been written with assistance from the CRM Alliance, a multi-commodity industry group focused on those elements listed as critical raw materials by the European Union. The T.I.C. is a member of the CRM Alliance.


2 Official Journal of the European Union is located at http://eur-lex.europa.eu/oj/direct-access.html

3 The website of the CRM Alliance is http://criticalrawmaterials.org/
iTSCi in focus: incident reporting process

This article formed part of a presentation given by Roland Chavasse, T.I.C. Director, at the Association’s 57th General Assembly held in Toulouse, France, in October 2016. The full presentation is available to members via the T.I.C. website. The iTSCi Programme aims to work within the OECD’s framework and to comply with the UN guidelines to create a system that assists companies with traceability, due diligence and audit requirements that arise from purchasing 3T minerals, particularly from the DRC and Rwanda. The T.I.C. and ITRI sit on the iTSCi Governance Committee.

One of the core processes of the iTSCi Programme is the reporting of incidents that allows problems to be identified, worked through and learned from. An incident is any event that contravenes the Dodd-Frank Act (1502) or the OECD or UN guidelines and includes abuse of the system, human rights abuses, bribery, illegal trading, smuggling, selling tags, charging for services, tagging illicit material, or breaking the terms of iTSCi membership. Every incident is numbered, recorded and copies of all supporting documents, photos, tag details, etc., are stored with the report. Regularly, summaries of incidents are circulated to the iTSCi membership for action so that Programme members can understand the risks in their supply chains and act accordingly.

Incidents are broken down into five categories and each category is then broken down into three levels depending on the seriousness of the incident, with 1 being the most serious. The more serious the incident, the higher up in iTSCi the incident is dealt with; for example, the Governance Committee is immediately informed of all level 1 incidents such as conflict minerals, whereas some level 3 incidents, such as poor staff training, are often dealt with by a steering group of community stakeholders adjacent to where the incident took place.

### Total incident summary (April 2011 to June 2016)

<table>
<thead>
<tr>
<th>Incidents by level</th>
<th>Incidents by type</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="chart1.png" alt="Incidents by level chart" /></td>
<td><img src="chart2.png" alt="Incidents by type chart" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
<td>23%</td>
<td>75%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Security</th>
<th>Corruption</th>
<th>Chain of custody</th>
<th>Due diligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>8%</td>
<td>7%</td>
<td>13%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Each year between 600 and 700 incidents are reported, of which, on average, 75% are the lowest category (level 3), 23% are the intermediate category (level 2), and 2% are the more serious category (level 1). Of the incidents that get reported, some 70% relate to chain of custody problems such as sloppy tagging procedures, 13% to human rights issues, 8% to due diligence and 7% to security.

Incident reporting is time consuming but has been shown to work: for example, in 2016 an independent end-user of tantalum examined over 700 incidents recorded during 2015, a considerable undertaking that took several months to complete and included visiting the region. They found just $400 of possible conflict funding.

If you know of risks that are currently overlooked, please come forward to iTSCi, or to the T.I.C., but be prepared to answer follow-up questions and provide evidence, especially if national police authorities become involved which may be inevitable if an incident contravenes national laws.

Sunlight is often the best disinfectant and stamping out wrongdoings will improve the system for all those who are acting in a legitimate way. All of us involved in supply chain need to constantly be striving to improve the system, so always keep in mind the old rule of thumb of risk mitigation: When were you told about a risk? What were you told about a risk? And what did you do about that risk?
T.I.C. letter to the U.S. SEC regarding Dodd-Frank Section 1502

The U.S. SEC Commission is examining the current status of Section 1502 of the Dodd-Frank Act (DF-1502) covering reporting requirements for U.S. companies sourcing tantalum, tin, tungsten and gold from the Democratic Republic of Congo (DRC) and neighbouring countries. The T.I.C. has submitted the following open letter to the U.S. SEC for its consideration. If you wish to read all the comments on DF-1502 received by the SEC then please visit the second link shown on page 2.

Michael S. Piwowar
Acting Chairman of the United States Securities and Exchange Commission (SEC)
100 F Street NE
Washington, D.C. 20549
United States

Dear Acting Chairman Piwowar,

Comments on the Dodd-Frank Wall Street Reform and Consumer Protection Act Section 1502 (DF-1502)

The Tantalum-Niobium International Study Center (T.I.C.) is the international association representing the tantalum and niobium supply chains. The T.I.C. absolutely supports due diligence requirements for mineral sourcing provenance. Our membership believes that verified supply chains which confirm that sourcing is legal, ethical, responsible and sustainable, will improve the quality of life for those directly involved in mining and provide consumers with confidence that they are ethically supporting minerals industries. While the T.I.C. supports the extra weight that DF-1502 brings to our industries’ due diligence efforts, our members believe that the wording of DF-1502 incorrectly stigmatizes a select few minerals and countries.

