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TANTALUM-NIOBIUM INTERNATIONAL STUDY CENTER

PRESIDENT'S LETTER

In the wake of the horrific terrorist attacks in the United States on September 11th, it is extremely difficult to continue with business as usual. Precipitated by such sheer boundless hate, the attacks have shaken the world to its very core and left us reeling from shock. On behalf of all member companies of the T.I.C., may I extend my deepest condolences to the families of the victims and to our colleagues in the United States. We sincerely hope that the global coalition will stay united in its resolve to combat this appalling terrorism.

This heightened sense of uncertainty has dealt a further blow to the already weakened world economy. Many experts speak openly about a recession, and, clearly, the electronics industry is one of the most hard hit – with all the inevitable consequences for the tantalum-niobium business. It is thus more important than ever that we work together in ensuring reliable supplies of tantalum and niobium products are available at reasonable prices. My predecessor as President of the T.I.C., Tom Odle, was equally dedicated to achieving this goal, and I would like to take this opportunity to thank him for this commitment. I am also grateful to the delegates for their vote of confidence in electing me to be President for the coming year at the General Assembly in Rio, and pledge to do everything in my power to bring stability to our sector.

I speak for all attendees in expressing my thanks to CBMM for their kind hospitality in Brazil. The wonderful plant tour and the ladies' programme were just two of the many highlights of the interesting and fruitful General Assembly. It will be a difficult act to follow, and that is why I would like to ask member companies for your help in enlisting experts for equally outstanding papers in preparation for the Kyoto Meeting in 2002. I am confident that our hosts, Nichicon Tantalum, will do their part in guaranteeing an unforgettable visit.

As 2001 draws to an end, and we reflect on the events of the past twelve months, may I close this letter with best wishes to you and your families for peace and goodwill in the New Year.

Axel Hoppe
President

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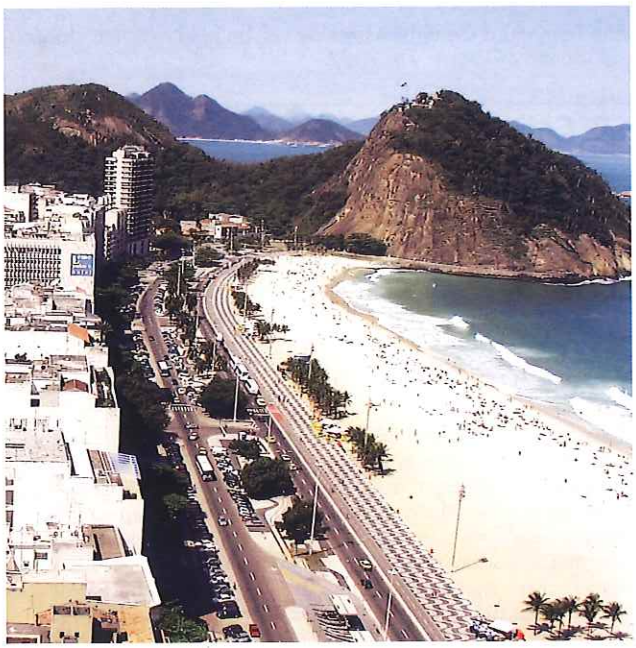

GENERAL ASSEMBLY IN RIO DE JANEIRO

The Forty-second General Assembly, with its associated technical meeting and plant tour, was held in Rio de Janeiro, Brazil, from October 7th to 9th 2001. Attendance numbers were good, in spite of the uncertain situation regarding long distance travel at the time, and only a very few cancellations were received although the flight bookings of many participants were disrupted.

Those who took part were able to enjoy the comfort of the Hotel Le Meridien and the broad sandy expanse of Copacabana beach, set against the dramatic scenery which surrounds Rio de Janeiro.

A cocktail party was given by the T.I.C. on Sunday evening to greet the participants and welcome them to Rio. On Monday evening CBMM hosted a splendid gala dinner in the St Honoré restaurant high above the lights of Copacabana. Sightseeing tours were organised on Monday and Tuesday. Many of those taking part in the meeting were able to include in their trip some further touring and visits to the Sugar Loaf, Corcovado, the lagoon, beaches or Tijuca forest.

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GENERAL ASSEMBLY

Mr Tom Odle, of Cabot Performance Materials, completed his term of office as President. Dr Axel Hoppe, H.C. Starck GmbH, was elected as President to serve for the coming year.

Dr Josef Gerblinger, Epcos AG, was elected as a member of the Executive Committee, and the other members of the Committee were elected to a further term of office.

The General Assembly elected sixteen applicant companies as new members of the association (see Member Company News in this Bulletin). The minutes of the Forty-first General Assembly and the audited accounts for the year ended June 30th 2001were approved.

The Forty-third General Assembly will be held in Kyoto, Japan, on Monday October 7th 2002.

TECHNICAL PROGRAMME

The programme of technical presentations focussed on niobium and on the industry of niobium and tantalum in Brazil.

The activities of the host company for this meeting were described by by Mr Clovis Antonio de Faria Sousa and Mr Antonio Telhado Pereira in their presentation 'CBMM – The most comprehensive and fully integrated manufacturer of niobium products', which was also an introduction to the plant tour.

Two other Brazilian member companies of the T.I.C. also contributed presentations. The 'Overview of Metallurg's tantalum and niobium activities in Brazil' by Mr Itamar Resende gave an account of the mining and processing by one of the longest established tantalum and niobium firms in that country. Another important group is Paranapanema, parent of Mamoré Mineração e Metalurgia, and Mr Ricardo Dequech and Mr Jorge Salles of the Tin, Tantalum and Niobium Division described 'Mamoré's position in the tantalum and niobium markets'.

The Technical Promotions Officer of the T.I.C., Mr Edward Mosheim, examined in detail the statistics collected by the T.I.C. in the past year, and set them in the context of the preceding years, in his paper 'Niobium and tantalum – a year in review', which is published in this issue of the Bulletin.
The past year was also the theme of two other papers. The personal experiences of Mr Alan Crawley as a trader were the topic of a short talk.

State of the Industry

Mr Peter Kählert, Chairman of H.C. Starck GmbH, gave 'A processor's view of the current state of the tantalum industry'. He spoke of the damage done to the industry by perceptions that tantalum was in short supply, speculative, expensive, and injurious to people and animals in Central Africa. End-users were trying to replace tantalum wherever possible, and this was unnecessary. He strongly encouraged communication as a means of countering the problems. Mining companies should explain that resources, capacities and inventories were available and would be developed to satisfy future needs. Processors should maintain sufficient capacity to enable them to react to sudden increases in demand, and intensify their research and development efforts - his own company had already implemented this by increasing production capacities worldwide, introducing niobium as a material for capacitors and taking over Bayer's electronic materials (e.g. conductive polymers). For component manufacturers, in their role as the link between end-user and feedstock supplier, it was essential that they should communicate well on the realistic development of demand and technological trends as well as long-term orientation: these were key factors for success. End-users should be persuaded that the T.I.C. and its meetings offered advantages for them, the association had funds which could be used, and the Executive Committee would welcome recommendations and ideas for the purpose. Mr Kählert hoped that his personal thoughts would inspire member companies to reflect on their approach and he exhorted them to prepare their own concept, for the good of the industry as a whole.