The T.I.C.’s views on due diligence are established in the Association’s ASM (Artisanal and Small-scale Mining) Code of Conduct, adopted by the T.I.C.’s members in October 2016 to replace the Association’s 2009 ASM Policy. Central to this process is the OECD's due diligence guidance, which is clearly-written, non-discriminatory in its application, and has a proven track-record of practicality in the field. The scope of the OECD’s due diligence guidance also covers human rights, which this Association also fully supports.

Dodd-Frank’s Section 1502 (DF-1502) shares some similarities with the OECD’s guidance and has given extra credibility to the field implementation of mineral validation processes since 2011. However, unlike the OECD’s guidance, DF-1502 is discriminatory both geographically and in targeting only tantalum, tungsten, tin and gold (‘3TG’). Under DF-1502 all 3TG minerals are called ‘conflict’ minerals regardless of their origin or the certification of the supply chain. Similarly the DRC and its neighbours are termed ‘conflict countries’ regardless of the presence, or former presence, of conflict. The T.I.C. believes DF-1502 was written quickly in response to a set of particular events, and attempted to achieve simple, inflexible solutions from a highly complex situation; now the named countries and industries are left with an inappropriate perpetual dictum.

Therefore, while in general agreement with the overarching goals of DF-1502, the T.I.C. questions its geographical, temporal and mineral ambit:

1. Why should the DRC and its neighbours be singled out for special treatment rather than ‘conflict-free’ sourcing procedures being a global requirement?
2. What criteria determine whether and for how long the DRC and its neighbours are classified as ‘conflict’ countries?
3. Why should 3TG be singled out and tainted as the only ‘conflict’ minerals rather than requiring all mineral supply chains to undergo a risk-proportionate level of due diligence?

In our view, world-class original equipment manufacturers (OEMs) are extremely likely to continue demanding responsible sourcing best practices from their supply chains, especially considering the imminent European Union (EU) legislation on this subject. The T.I.C. urges the Securities and Exchange Commission Commissioners to take this opportunity to review and improve the law to enable clear and uniform implementation in line with the OECD guidance (as is the EU legislation), and in doing so recognize the importance of responsible supply chains to business and the livelihoods of the most vulnerable within those supply chains.

Yours sincerely, The President, Executive Committee and Director of the T.I.C.
Statistics: initial findings of the 2017 questionnaire

In February 2017 the T.I.C. circulated to its corporate members a questionnaire asking them about the statistics service provided by the Association. Members responded in large numbers and we are confident that the replies we received represent members’ views. This is a summary of the uninterpreted quantitative feedback we received; qualitative feedback is being studied by the Statistics Subteam, led by Alexey Tsorayev, and will be presented to the Executive Committee at its April meeting.

It is the intention of the T.I.C. to have an excellent statistics service that provides useful information to our corporate members, that educates and informs them about market trends. For many years the Association has operated the statistics service without changing the core methodology of how and what data is collected, aggregated or distributed. In 2016 the Statistics Subteam was established to examine the fundamental assumptions behind the statistics service, starting with this questionnaire.
* Members’ confidential data is collected by Miller Roskell Ltd, a chartered accountancy that is 100% independent of the Association. Miller Roskell Ltd has collected members’ statistics since 2015. It is a member of the Association of Chartered Certified Accountants and is ruled by their client confidentiality rules. Their website is www.millerroskell.co.uk. The T.I.C. has no access to the confidential data and only sees the anonymised, aggregated data that is presented to members.
Did you know that both members and non-members can ask technical questions to the Association’s Technical Officer, David Knudson?

This service is designed to promote a better understanding of and within the tantalum and niobium industries, and questions have no limit in their scope. If you have a question please don’t hesitate to contact David. All correspondence for this service is by email and the response time will depend on the complexity of the question, but is typically 5 working days.

**About Mr Knudson**

Mr Knudson has been in the tantalum industry for over 30 years, first spending 23 years at Cabot Corporation’s Boyertown plant (now part of Global Advanced Metals, GAM), before working for 8 years with Niotan Inc., and 3 years with KEMET Corporation. David began his career at Cabot as a Research and Development (R&D) Technician working on tantalum powder development projects. After KEMET purchased the Niotan plant in 2011, David held the position of Engineering Manager. David joined the T.I.C. on July 29th 2016.

**Frequently Asked Questions (FAQ)**

In a typical year the T.I.C. receives around one hundred enquiries and a comparison of enquiries from members versus non-members indicates non-members were most interested in information about prices or market forecasts, while members asked more about regulations such as REACH and due diligence guidance.

The identity of companies and individuals that use this service is treated as confidential to the T.I.C. although the Association retains the right to add anonymised and/or general questions and answers to the Frequently Asked Questions (FAQ) section of its website.

To ask your question simply email tech@tanb.org; he’s looking forward to hearing from you!

(Please note that the T.I.C. is constitutionally bound not to discuss current or future prices of tantalum and niobium items.)

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**The 5 most popular questions**:  
- Would you like to buy my tantalite?  
- What are the prices of tantalum and niobium?  
- What is 'colltan'?  
- How do I measure the radioactivity level in becquerels per gram (Bq/g) of my minerals?  
- Why is niobium also called columbium?

* Answers available at www.tanb.org
Abstract

Non-Governmental Organizations and consumers have recently focused on socioeconomic issues in the global supply chains. The most visible of these concerns has been on funding of conflict through natural resource extraction, in particular the mining of tin, tantalum, tungsten and gold in the Democratic Republic of Congo (DRC). The resultant US conflict minerals legislation and SEC implementation rules caused companies to examine where materials are used within their supply chain in order to determine if the metals in their products have contributed to the funding of this conflict. Our survey of our supply chain revealed more tantalum use than we expected. Nearly one third of our supply chain provided products or components containing tantalum, and thirty-four distinct tantalum processors were reported in our supply chain, eight of them occurring more than ten times. Public facing public companies that, in many cases, are both far removed from mineral extraction and processing, and resource limited, need to determine the conflict-free status of all of the minerals.

Companies therefore work through downstream industry associations to implement validation of conflict-free sourcing. The co-operation of the companies closer to the sourcing of the minerals, i.e. smelters and refiners, is key in developing and validating a conflict-free supply chain, and at the same time, not creating a de-facto embargo of minerals from central Africa. The participation of industry organizations such as T.I.C. and the influence on their members has proven to be one of the most effective ways of achieving these goals. Global legislation is now expanding the scope beyond conflict in the DRC. The expansion is geographical, other minerals, social issues like forced and child labor, and environmental issues. Continued cooperative efforts between downstream companies and organizations and upstream processors will be even more critical to addressing these issues.

Plantronics is a global leader in contact center, consumer Bluetooth®, air traffic control, and business communications devices. The company is headquartered in Santa Cruz, California and has more than 3,000 employees worldwide, including major hubs in the Netherlands, China, UK, and Mexico.

Introduction

In the last few years, social and environmental practices in consumer facing companies’ supply chains have received increasing scrutiny. This attention has tended to originate with non-governmental organizations (NGOs) such as the Enough Project and Global Witness, who create public awareness, which in turn eventually may result in pressure to create government regulatory solutions. Some socially conscious companies will be at the forefront of creating programs to monitor and mitigate abuses in the supply chain, because they believe it to be the right thing to do and have the resources to do so. Other companies may act only when it becomes absolutely necessary. The reason is often resource limitations which hinder smaller companies’ ability to be proactive. For this reason, collaboration amongst both downstream customers and companies further upstream in the supply chain becomes critical to successfully monitoring and mitigating these issues.
One of the most visible of the supply chain concerns to arise has been the funding of conflict in the eastern Democratic Republic of Congo (DRC), through control of various portions of the mineral extraction sector, specifically the “3TG”, tungsten, tin, tantalum, and gold. Public Awareness eventually resulted in Section 1502 of the US Dodd–Frank Wall Street Reform and Consumer Protection Act. This section required all companies subject to US Securities and Exchange Commission (SEC) rules to file an annual report outlining the sourcing of 3TG in their products, and a statement on whether or not the sourcing directly or indirectly funded armed conflict. This requirement was a considerable challenge for most companies, who not only did not have the resources to investigate mines, but often had to start with learning where 3TG were used in their products.