The technical paper on 'Alternative materials for electrolytic capacitors' by Dr Karlheinz Reichert, H.C. Starck GmbH, described the steps taken by his company to develop niobium as an alternative to tantalum. Production of niobium capacitor powder by magnesium vapour reduction has been shown to result in high capacitance and low leakage currents, and the company has recently made two major improvements to the process.

Panel

This paper was an ideal introduction to the panel discussion on 'The development of niobium capacitors', where Dr Reichert was joined on the panel by Mr William Millman of AVX, Dr Josef Gerblinger of Epcos, Mr Katsuhiro Yoshida and Mr Peter Maden of Vishay, for the manufacturers of capacitors (Dr Persico sent a statement on behalf of Kemet); Mr Randall Redd of Cabot Performance Materials and Mr Solon Tagusagawa of CBMM as other processors of niobium. Mr John Linden chaired the panel. The chemical similarity of niobium and tantalum and their proximity in the Mendeleev Table have long given rise to the thought that niobium could also be used for capacitors, but only recently has extensive practical development been undertaken. Niobium powder and capacitor construction technology are beginning to provide niobium capacitors for the rather less demanding applications, at temperatures under 105°C and voltages under 10V, with similar ESR to tantalum capacitors but with higher leakage currents. The panel members commented on the technical difficulties and possibilities, the advantages and disadvantages, the time-frame and performance of the developing materials.

PLANT TOUR

As guests of Companhia Brasileira de Mineração e Metalurgia (CBMM), the participants were taken by three chartered aircraft to Araxá on Tuesday October 9th. The groups were given an extensive guided tour of the pyrochlore mine and of the processing facilities of the company, which produces ferro-niobium and niobium products (see Bulletin 107 for a description), and were greatly impressed.

The mine is set in rolling countryside, with lakes, and many trees and shrubs. The company likes to ask each visitor to plant a tree, usually in the garden which graces the area surrounding the offices and restaurant. For such a large group as this, with more than a hundred participants, CBMM organised the plantation of a new band of trees, called 'The T.I.C. Arboretum'. While a choir performed an appropriately international repertoire of songs at the side of the 'arboretum', the members of the tour group shovelled earth round the roots of innumerable saplings and watered the plants with the specially-provided watering cans. Long live the grove of trees in the T.I.C. Arboretum.

The visitors then moved on to the company's delightful guest house for a splendid meal, before taking the chartered aircraft back to Rio de Janeiro, at the close of a memorable day. Our warmest thanks go to CBMM for its generous hospitality at Araxá and throughout the meeting.

CALL FOR PAPERS

If you would like to propose a paper for the meeting associated with the Forty-third General Assembly, to be held in Kyoto from October 6th to 8th 2002, please contact the T.I.C. secretariat as soon as possible.

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NIOBIUM & TANTALUM: REVIEW OF INDUSTRY STATISTICS

This paper by Mr C. Edward Mosheim, Technical Promotions Officer of the T.I.C., was presented in the technical session of the meeting in Rio de Janeiro, October 8th 2001

INTRODUCTION

The Tantalum-Niobium International Study Center collects industry statistics from its members to give totals that are consolidated to try to track industry mining, processing, and shipments of niobium and tantalum products in various forms, including chemical intermediates. The data are collected semi-annually and reported on the same basis to the membership.

In 2001, a number of changes have been made to the data collection process in comparison to previous years. Most involve a renaming of categories to reflect current industry definitions or separation of a specific category into two distinct descriptive entities. Those modifications will be indicated in this article as the data are presented. The data collected for the first six months of 2001 constitute the first information obtained in the revised reporting format. The graphs will be shown here in the same form as used previously, and separate graphs will be drawn when sufficient data become available to make them meaningful.

It is important to note that the niobium and tantalum statistics are presented in graphical form with the quantities designated as pounds of the contained metal or pounds of the contained metal oxide. The Y-axis labelling provides this information in each graph.

For 2001, it should be noted that the first six months of data for niobium have been doubled to provide an estimate for the annual quantity in each of the segments. The tantalum statistics **have not** been doubled due to the known downturn in tantalum shipments, with the greatest effect seen in the capacitor powder market segment.
Growth trendlines are presented for each of the niobium product shipment categories. For tantalum product shipments, estimated growth rates are indicated due to the unknown impact of the downturn during the second half of 2001.

The year 2001 marks the 200th anniversary of the discovery of the element niobium by Charles Hatchett, an English chemist. He isolated this element from a mineral specimen that was sent to the British Museum from Connecticut in 1753. He named the element columbium. In 1844, Heinrich Rose, a German chemist, announced the discovery of a new element that he called niobium after Niobe, the daughter of Tantalus. Further studies revealed that columbium and niobium were the same element. It took another 100 years for the International Union of Pure and Applied Chemistry to adopt officially the name niobium.

The 200th anniversary of the discovery of tantalum will fall in 2002.

NIOBIUM ORE PRODUCTION

Pyrochlore concentrates, mined in Brazil and Canada, supply about 90% of the world's niobium requirements. Additional niobium-bearing raw materials, including columbite, are furnished from mineral concentrates obtained primarily for their tantalum content in Africa, Australia, Brazil, China and Canada, with additional quantities being obtained from the tin slags accumulated in Southeast Asia and Brazil. The breakdown of the niobium content supplied by the tantalum-bearing minerals is estimated at about 7.5% from columbite and the remaining 2.5% from struverite, tantalite, and tin slags.

The first six months of 2001 saw the niobium oxide content of mined ore concentrates, etc. increase to 49.2 million pounds of niobium oxide from 37.6 million pounds of contained niobium oxide units during the last six months of 2000. The 2001 data are represented in Figure 1 as a full year's production by doubling the data for the first six months, thus giving an estimate for the entire year.

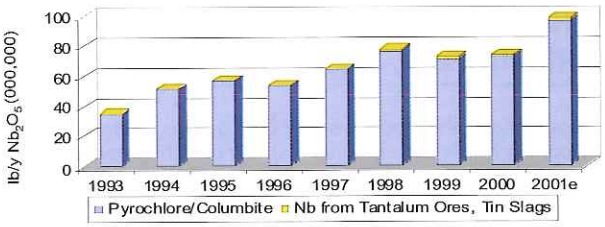


Figure 1: Niobium raw material production

NIOBIUM IN ORE VERSUS NIOBIUM IN PROCESSOR SHIPMENTS

The same companies that mine the ore, namely CBMM and Mineração Catalão de Goiás Ltda in Brazil, and the Mazarin Corporation in Canada, carry out the conversion of pyrochlore to HSLA ferro-niobium. The largest columbite processor is Paranapanema in Brazil. Both pyrochlore and columbite are upgraded to a 55 to 65% niobium oxide concentrate before conversion into ferro-niobium.

A comparison of niobium ore production and processor shipments up through 2000 (converted into contained niobium from Nb_2O_5) shows that there is a reasonable balance between ore production and shipments (Figure 2). For the first six months of 2001, mined ore contained 34.4 million pounds of contained niobium compared to shipments of 30.1 million pounds. This suggests that the mining capabilities of the expanded capacities of the current producers are more than sufficient to take care of demand in the near term.

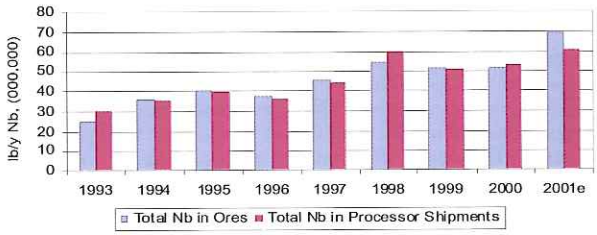


Figure 2: Niobium in ore versus niobium in processor shipments

PROCESSOR SHIPMENTS – NIOBIUM

The impact on the production and shipments of niobium materials of HSLA ferro-niobium is readily seen in Figure 3. Assuming a repeat of the first six months of 2001 during the second six months, shipments are expected to reach an all time high of about 60 million pounds of contained niobium. Approximately 86% of the total niobium shipments are contained in HSLA ferro-niobium. The remaining three categories comprise the other 14%, with the segment designated as chemical compounds, unwrought metal, vacuum-grade ferro-niobium and nickel-niobium representing 86% of those total pounds. Each of the four categories will be looked at separately.

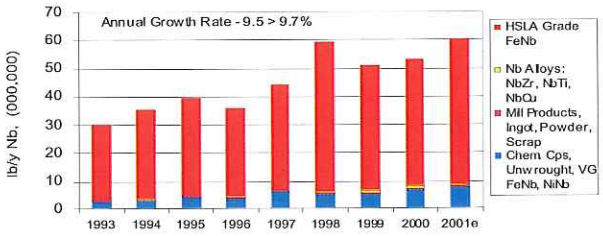


Figure 3: Processor shipments - niobium

PROCESSOR SHIPMENTS – NIOBIUM CHEMICALS, METAL, AND ALLOYS

Figure 4 shows the other three product groups of Figure 3 without the HSLA ferro-niobium. Looking at the three market segments of product shipments other than the HSLA ferro-niobium, it is obvious that the group 'chemicals, unwrought metal, vacuum grade FeNb and NiNb' is the largest volume category. The blue segment in the chart represents a six month total of 3.7 million pounds of contained niobium, with 2.2 million pounds of niobium as vacuum grade ferro-niobium and nickel-niobium at 60% Nb content, and 1.5 million pounds of niobium as found in various chemicals, with the largest volume most probably being pure niobium oxide (with the figures doubled to give a full-year estimate). The unwrought metal has, in 2001, been removed from this category and the data previously collected in that segment have been separately designated as 'mill products, ingot, powder, and scrap .

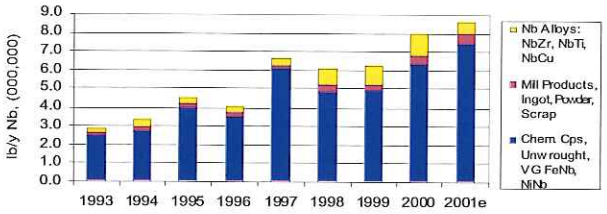


Figure 4: Processor shipments – niobium chemicals, metal and alloys

PROCESSOR SHIPMENTS – HSLA GRADE FERRO-NIOBIUM

The growth rate for HSLA grade ferro-niobium continues to range from 7.5 to 8.0% (Figure 5), with the U.S. and European markets consuming about 70% of the total production. The largest potential market is in China, the largest steel producing country in the world. The concentration of niobium in steel in China is only about 15% of that found in the U.S. and Europe today. Shipments are estimated at about 51 million pounds of contained niobium.

Major applications are pipeline steel, the automotive industry, and micro alloyed steels for structural requirements.

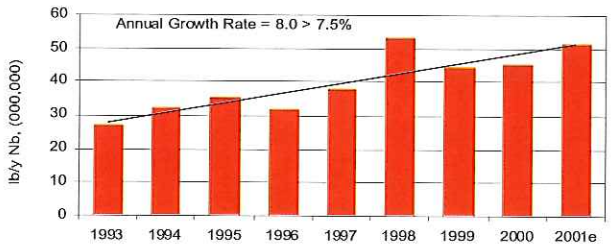


Figure 5: Processor shipments – HSLA grade ferro-niobium

PROCESSOR SHIPMENTS – CHEMICAL COMPOUNDS, UNWROUGHT METAL, VACUUM GRADE FERRO-NIOBIUM, NICKEL-NIOBIUM

Unwrought niobium is no longer included in this segment for the data representing 2001 shipments. The data are strictly niobium chemicals and vacuum grade alloys with 60% of the niobium values being in the 'FeNb and NiNb' category. The niobium chemicals segment is composed of such chemicals as niobium carbide, niobium oxide, niobium chloride, and possibly some organic compounds containing niobium, such as niobium ethoxide. (Figure 6)

Uses are found in optics of high index of refraction, ceramic capacitor formulations (MLCC), cutting tools, lithium niobate for surface acoustic wave filters (SAW), as well as other minor applications.

This segment continues to grow at about 13% per year.

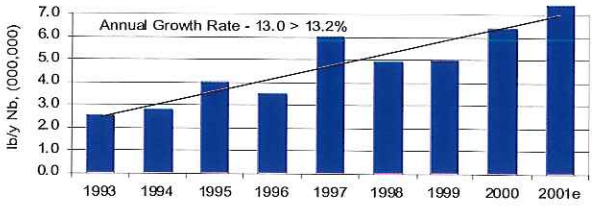


Figure 6: Processor shipments – chemical compounds, unwrought metal, vacuum grade ferro-niobium, nickel-niobium

PROCESSOR SHIPMENTS – MILL PRODUCTS, INGOT, POWDER, SCRAP

The components of this segment (see Figure 7) are generally used either as pure metal or as an additive to high temperature alloy formulations. The nominal growth rate is 15%.

The primary uses for pure metal are sputtering targets, cathodic protection systems, chemical processing equipment, medical applications, and jewelry. One of the largest uses for niobium in this category is for the production of superalloys, primarily in the family of Inconels as well as niobium-based alloys for high temperature applications in both land and air-based turbines.

This category contains 'unwrought niobium' in the 2001 data but not the prior years. The data are a representation of the estimated total for 2001.

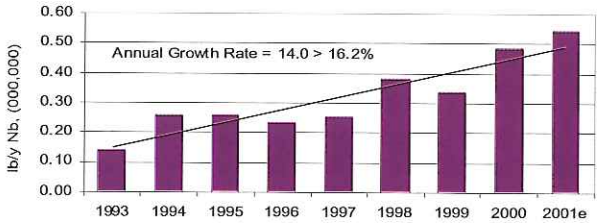


Figure 7: Processor shipments – mill products, ingot, powder, scrap

PROCESSOR SHIPMENTS – Nb ALLOYS, NbZr, NbTi, NbCu

As can be seen in Figure 8, the total reported shipments for 2001 fell significantly from 777 400 pounds in the last six months of 2000 to 313 000 pounds during the first six months of 2001. The primary reason is that the requirements for the Large Hadron Collider near Geneva, Switzerland have probably been completed or are nearing completion. This project required 400 tonnes of contained niobium-titanium alloy to be supplied over a three-year period. Contracts of this size are abnormal. The application is a 26 km diameter accelerator tunnel for the European Laboratory for Particle Physics, known as CERN. A growth rate has not been estimated due to the significant change in shipments for, specifically, niobium-titanium alloy in this category and the impact of this one project.