Finding where 3TG were in products varied quite a bit by industry, and in electronics, the easiest one was tin, since we all use solder. Gold is used for bonding wires and conductive coatings, but tungsten and tantalum are less familiar elements. Tungsten was found to be used in fabrication of integrated circuits (IC). However, while most electrical engineers and purchasing managers have heard of tantalum, this is what the word “tantalum” would conjure up:

![Figure 1: What an electrical engineer might think of when hearing the word “tantalum”](image)

The next challenge for the end user would be going back through the supply chain from the solder, gold bonding wire, IC or tantalum capacitor, through the various steps, to the mine. The example of tantalum is shown in figures 2a and 2b. Most people working in the electronics industry had probably never seen metallic tantalum ingots, powder or oxide, and certainly would have had little or no knowledge about coltan.

![Figure 2a: What an electrical engineer might not think of when hearing the word “tantalum”](image)
Supply chain investigation would need to be done and, according to the SEC rule, due diligence done in accordance with the OECD’s Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas. There are many thousands of artisanal and large scale mines, and also many thousands of end-user companies, but a limited number of entities that process the mineral to the metal. The classic hourglass diagram was effectively used to divide upstream from downstream in the mineral supply chain and illustrates why smelters and refiners were chosen as the best point to try to determine the origin of the minerals.

However, even narrowing down the investigation point to the expected fewer than 500 smelters or refiners, and with inquiries only from the 1300 companies obligated to report to the SEC, this could lead to the extremely burdensome tangle of requests for information (see figure 4a), perhaps in many different formats and, per the OECD, the independent audit of SOR (Smelter Or Refiner) sourcing practices. Coordination of efforts is obviously required, both for simplicity and because many companies, both upstream and downstream, do not have the resources to manage the process shown in figure 4a.
Option B shows how downstream co-operation is done primarily through the Conflict-Free Sourcing Initiative (CFSI), which originated as the EICC Extractives sub group, which Plantronics joined in January 2013. CFSI established the standard data collection format, the Conflict Minerals Reporting Template, which allows companies along the supply chain to create a standard response to satisfy multiple inquiries. CFSI collects information from members as to what entities are being reported as smelters or refiners by the supply chain, and investigates “alleged” SORs that have not been previously verified as meeting the definition of a smelter or refiner. Upstream organizations help with the determinations of the status of these entities.  And the most critical of the CFSI efforts is probably the Conflict-Free Smelter Program (CFSP) which audits and validates SORs (as required by the OECD guidance) as conflict-free.

For the upstream portion of the supply chain, industry organizations representing smelters, refiners, and other operators in the 3TG contribute in numerous ways to validating a conflict-free source of minerals. Some audits are conducted by the upstream organizations and recognized by CFSI. These efforts are critical to downstream companies.

**Gold, Tungsten and Tin**

In gold, the LBMA and RJC conduct audits and issue Responsible Gold certificates. These audits are cross recognized by CFSI with the agreement of the auditee.

For tungsten, the joint effort of the International Tungsten Industry Association (ITIA) and Refractory Metals Association (RMA) created the Ti-CMC (Tungsten Industry Conflict Minerals Council) to manage self-declarations on the part of tungsten smelters. This status is recognized by CFSI, though it is not awarded the same status as an LBMA or RJC certificate, since no third party audit is required.

For tin (and to some extent all 3T), ITRI set up the iTSCI program, a joint industry membership program assisting companies with traceability, due diligence and audit requirements for minerals from high risk areas, currently operating in DRC, Rwanda, Uganda and Burundi. It aids with compliance with the US Dodd-Frank Law on conflict minerals, but is not itself a certification system.
Tantalum: critical to a downstream company like Plantronics

The Dodd-Frank Section 1502 provision states that if a company knows or has reason to believe that materials in its products are or MAY be sourced in the covered countries, it must do due diligence per the OECD. The first SEC step is a Reasonable Country of Origin Inquiry (RCOI). For Plantronics, this was a very straight forward and simple exercise. In performing this step, Plantronics determined in a very short time that the manufacturers of tantalum capacitors likely sourced tantalum from the covered countries, so Plantronics would be obligated to perform due diligence and file a conflict minerals report with the SEC.