The most commonly known application for niobium-titanium alloy is for the superconducting magnets in Magnetic Resonance Imaging Equipment (MRI) used to detect abnormalities in soft tissue. The alloy contains 53 to 54% Nb.

Additional applications are magnetic levitation (NbTi) and sodium vapor lamps (NbZr).

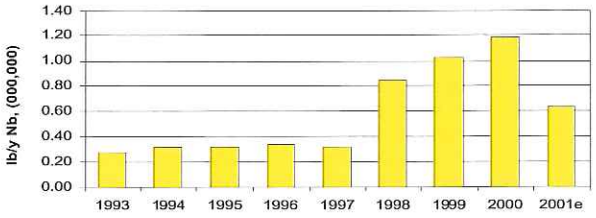


Figure 8: Processor shipments – Nb alloys, NbZr, NbTi, NbCu

SUMMARY – NIOBIUM

Worldwide demand for niobium products continues to grow at an estimated rate of 9.7% per year. Raw material availability is not a matter of concern since expansion projects in Brazil and Canada at existing mines have been completed and have demonstrated those capacity increases. It is estimated that reserves still in the ground are sufficient to meet current levels of demand for more than 100 years.

Additional pyrochlore resources are being evaluated in Africa and Canada, specifically, the Mabounié Deposit in Gabon and the Niocan Deposit in Oka, Quebec, Canada with targets of 4000 tonnes niobium and 2800 tonnes niobium per year respectively as HSLA grade ferro-niobium.

All the market segments are exhibiting fairly steady growth, year over year. An exceptional increase for NbTi alloy was due to the large requirement during the period of 1998-2000 for the Large Hadron Collider Project in Switzerland. Completion of those requirements or on/off scheduling delays will provide a return to normal behavior for the growth rates for this niobium alloy category.

TANTALUM RAW MATERIAL PRODUCTION

Tantalum-bearing minerals are found predominantly in Australia, the tin belt of Southeast Asia, Brazil, Canada, and in Ethiopia, Democratic Republic of Congo, Rwanda, Burundi, Uganda, and other countries in Africa. Resources also occur in a number of areas in China, and in the former Soviet Union. The area of Southeast Asia, predominantly Thailand and Malaysia, was the source of high-grade tin slags (10 to 15% tantalum oxide) in the past resulting from the processing of cassiterite ores for the extraction of tin. These are no longer available. Low grade slags containing 4% or less tantalum oxide (with some less than 2%) have been available in the past due to the high level of tin production in that area. Excavation of old slag dump areas and reprocessing those materials has made available between 500 000 and 750 000 pounds of contained tantalum oxide per year to this industry. The supply from these dump stockpiles from former tin production operations is limited. Current production of tin in this area is much smaller in volume than in former times, with the resulting availability of tantalum oxide values in the slag being much smaller on a yearly basis.

The only high volume mining operation is the Sons of Gwalia mines, headquartered in Perth, Western Australia. The Greenbushes and Wodgina mines, located in the southern and northern extremes of this state respectively, are the world's leading producers. Capacity expansions have brought production levels up to a combined output of 963 000 pounds of tantalum oxide in mineral concentrates during the first six months of 2001, or an anticipated total of almost 2 million pounds during the entire year. Most other operations are processing material at levels not exceeding 200 000 pounds per year.

Production in the central African countries of DRC, Rwanda, Burundi, and Uganda during the period of ore price escalation from about July 2000 through about March 2001 resulted in illegal mining inside National Park areas, that were under the control of renegade militia. This occurred primarily in western DRC. Significant quantities were reported to have come out of that four-country area during the noted time frame.

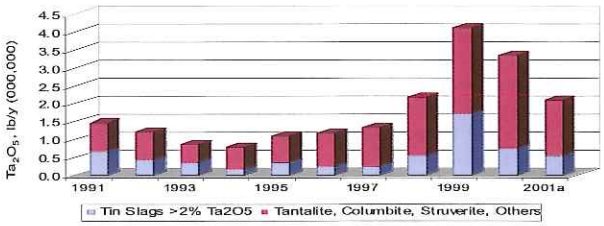


Figure 9: Tantalum raw material production

Actual data for the first six months of 2001 are shown in Figure 9. The first half of 2001 shows an increase in production of mineral concentrates to almost 1.56 million pounds of tantalum oxide, in comparison to 1.30 million pounds in the previous six months. A total of 531 000 pounds of tantalum oxide in tin slag was also produced during the first six months of 2001 in comparison to the 216 000 pounds reported during the previous six-month period. The trend suggests that a total production of around 4 million pounds of tantalum oxide for the year should be expected.

The beginning of a downturn in demand during the first half of 2001 should calm any fears of any future shortage.

It should also be stated that most of the small mining operations other than Sons of Gwalia in Australia, the Tanco mine in Canada, and the Kenticha Mine in Ethiopia do not report production data directly to the T.I.C. since they are not members. Some of the production from those mines is reported by member trading companies which purchase the material, but obviously some of the production from small mines is not counted in the production data reported to this organization.

TANTALUM PROCESSORS' RECEIPTS

Tantalum processors' receipts are reported in two categories. They are, in one category, mineral concentrates plus tin slag and, in the other category, secondary sources, such as chemicals, scrap, ingot, etc.

The processors report on the material they receive, which may come from member or non-member trading companies, as well as mineral concentrates purchased directly from large miners, or from small mining operations where most of the mining community is not involved with this organization.

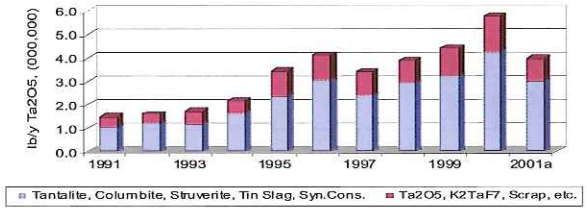


Figure 10: Tantalum processors' receipts

Total tantalum processor receipts for the first six months of 2001 (see Figure 10) show a significant increase from the previous six months. The second half of 2000 saw a total of 2.65 million pounds of tantalum oxide received in mineral concentrates plus secondary materials, compared to 4.0 million pounds for the first six months of 2001. The primary increase was in the raw material category where the increase was from 3.32 million pounds in all of 2000 to almost 3 million pounds during the first six months of 2001. One could reasonably assume that equivalent quantities would be available during the second half of the year.