Plantronics due diligence efforts

Plantronics manufactures, and contracts to manufacture, headsets and associated equipment for consumer, corporate call center, aircraft, air traffic control and other applications. Our products are manufactured in Asia and North America and sold globally. Using the CMRT we surveyed a diverse, global supply chain, and we were a bit surprised that about 40% of our direct suppliers reported that tantalum was in the component, assembly, or product purchased by Plantronics. These suppliers reported a total of forty-five tantalum processing facilities listed on the CMRT standard smelter list, and eight of these appeared more than ten times in our supply chain. A total of eighteen tantalum processors overall sourced from the DRC, surrounding countries, or the countries listed as possible smuggling routes per CFSI RCOI information. Since a greater percentage of tantalum minerals originate in central Africa than the other 3TG, this number was not surprising. Therefore, the risk of sourcing minerals that may provide funding for armed conflict would appear to be high. Plantronics, and most other electronics companies, are then quite reliant on the tantalum processing industry to determine that our products are conflict-free.

However, the good news for companies utilizing tantalum in their products, is that the tantalum industry has the greatest percentage of smelters and processors validated as conflict-free of any of the 3TG. In fact, all known operational tantalum smelters are either validated as conflict-free or actively participating in CFSP to become validated. The T.I.C. has contributed to this outstanding record by being pro-active with actions like the 2009 Artisanal and Small-scale Mining policy and good governance membership requirements. In addition, T.I.C. members on CFSI sub-teams have provided assistance in determining status of entities reported as potential tantalum smelters, either through members’ supply chain inquiries or through direct application to CFSI by the entity.

What will be required in the future?

Near term, the EU conflict minerals proposal, while not in its current form having a regulatory impact on the furthest downstream actors, will impact EU importers of 3TG as the geographical scope will not be limited to central Africa. Other “conflict affected, high risk” geographical areas being mentioned are Myanmar (tin), and Venezuela and Columbia (tungsten and tantalum).

In addition to the increased geographical scope of the EU conflict minerals proposed legislation, other aspects of the mineral extraction are receiving increasing scrutiny, including other types of human rights abuses such as forced labor, child labor, and violation of indigenous peoples’ rights, as well as environmental impacts of resource extraction.

What will be the impact on smaller companies, both upstream and downstream, of the increased areas of interest and potential compliance requirements? There is also an increased demand by some downstream companies for conflict-free validation beyond the strict definition of smelters, which can harm the business interests of these companies if they cannot provide something. And finally, while the efforts of upstream companies will remain critical to downstream companies, what can the downstream, end user do to aid the upstream portion with compliance?

Acknowledgements:

Anna Li of Taike Technology (Suzhou) Co., Ltd for the tantalum ingot photos

David Henderson of Rittenhouse International Resources LLC for the invitation to present and background information on T.I.C.
Study of large size large grain superconductor niobium disks

Paper written by Zhao Hong-yun, Chen Ming-lun, You Yu-song and Huang Jun-feng, CNMC Ningxia Orient Group, and presented by Jiang Bin on October 18th 2016, as part of the Fifty-seventh General Assembly held in Toulouse, France.

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Abstract

The paper describes the physical properties of large grain niobium and its application in superconductor cavities, and the research into the processes to produce the 483 mm diameter disk large grain niobium. The difficulty in rolling niobium ingot is intergranular fracture, which was first researched and found that 290 mm diameter niobium ingot with cast large grains could be processed to 483 mm diameter disks with the same large grain, by rolling and vacuum annealing. The distribution of the grains is similar to the original ingot.

The 483 mm diameter disk large grain niobium ingot exhibited good plasticity and finished deep drawing to half cell without defect. This presentation shows how compared with normal metal deformation processes in this process the original metal grain could be maintained throughout rolling and annealing, to produce the large size large grain superconductor niobium disk to meet the demands for SRF cavity fabrication.

Keywords: niobium; superconductor cavity; large grain high purity niobium; rolling; anneal

1. Background

The cavity is the important component of a particle accelerator. Dissipation happens when the superconductor radio frequency cavity made from fine grain niobium is tested at low temperatures. The Q-slope at high Eacc of the Q-Eacc curve is one of the results of this dissipation. Study of this phenomenon is focused on the interface of the grain boundaries within the niobium base material. These grain boundaries retain hydrogen and other impurities and degrade the superconducting properties of the niobium [1].
Good test results of cavities made from large and single grain niobium are of interest to cavity researchers. The large grain niobium material results in fewer grain boundaries, simplified processing, and improved properties of the cavity. DESY and HERAEUS developed the niobium large grain disk in 2007-2008 [2]. Peking University and Ningxia OTIC developed the niobium large grain sheet in 2005-2007 [3]. Jefferson Lab, DESY and KEK, the labs which research superconducting radio frequency cavities, have fabricated the cavity with large grain niobium successfully and observed encouraging test results. A large grain niobium 1.3 GHz single cell cavity made by DESY achieved an accelerated gradient of 40 MV/m after electric polishing [4]. A large grain niobium 1.5 GHz single cell cavity made by Ningxia OTIC achieved an accelerated gradient of 46 MV/m after electric polishing (see figure 2).