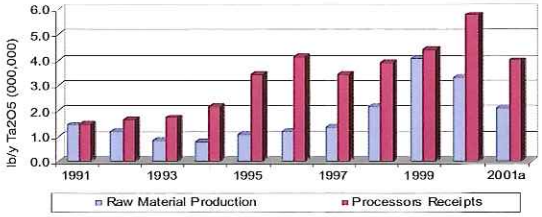


Figure 11: Production of tantalum ore and slag, vs. processors' receipts

The processor receipts (Figure 11) are the six month total of mineral concentrates plus tin slag plus secondary materials such as scrap, crude chemicals, residues, etc., with the total reaching almost 4 million pounds of tantalum oxide. Of these 4 million pounds, 2.6 million pounds are mineral concentrates and tin slag. The difference, approximately 0.6 million pounds, would be purchases from non-T.I.C. associated sources such as the DLA stockpile.

PROCESSORS' SHIPMENTS – TANTALUM

The categories of data collection have been modified to reflect changes in the industry and also to place additional emphasis on growing market segments in terms of product shipments. The category previously known as 'Powder/Anodes' is now designated as 'Capacitor Grade Powder'. The category previously known as 'Tantalum Oxide, Potassium Tantalum Fluoride, and Other Chemicals' is now designated as 'Tantalum Chemicals'. The category known previously as 'Alloy Additive' has been changed to 'Tantalum Ingot' and materials that could have been previously been placed in that category are now reported in either 'Mill Products' or the category designated as 'Metallurgical Powder, Unwrought Metal, Scrap, Other'.

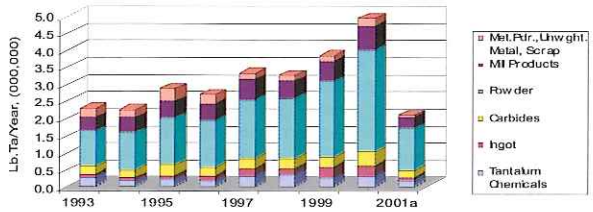


Figure 12: Processors' shipments - tantalum

In Figure 12, the data for the first 6 months of 2001 clearly show the impact of decreased shipments of capacitor grade powder, with total shipments from all categories only reaching 2.1 million pounds of contained tantalum – in 2000 the total for the entire year was 4.9 million pounds, of this 2.36 million pounds was reported in the second half of the year. The largest segment continues to be the capacitor grade tantalum powder, but it is quite obvious that shipments in this category were reduced considerably, as they fell from 1.43 million pounds during the second half of 2000 to 1.22 million pounds during the first half of 2001.

CAPACITOR GRADE TANTALUM POWDER

Shipments of tantalum powder (see Figure 13) for capacitor applications were down almost 20% based on the data from the first half of 2001 in comparison to the last six months of 2000. The estimated year-over-year growth rate was reduced from 17.5% to 14.5%. This category accounts for virtually 100% of the reduced demand for tantalum-containing products. Expectations are for this trend to continue into the second half of 2001.

Capacitor grade tantalum powder represents about 60% of the total tantalum supplied to world markets. Product shipments of tantalum wire and furnace components (reported as 'Mill Products') add to the total requirements of the tantalum capacitor industry.

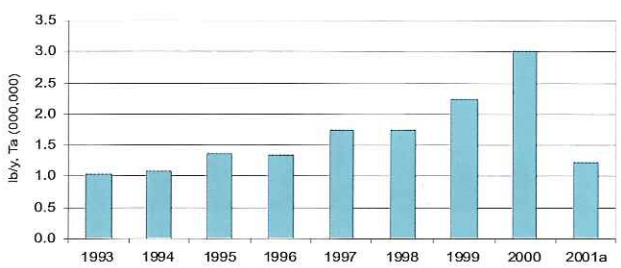


Figure 13: Processor shipments –capacitor grade tantalum powder

The dramatic increase in demand during 2000 up through the end of the year and into 2001 was the result of 'excess exuberance' concerning requirements in the cellular telephone market and others that led to double and triple ordering of components for the circuitry. This applied not only to tantalum capacitors, but to passive components in general. The fear of a shortage of tantalum developed when the industry could not meet these unrealistic demands for product, but this 'perceived shortage', by all accounts, was never a reality.

This phenomenon has been widely reported in the electronics press during 2000 and 2001. The downturn during the first six months of 2001 has been dramatic. It has resulted in an extended period of 'inventory reduction' throughout the entire manufacturing pipeline and extends well into the second half of 2001.

The area of application is solid-state capacitors for cellular phones, computer circuitry, video and still cameras, entertainment systems, and automotive, military, and medical electronics.

PROCESSOR SHIPMENTS – TANTALUM INGOT

The category was previously known as 'Alloy Additive', however, the material actually being reported in the category was primarily ingot designated for alloy manufacture, with additional quantities of relatively pure tantalum scrap also being reported in this segment for the same applications. The name was changed to reflect more accurately a product sold by a processor instead of material designated for a specific application.

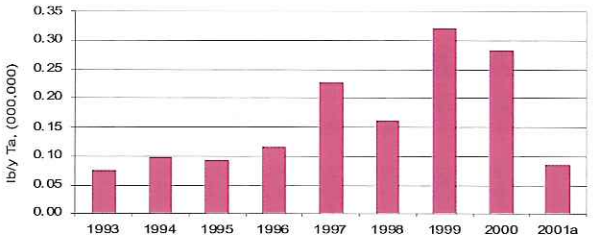


Figure 14: Processor shipments – tantalum ingot

The sudden drop in shipments (Figure 14) for the first half of 2001 is not necessarily due to a reduction in demand but perhaps due to a 'reclassification' of the content in this category. Another factor could be the changing supplier/user relationships in this industry. Additional data are required to establish any significant conclusions.

One of the major areas of application is the manufacture of superalloys, especially for land and air-based turbines. Land-based turbines are used for power generation utilizing natural gas as the fuel. The tantalum content of these alloys ranges from 2 to 12% with the most common in the 5 to 9% range.

PROCESSOR SHIPMENTS – TANTALUM CHEMICALS

The first six months of 2001 show about 175 000 pounds of contained tantalum were shipped (see Figure 15) in the form of various chemicals, the largest volume probably as tantalum oxide. Estimated growth rates for this segment are about 8%.

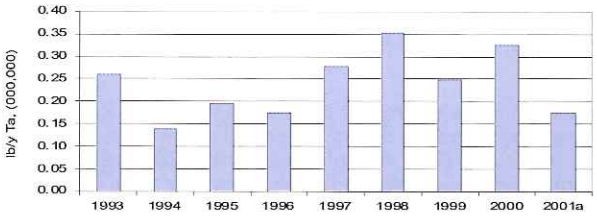


Figure 15: Processor shipments – tantalum chemicals

Tantalum oxide sees significant consumption in electronics, medical applications, optics, and as a sputtered film to form a capacitor in integrated circuitry. Lithium tantalate is used in SAW filters. The oxide is a component of an yttrium tantalum formulation that is applied as a layer in the composition of X-ray films providing image enhancement with a reduction in X-ray intensity.

PROCESSOR SHIPMENTS – TANTALUM CARBIDE

Tantalum carbide (see Figure 16) has exhibited a growth rate of about 5% per year based on the addition of the data from the first six months of 2001. This material is an additive to cemented carbide formulations used in the preparation of tool steels for cutting steel and cast iron machining.