The large grain niobium disk was sliced from a niobium ingot. But some researchers need larger diameter disks than the 1.3 GHz cavity. Jefferson Lab needs 483 mm diameter large grain niobium disks to fabricate a 650 MHz cavity. The original method of slicing the large grain disk directly from the ingot does not meet the requirements for the new cavity prototype. More research is needed to produce larger diameter, large grain niobium disks which will benefit in the research of higher performance cavities.
Figure 3: Cross section of the large grain niobium disk with two half cavities

2. The production of large diameter large grain niobium disks

2.1 The process

Figure 4: Schematic of ingot processing.

Figure 5: Disk grain distribution of original (left) and finished (right)
The process is: ingot – large grain niobium disk with diameter of 290 mm – machining of sides – rolling – etching – annealing – flattening – machining – etching. With this process, a large grain niobium disk with a diameter of 483 mm and a thickness of 4 mm was obtained from a large grain niobium disk with a diameter of 290 mm and a thickness of 18 mm. RRR>300 (see figures 4 and 5).

2.2 A discussion of the process

2.2.1 Crack control from the outer profile

The outer profile of the niobium ingot is not smooth. Cracks around the diameter of the disk after rolling are routinely observed. These cracks grow along the grain boundaries towards the center of the disk with additional rolling. Machining around the diameter of the disk before rolling may control cracking along grain boundaries.

2.2.2 Rolling

It is thought the primary cause of crack propagation is anisotropy, or dislocation slide direction difference between two crystals at the grain boundary. This difference is caused by deep rolling of the material. The dislocation slide accumulates at the grain boundary creating a lattice defect. The physical crack is the macroscopic result of this defect. Annealing between rollings and reducing the amount of thickness reduction per roll may control or stop this from happening. Study of the rolling/annealing schedule is an important part of this project.

![Figure 6: The crack of the disk for reduction of ~35% (left) and ~50% (right)](image)

It has been observed that cracks grow more rapidly with rolling thickness reductions greater than 35%. Thickness reduction during rollings was controlled at 30% between the two cycles of annealing. This not only controlled the growth of a crack, but also the density of the dislocation inside the grain boundary while decreasing the possibility of generating new grain boundaries.

Variation in material thickness after rolling is also thought to be caused by the anisotropy of different grains. To improve disk thickness deviations, the material feeding direction into the rolls was altered 60 degrees with every turn in the rolling operation.

![Figure 7: The shrinkage at the finished large grain disk edge (left and right)](image)
With these rolling practices, cracks do not develop at the same rate. It was observed that the rough edge defects did not grow into larger cracks, while others stopped when meeting a vertical grain boundary.

![Image of in-site shrinkage](image1)

**Figure 8:** The in-site shrinkage of the beginning (left) and the finished (right) from 3# large grain disk

![Image of in-site shrinkage](image2)

**Figure 9:** The in-site shrinkage of the beginning (left) and the finished (right) from 2# large grain disk

### 2.2.3 Etching and annealing

Ultrasonic cleaning and etching of the niobium disk is necessary before vacuum annealing. It is thought to keep the niobium and the annealing furnace free of contamination. The rolled niobium disk is etched with blended acids (HF: HNO$_3$; H$_3$PO$_4$=1:1:2) for 10 minutes. Hydrogen is generated during the etching process which is readily absorbed by the niobium when the bath temperature exceeds 40°C. Therefore, the bath temperature is controlled to less than 40°C during the etching process. Hydrogen exists interstitially as niobium hydride (H$_x$Nb) in the niobium and affects the yield of the material and increases the risk of forming cracks while rolling. Vacuum annealing is the conventional way to remove the hydrogen in the niobium. The temperature profile used for annealing: 500°C for 60 minutes then 800°C for 120 minutes. After vacuum annealing the hydrogen content in the niobium is less than 2 ppm. Following this process, crack control is as expected and no new grain boundaries are created.