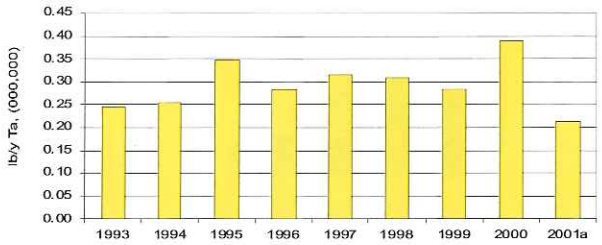


Figure 16: Processor shipments – tantalum carbide

PROCESSOR SHIPMENTS – TANTALUM MILL PRODUCTS

The mill product shipments (see Figure 17) were about 329 000 pounds of contained tantalum for the first six months of 2001. This would include any alloys, such as tantalum-tungsten, in the form of mill products. An estimated growth rate for this segment is about 7.5%.

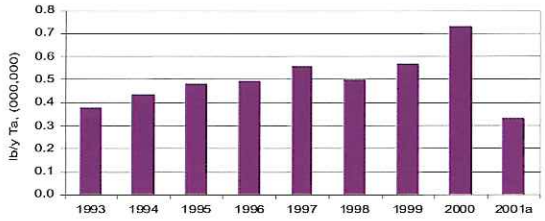


Figure 17: Processor shipments – tantalum mill products

It is anticipated that a decrease in reported shipments in this category will be seen for the second half 2001 data due to the downturn in the capacitor segment resulting in reduced shipments of wire and furnace hardware.

The products in this segment include sputtering targets, sheet, tubing, rod, wire, etc. Sheet is generally used to fabricate chemical processing equipment. Perhaps half of the tantalum in this category is wire used in the fabrication of the tantalum anode for capacitors. Additional quantities are used for fabrication of heat shields and processing fixtures in anode sintering furnaces.

PROCESSOR SHIPMENTS – METALLURGICAL POWDER, UNWROUGHT METAL, SCRAP, OTHER

This area continues to see reductions in each six-month reporting period, with the first six months of 2001 being no exception: only about 65 000 pounds of tantalum were reported in this category. A potential explanation is that materials that formerly were reported in this category are being utilized to produce higher value products and are no longer available.

SUMMARY – TOTAL TANTALUM RECEIPTS VS. PROCESSOR SHIPMENTS

A comparison of the total tantalum receipts by processors and their shipments during 2001 does not seem to indicate a shortage of tantalum materials (Figure 18). One might conclude that the processors shipped all the product they could manufacture from the available raw materials and secondary feedstocks. There is considerable evidence that the double and triple ordering in the tantalum capacitor market created the perceived shortage during 2000. That perceived shortage in the capacitor segment cascaded into the chemicals, ingot, and mill products segments when 'their share of tantalum raw materials' were perhaps allocated to the manufacturing pipeline for powder, resulting in capacitors being produced that inflated inventories.

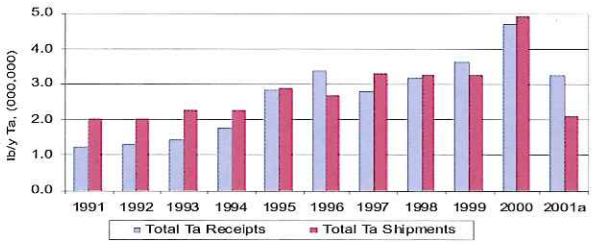


Figure 18: Processors' receipts vs. processors' shipments (tantalum)

This put pressure on powder and capacitor manufacturers for increased production capacity, especially for those powder and capacitor designs requiring high capacitance powders. Expansions were completed, based on those excessive demands, but with the economy beginning to deteriorate, and excessive inventories throughout the entire pipeline, up to and including the actual cellular phones, an inventory reduction period is currently in progress.

Overall, the long-term trend suggests that the total tantalum shipment growth rate is about 12% beginning with 1993 data up through the present time. The growth rate for capacitor grade powder has averaged 16% but with 2000 well above the regression line and the full year of 2001 going to be well below the line, one can probably assume that the year-over-year growth rate will decrease once complete 2001 data are available.

One forecasting organization, the Gartner Group Inc., has stated that 2000 ended with a 'significant stock of carryover' into the new year. The conclusion reached by many is that OEM, CEM, and distributors of passive components placed orders for tantalum capacitors with each purchasing for the same circuit boards (double and triple ordering). Growth is expected to return as soon as the current inventory correction has been completed.

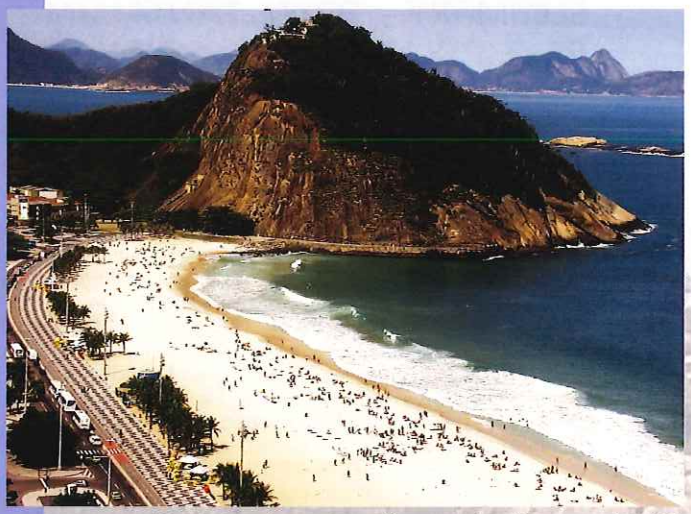
DLA

We thank the DLA for sending us the following information.

With the beginning of its new fiscal year on October 1st 2001, the Defense National Stockpile Center resumed sales of its tantalum and columbium products. The Annual Materials Plan, approved by the U.S. Congress, determines the quantity of material that DNSC is allowed to sell each fiscal year. (The Annual Materials Plan is not a sales goal, but rather a limit placed on the amount of material that DNSC can sell in a fiscal year.) For Fiscal Year 2002, the Annual Materials Plan for the columbium and tantalum groups is as follows:

(continued on page 10)

PHOTO CALL - RIO DE JANEIRO



Rio de Janeiro, a magnificent setting for a meeting (C)

Appreciating the splendid gala dinner(C)

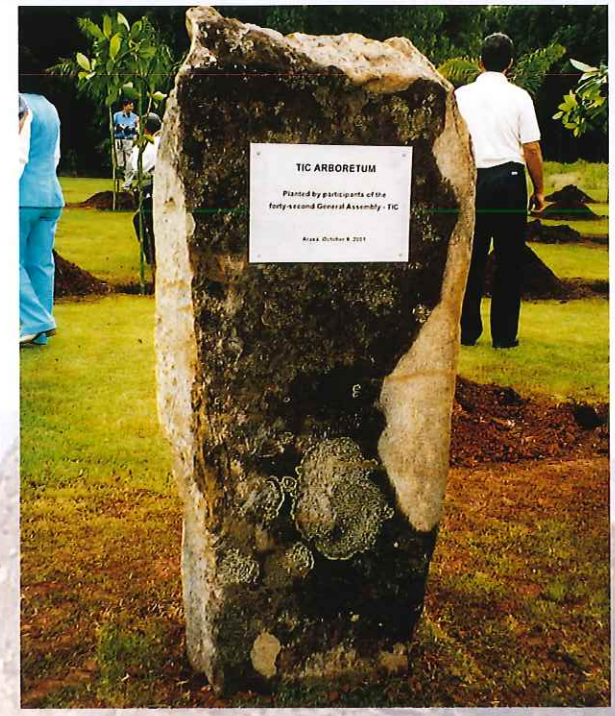
The group of ladies

Enjoying the plant tour

The anteater (see Bulletin 107) had produced a baby - the youngster was clinging contentedly to its mother's tail, asleep

(With thanks to Mr Fernand Cyroux for photos C)

After the plant tour



T.I.C. Arboretum

Tadeu Carneiro, CBMM delegate to T.I.C., and Barry Valder (Wah Chang) at the inauguration of the Arboretum

Tree planting in full swing - David Craik (AMC) makes his mark

The choir serenading the party

Lunch on the terrace at the CBMM guest house

Material	AMP Quantity
Columbium Carbide Powder	21 500lb Cb
Columbium Concentrates	560 000lb Cb
Columbium Metal Ingots	20 000lb Cb
Tantalum Carbide Powder	4 000lb Ta
Tantalum Metal Ingots	40 000lb Ta
Tantalum Metal Powder	50 000lb
Ta Tantalum Minerals	500 000lb
Ta Tantalum Oxide	20 000lb Ta

On November 16th 2001, an offering was held for 21 500 pounds of Columbium Carbide Powder. A final decision on the offers is still being made. On December 14th 2001, DNSC will offer 20 000 pounds of Columbium Metal Ingots.

There is an offering for 20 421 pounds of Tantalum Metal Ingots on November 30th 2001 at 1p.m. To date, no other offerings for the Tantalum group materials have been planned.

For more information about Tantalum and Columbium sales in Fiscal Year 2002, please contact the Directorate of Contract Sales, Defense National Stockpile Center at 8725 John J. Kingman Road, Fort Belvoir, VA 22060-6223. The telephone number is +1 7030 767 6500 and the web site is https://www.dnsc.dla.mil/.

REPORTS ON 'COLTAN'

UN Addendum

An 'Addendum to the report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of the Democratic Republic of the Congo' was referred by the Secretary-General of the United Nations to the President of the Security Council on November 10th 2001.

Some members of the Panel which produced the earlier report were changed, notably the Chairman: the new Chairman is Ambassador Mahmoud Kassem, of Egypt.

The Panel said that it had 'limited its examination of specific material resources to coltan, gold, copper and cobalt, since they best illustrate the current pattern of exploitation'. The section of the report on 'coltan', which opens 'an excellent conductor, this metal ore occurs throughout the eastern region of the Democratic Republic of the Congo', notes the rise and fall of 'coltan prices', and that 'there have been some accounts that part of the decrease in demand resulted from manufacturers' desire to disassociate themselves with what became known, following release of the report, as 'blood tantalum'. It continues 'the fluctuation in the price, as well as the Panel's report, have had a number of effects on the coltan trade', and says that a bill was introduced in the US House of Representatives to prohibit temporarily coltan imports from certain countries involved in the conflict in the DRC. 'These factors have led to a change in tactics by the Rwandan army', and the publication of the earlier report has also caused 'transport networks [to be] reconfigured'. The routes taken by 'a large amount of coltan' are discussed in several sections of the report, as are discrepancies in the export figures for Rwanda which the Panel was unable to reconcile.

In its conclusions, the Panel finds that 'the systematic exploitation of natural resources... of the Democratic Republic of the Congo continues unabated'. One of its recommendations is that 'a moratorium should be declared for a specific period of time banning the purchase and importing of precious products such as coltan, diamonds, gold, copper, cobalt, timber and coffee originating in areas where foreign troops are present in the Democratic Republic of the Congo, as well as in territories under the control of the rebel groups'.

The Annex listing the organizations interviewed does not include any tantalum processors or industry members.

Dian Fossey Gorilla Fund

This Fund has published, on November 24th 2001, a report on its 'Campaign for Gorilla-Friendly Technology'. Instead of joining any call for a ban on tantalum from DRC, the Fund 'decided to work with local groups, industry leaders and conflict resolution specialists to determine a win-win solution, which will both save gorillas and improve conditions and economic returns for peasant miners'. Nevertheless the Fund is 'in full agreement with other conservation groups in calling for the immediate cessation of mining and hunting in Kahuzi Biega National Park'. The report describes the four-point campaign developed by the Fund. (Contact with the Fund can be made through www.gorillas.org.)

The T.I.C. continues to call on its members to refrain from purchasing raw materials from illegal or illegitimate sources

MEMBERSHIP

The following companies were elected to membership by the Forty-second General Assembly:

ABS Industrial Resources
Harry Works, Glasshouse Road,
Kilnhurst, Mexborough,
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Tel.: +44 1709 571717
Fax: +44 1709 571801
E-mail:
allmetal@absgroup.co.uk

Advanced Alloy Services Ltd.
Unit 4, Universal Crescent,
N. Anston Trading Estate,
North Anston, Sheffield S25 4NZ,
England.
Tel.: +44 1909 569930
Fax: +44 1909 569925
E-mail: afisher@advancedalloys.co.uk

Angus and Ross plc
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Ely, Cambridgeshire, England.
Tel.: +44 1439 748 350
Fax: +44 1439 748 362
E-mail: whimbrel@easynet.co.uk

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Tel.: +1 805 482 9825
Fax: +1 805 987 7961
E-mail: tom.ukolowicz@astrocosmos.com

Di Assets S.A. Luxembourg
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Tel.: +44 208 858 2999
Fax: +44 208 305 0211
E-mail:
mony@metallo.com

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Fax: +44 208 952 1177
E-mail:
@eurometco.uk

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1851 Blount Road,
Pompano Beach, FL 33069, U.S.A
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Fax: +1 954 917 3033
E-mail:
exopompbch@aol.com

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Tel.: +61 8 9226 1550
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colmac@haddington.com.au

Jiujiang Tanbre Smelter
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Jiangxi Province 332014, P.R. China.
Tel.: +86 792 873 6566
Fax: +86 792 873 6815
E-mail: jtsjxb@public1.jj.jx.cn

Leo Shield Exploration Ghana Ltd
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Tel.: +61 8 9240 2405
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Fax: +81 3 5620 0707
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New Millennium Resources
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Sanyo Electronic Components
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Fax: +81 72 870 6087
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niwa021444@dt.sanyo.co.jp
0
Zhuzhou Cemented Carbide Works
Diamond Road,
Zhuzhou, Hunan, China 412000.
Tel.: +86 733 826 1886 /826 3294
Fax: +86 733 822 2044
E-mail: zccc@mail.zz.hn.cn

The companies Lev Gubenko and Special Metals Fabrication have resigned from membership. The membership of Daewoo Electronic Components has been terminated.
The membership of Australasian Gold Mines has been transferred to the associated company Tantalum Australia.