### 3. The repeatability of the process

To confirm repeatability of the large grain niobium disk enlarging process, a second piece of niobium was sliced from a different ingot and coded as 2#. After the same process, a disk increased in diameter from 290 mm to about 500 mm, resulting in a disk with similar grain numbers and distribution as the original example.
4. Chemical

With this study, an enlarged niobium disk was achieved, 483 mm in diameter with a thickness of 4 mm, RRR>300 and HV<65. Chemical composition was as reported in table 1.

<table>
<thead>
<tr>
<th>Elements</th>
<th>( W_{\text{element}} ) / ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ta</td>
<td>&lt;500</td>
</tr>
<tr>
<td>C</td>
<td>&lt;10</td>
</tr>
<tr>
<td>N</td>
<td>&lt;10</td>
</tr>
<tr>
<td>H</td>
<td>&lt;2</td>
</tr>
<tr>
<td>O</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>

Table 1: Chemical composition

5. Summary

It takes a 290 mm diameter large grain niobium disk as starting material to produce a 483 mm diameter large grain niobium disk based on the results of this project. The achievement of this study in metallurgy is in general, the large grain boundaries of niobium ingot material became fine grains after rolling and annealing while the final product retains the original grain boundary profile after rolling and anneal. The process also benefited from the excellent ductility of high purity niobium ingot.

Reference


Note: all photos are copyright CNMC Ningxia Orient Group Co., Ltd unless otherwise accredited.
Obituary: Sir Peter Mansfield, MRI pioneer, 1933-2017

Magnetic resonance imaging (MRI) machines are found in hospitals around the world and their diagnostic imaging techniques make an immeasurable contribution to improving human health. On February 8th 2017 the man who pioneered much of their development, Sir Peter Mansfield, died aged 83.

Growing up in London, UK, in the nineteen thirties and forties Peter Mansfield did not have a straightforward education; it was disrupted by war and evacuation so nobody was surprised when aged 15 he left school with no qualifications and only the prospect of an apprenticeship at a local printing works. However, this was no ordinary boy and from an early age an interest in science, especially rockets and flight, had fired his imagination.

Over the next fourteen years, through considerable hard work, he gave himself a more formal education by studying after work at evening classes, eventually completing a doctorate in nuclear magnetic resonance at Queen Mary College, London, in 1962. In the same year he married Jean Kibble and after a brief spell in the United States he took up a position in the physics department at Nottingham University, UK, where he was to stay until his retirement in 1994 as professor of physics. Mansfield’s work on magnetic resonance imaging (MRI, also called nuclear magnetic resonance (NMR) imaging) initially looked at the structure of crystals, but these proved impenetrable to the early MRI machines and he quickly moved on to biological samples which gave far better results. After testing various plants and vegetables from his garden Mansfield explored the possibilities of imaging human anatomy. The first MRI scan of a human was made in 1976 using a student’s finger.

Niobium makes MRI possible

At the heart of an MRI machine is a system of superconducting electromagnets. These non-permanent magnets are formed by winding copper-coated niobium-titanium (NbTi) alloy wire around a hollow core. During operation, the NbTi winding is cooled in a bath of liquid helium to minus 269°C, within a few degrees of absolute zero. At this temperature the electrical resistance within the wire falls to virtually zero, allowing a very large current to be applied without the wires heating or any loss in current flow. A higher current creates a higher magnetic field and some laboratory MRI machines can now achieve field strengths of up to 20 tesla (T).

In memoriam

In 2003, to crown his distinguished career, Mansfield was awarded a Nobel prize for medicine, shared with Professor Paul Lauterbur, for their pioneering work on MRI. According to John Talbot, an expert on MRI at Anglia Ruskin University, UK, although Mansfield didn’t originate the theory of using magnetic resonance to create images (this was Professor Paul Lauterbur) or build the prototype NMR body-scanner (this was done by Dr Ray Damadian in the United States) through his tireless efforts he was unquestionably the driving force who brought MRI to its full potential, especially in the field of medical diagnosis, and for that millions of people around the world can be grateful.

Sir Peter Mansfield with a modern MRI machine. Today some 36,000 are in operation globally. (photo: University of Nottingham)
Member company updates

Transfers of membership

H.C. Starck GmbH has applied to transfer its membership to H.C. Starck Tantalum and Niobium GmbH at the 58th General Assembly. The delegate to the T.I.C. will remain Mr Marc Hüppeler, who can be contacted at marc.hueppeler@hcstarck.com.

Changes in member contact details

Since the last edition of this newsletter the following changes have been made to delegate contact details:

- The delegate for ATI Specialty Alloys & Components has changed from Mr James Stearns to Mr Corey Smith. Mr Smith can be contacted at corey.smith@atimetals.com.
- MTU Aero Engines AG has nominated Ms Stefanie Winter as delegate to the Association. She replaces Mr Maximilian Pfau who has moved to another position within MTU. Ms Winter’s email address is stefanie.winter@mtu.de.
- The delegate for NPM Silmet AS has changed from Mr David O’Brock to Mr Tiit Vau. Mr Vau’s email address is t.vau@neomaterials.com.
- The delegate for Zimmer – Trabecular Metal Technology has changed from Mr Steven Seelman to Mr Mark Haskins. Mr Haskins can be contacted at mark.haskins@zimmerbiomet.com.

Resignations

The following companies have resigned from the Association since issue 168 of the Bulletin was published: AVX Corporation and DM Chemi-Met Ltd.

Members of the Executive Committee of the T.I.C. 2016-2017

The Executive Committee is drawn from the membership and committee members may be, but need not also be, the delegates to the T.I.C. of member companies. The Executive Committee named here was approved by the T.I.C. members at the Fifty-seventh General Assembly and consists of (in alphabetical order of member’s surname):

- Conor Broughton
- John Crawley
- David Gussack
- David Henderson (President)
- Marc Hüppeler
- Jiang Bin
- Kokoro Katayama
- Raveentiran Krishnan
- David O’Brock
- Candida Owens
- Daniel Persico
- Alexey Tсоряев

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david.obrock@gmail.com
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danielpersico-rc@nec-tokin.com
tсоряевaa@ulba.kz

Of these twelve, Mr David Henderson was re-elected as President of the T.I.C. until October 2017. The next elections will take place on Monday October 16th 2017 in Vancouver, Canada.

The T.I.C. currently has the following subteams (chaired by): Marketing (Daniel Persico), Meetings (David Gussack), Statistics (Alexey Tсоряев) and Supply Chain (John Crawley).

We are always looking for enthusiastic T.I.C. members to join the Executive Committee or one of our subteams. If you are interested in doing so and have a couple of hours each month spare, please don’t hesitate to contact director@tanb.org.
Vancouver, Canada: host city of the Fifty-eighth General Assembly

As the venue of the T.I.C.’s Fifty-eighth General Assembly, Vancouver is a city with something for everyone. From internationally renown cuisine and cultural treasures to world-class whale-watching and spectacular mountain scenery, a visit to Vancouver is memorable in many ways.

The year 2017 marks the 150th anniversary of the first European settlement in what is now Vancouver; a bar and a few shacks set up to service the embryonic logging industry in the vicinity. Evidence of this logging activity is still to be found in nearby Stanley Park, Vancouver’s largest park located about a mile (1.5km) from the waterfront. Since that unpromising start, the settlement, initially called Gastown, has thrived and grown to become Canada’s third largest city and that country’s gateway to the Pacific.

Geography favoured Vancouver: it sits on a sheltered deep-water harbour, enjoys a mild (if rather rainy) climate, and the surrounding mountains are filled with natural resources, including tantalum and niobium deposits. Since the transcontinental railway reached the city in 1887 it hasn’t looked back. Today the harbour is still very busy with ships, pleasure-craft and sea-planes, and will form a spectacular backdrop to the Gala Dinner at the General Assembly in October.

A great place to live (it’s official)

Vancouver is consistently named as one of the top five worldwide cities for liveability and general quality of life (for example by the Economist Intelligence Unit) and it’s easy to see why. With stunning mountain scenery, a thriving economy and growing population the outlook for this city is bright. Culturally the city is a popular filming location for both films and television, it’s surrounded by mountains, and also has thriving art, theatre and music scenes. Vancouver Art Gallery is known for its works by regional artists, while the Museum of Anthropology houses preeminent First Nations collections.

Today the inhabitants of Vancouver form one of Canada’s most ethnically diverse cities, including a sizeable Chinese-Canadian population. In the 1980s, an influx of immigrants from Hong Kong in anticipation of the transfer of sovereignty from the United Kingdom to China, combined with an increase in immigrants from mainland China and previous immigrants from Taiwan, established in Vancouver one of the highest concentrations of ethnic Chinese residents in North America.

The T.I.C. in Vancouver

The 58th General Assembly will be held from Sunday October 15th until Wednesday October 18th. Since it will be a technical seminar there will not be a field trip, but an additional plenary session. If you are interested in speaking or sponsoring please contact the Association as soon as possible as opportunities are limited.