MEMBER COMPANY NEWS

AVX
AVX reported on October 10th 2001 its results for the quarter ended September 30th. President and CEO Mr John Gilbertson said that net sales for the quarter were better than anticipated, 'declining only 16%' from the preceding quarter. AVX had been 'implementing worldwide cost reduction programs since the beginning of the calendar year and will continue to drive our costs down'. Mr Gilbertson commented on 'the weak economic environment and unprecedented decline in the demand for our customers' products', and stated 'the outlook for the next quarter suggests that the business climate will continue to be sluggish and expectations for growth have been pushed into calendar 2002'. Mr Gilbertson, formerly President and Chief Operating Officer, was appointed Chief Executive Officer in July 2001 by the Board, succeeding Mr Dick Rosen who remains on the AVX Board.

Cambior
For the third quarter of 2001, Cambior's share of production from the Niobec mine was 354 tonnes of niobium, an increase of 36% over the corresponding quarter in 2000 (261 tonnes niobium) due to the recent mine expansion, in spite of a ten-day strike in August.

EMDSC
Metal-Pages reported on August 13th 2001 that Ethiopian Mines Development Share Company produced 47 tons of tantalum in the recently ended fiscal year.

Epcos
In October 2001, Epcos announced that it was the first manufacturer in the world to ship tantalum chip capacitors with polymer multianodes. The very low ESR (equivalent series resistance) of these innovative components makes them ideal as bulk capacitors for integrated circuits with high current requirements in the PC and telecom equipment industries. In switch-mode power supplies, the new capacitors can be used to smooth ripple currents up to 4.5 A.

In the same month it also reported that it was 'the first manufacturer worldwide to ramp up production of niobium capacitors. Case sizes D and V were the first to be produced in volume, in case size D capacitors rated at 100mF/10V were already available. In response to strong market interest, production capacity was being rapidly expanded, and the product range would be being widened in the coming year. The company considers that niobium capacitors will open up new benefits of miniaturisation and cost to circuit designers.
In a press release dated November 20th, an increase in sales of 3% for the year ended September 30th 2001 over the previous year was reported, 'despite the difficult business environment'. Fiscal year 2000 was a record year, and in the first quarter of 2001 the workforce was still being expanded. But as the year went on there was a 'sudden and massive decline in demand' for mobile phones and sales figures lagged behind expectations, and large surplus inventories of components built up. New orders fell to a trickle in the second and third quarters, followed by cancellations of orders. The situation has improved for Epcos in the fourth quarter, with an increase of new orders: inventory adjustment has been largely completed and production of mobile phones is rising, says the company. A sustained recovery of demand is expected in the second half of 2002. Epcos credits its innovative strength and its investment in research and development for its current position. It has also cut its workforce and relocated a number of operations.

Sons of Gwalia
The annual report of Sons of Gwalia for the year ending June 30th 2001, when tantalum production reached a record 1.6 million lb Ta_2O_5, included confirmation that tantalum reserves and resources at Wodgina doubled to 60 million lb Ta_2O_5 contained, and reserves at Wodgina are approximately 53 million lb Ta_2O_5 contained. The tantalum expansion programme at Greenbushes and Wodgina, in which the company has invested $100 million, continues to proceed within budget and on schedule for commissioning during the quarter ending March 2002. The company will have tantalum production capacity in excess of 3.0 million lb per year when the expansion is completed, and would be able to supply over 35% of the world's requirements. The Chairman stated that Sons of Gwalia owns approximately 75% of the global defined

tantalum reserve base, and is 'by far the largest producer of tantalum in the world'. The Greenbushes pegmatite is the world's largest hard rock tantalum resource, and Wodgina is the second largest.

The Advanced Minerals Division, which covers tantalum, achieved a 79% growth in earnings before interest and tax for the year, resulting from record tantalum production and sales. The Managing Director stressed that the company had focussed on safety management, striving to eliminate accidents in the work place, and on environmental management programmes at all its sites.

In his address to the company's annual general meeting on November 16th, the Chairman, Mr Peter Lalor, said that although the global tantalum market had weakened in 2001 with falling demand for electronic components, he believed that increased demand for tantalum would follow improvements in the global economy – and he hoped these would occur in 2002. The supply chain management in the tantalum industry needed improvement, he continued. Better communication throughout the supply chain was required, and a more satisfactory approach to supply in periods of high demand. For this reason, the company had decided to increase its inventory of tantalum products over and above contractual commitments to ensure supply was available at all times, continued Mr Lalor.

Haddington

Haddington International Resources, which has just been elected to membership of the T.I.C., announced on November 28th that it had acquired the unlisted company 'Australian Tantalum' (not to be confused with Tantalum Australia). This gives Haddington 11 more tantalum project areas, in addition to the production centres it has already been developing at Bald Hill and Cattlin Creek.

Kemet

For the quarter ended September 30th 2001, Kemet reported net sales 67% lower than in the same quarter of 2000. Mr David Maguire, Chairman and CEO, reported that unit shipments of surface-mount capacitors had declined for four quarters, right across the industry. He cited two factors which had caused this decline: first, that customers' consumption had declined as their business had declined, and second that customers were purchasing even fewer capacitors than they were really consuming because they were using up their component inventories.

Kemet's objective was to remain profitable for the remainder of the declining phase of the cycle in the capacitor industry, although profits were much reduced. The company's customer service strategy and the quality of its technologies would help it to earn a greater share of customers' business and to be ready when the recovery in the electronics industry came.

Matsushita

Mr Kaoru Watanabe has succeeded Mr Sumio Nishiyama as the nominated delegate to the T.I.C. of Matsushita Electronic Components. Mr Watanabe is the General Manager of the Products Engineering Group, Capacitor Business Unit, LCR Device Company, Matsushita Electronic Components Co., Ltd. His telephone number is +81 774 33 5818, fax +81 774 33 4251, and e-mail PAN35551@pas.maco.mei.jp.

Metallurg

Reporting on the quarter ended September 30th, Metallurg saw operating income increase by 65% over the corresponding quarter in the previous year. Net income for the first nine months of 2001 was higher than net income for the first nine months of 2000, said the report issued on November 12th. The gain included income from Metallurg's sale of its minority interest in Solikamsk Magnesium Works.

Mr Alan D. Ewart, President and Chief Executive Officer of Metallurg attributed the improved results for the third quarter to 'a combination of continued strong demand for our products from the superalloy and titanium industries, increased demand for aluminum powders and the profitability of our tantalum products'. He added that Metallurg's 'year-to-date performance additionally benefited from the restructurings we implemented last year and from the two acquisitions we made'.

H.C. Starck GmbH

The position of the company's delegate Dr Axel Hoppe at H.C. Starck GmbH & Co KG is General Manager, Production and Engineering. Tel.: +49 5321 751 3322, fax: +49 5321 751 4322.

Tantalum Australia

New address:
Tantalum Australia Pty Ltd
13 Mumford Place,
Balcatta, WA 6021, Australia.
Tel.: +61 8 6241 1888
Fax: +61 8 6241 1811
E-mail: mfotios@australasiangold.com.au
The company recently announced the discovery of a major pegmatite-hosted tantalum deposit at its recently acquired Mt Deans Project in Western Australia's Eastern Goldfields. Drilling indicates ' the potential for a significant resource containing at least 5 million pounds of tantalum pentoxide', said Tantalum Australia.