

# T.I.C.

## TANTALUM-NIOBIUM INTERNATIONAL STUDY CENTER

### PRESIDENT'S LETTER

Symposium 2000 is being finalized and all members should have received an information and pre-registration packet. I expect many O.E.M.'s and contract manufacturers from the Bay area to be in attendance also.

Our technical topics prove to be very interesting and cover all aspects of our business. The Symposium 2000 organization committee has done an outstanding job preparing the details and agenda for this conference. For planning purposes, please respond to the Secretary General relative to your pre-registration as soon as possible.

This continues to be an extremely demanding year for all businesses and continues to emphasize the need for strong communications and supply chain management relative to all aspects of our business.

I look forward to seeing you in San Francisco, October 22nd-25th 2000.

Charles Culbertson II  
President

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### DESTINATION SAN FRANCISCO

An exciting conference is in prospect for the T.I.C. when Symposium 2000 takes place in October.

Readers of this Bulletin have seen the wide range of interesting topics to be covered by our speakers, the abstracts were printed in Bulletin no. 102. All sectors of the industry will be covered, with special emphasis on developments in capacitor manufacture as befits a conference at this time and in California, with a field trip to Silicon Valley.

Sunday October 22nd will see the participants gather at the Grand Hyatt Hotel for registration and the welcoming reception. Following the Forty-first General Assembly of the Tantalum-

Niobium International Study Center, on Monday October 23rd, the President, Mr Charles Culbertson II, will open the technical sessions of Symposium 2000. The evening will be graced with the gala dinner. Technical presentations will continue on Tuesday and on Wednesday morning, when the President will formally close the Symposium before lunch.

The plant tour on the afternoon of Wednesday October 25th, from 1p.m. to 7p.m., will take the delegates to the heart of Silicon Valley to see products made with the capacitors which are the *raison d'être* of many T.I.C. member companies. The trip to Flextronics International and to the Intel Museum cannot fail to interest all the delegates, however. Each one of us, in every business, nowadays uses computers and telephones in constantly burgeoning variety and in ways unimagined only a short while ago, so a glimpse of this technology will be fascinating.

An additional plant tour to Wah Chang is offered on Thursday, a company at the forefront of developments in the applications of niobium.

Alternatively delegates can relax with a special tour to the Wine Country: some of the best spots in the Napa Valley have been selected and booked for our group to visit, including the Niebaum-Coppola Winery, and lunch at Clos Pegase.

Our welcoming reception will be hosted by Kemet Corporation, one of the major manufacturers of tantalum capacitors and the company of our President, Mr Culbertson. The splendid views from the top of the hotel will enhance the ambience for this cocktail party to open the conference in generous fashion.

The gala dinner with which Monday's events will culminate is sponsored and arranged by the H.C. Starck companies in celebration of their long involvement with tantalum and niobium. A sumptuous dinner and an evening of special entertainment are promised, to make the evening memorable.

### E-MAIL ADDRESS

Please note that the e-mail address of the T.I.C. is

**[tantniob@xs4all.be](mailto:tantniob@xs4all.be)**

although the former address [tantniob@agoranet.be](mailto:tantniob@agoranet.be) also functions.

The company which ran agoranet has been taken over, and the old address will cease to be current at some time on the future.

**[www.tanb.org](http://www.tanb.org)**

**e-mail to [tantniob@xs4all.be](mailto:tantniob@xs4all.be)**



## NIOBIUM TODAY: AEROSPACE AND SUPERCONDUCTOR APPLICATIONS

by Mr Barry P. Valder, Director, Business Development – Niobium/Superconductivity, Oremet-Wah Chang (now Wah Chang). Presented at the meeting in Perth, October 1999. N.B. A paper by Wah Chang, entitled 'Application for Ti-45Nb Beyond the Aerospace Industry', is in the programme for Symposium 2000.

While there exist many different and varied applications for niobium and niobium alloy metal today, this presentation will focus on two specific areas – our WC-103 alloy for aerospace applications, and Nb47Ti for superconductor applications, specifically those pertaining to High Energy Physics (HEP) programs.

### INTRODUCTION

In 1956, construction of a facility to manufacture production volumes of zirconium and hafnium products began in Albany, Oregon, to provide the necessary materials to help power the U.S. Naval Nuclear Propulsion system. In the early 1960's, in an effort to diversify markets and to expand business opportunities, Wah Chang installed new facilities to manufacture niobium/niobium alloy – or in those days columbium metal. The key markets identified at this time were aerospace and superconductors.

There was tremendous research performed at this time to develop 'space-age' materials to support various NASA programs. One of the most successful alloys coming out of this effort was the Wah Chang alloy WC-103, which contains 10 w/o hafnium, 1 w/o titanium, with the balance niobium. The key to the success of this material is directly related to its fabricability and its ability to withstand high stress levels at elevated temperatures. WC-103 became the alloy of choice for many of the aerospace applications – rocket thrusters, nozzle skirting, and jet engine thrust augmentors.

During this same period of time, research performed at Bell Laboratories predicted a future for niobium materials in the world of superconductivity. Wah Chang invested heavily in research that has allowed us to become one of the leading producers of niobium metal and NbTi alloy for superconducting applications. Expansion began in earnest during the mid-1980's in a new facility, located in Huntsville, Alabama, designed to manufacture product to feed various superconducting applications. Today that effort has allowed Oremet-Wah Chang to become the leading supplier of NbTi alloy for the Large Hadron Collider being built at CERN in Geneva, Switzerland. Oremet-Wah Chang stands poised to build on this success as work continues on various other HEP programs around the world.

### CORPORATE HISTORY

Dr K.C. Li established Wah Chang as an ore trading company in 1916 in New York State. Dr Li was instrumental in obtaining large amounts of antimony, considered a strategic material, from the Far East, for the U.S. Government. This relationship continued for many years, and subsequent to World War II, Wah Chang, in conjunction with the U.S. Bureau of Mines, was invited to develop the procedures for the production of high purity titanium metal.

In 1956, construction of a commercial facility for the manufacture of nuclear grade zirconium sponge via the Kroll process (developed at the U.S. Bureau of Mines in Albany, Oregon) and its co-product hafnium, began in Albany. In the early 1960's, additional facilities were added for the production of niobium products.

In 1967, Teledyne Inc. acquired Wah Chang, which resulted in an infusion of capital and management expertise that has enabled Wah Chang to grow to its present role in supplying both reactive and refractory metals to various markets.

In August of 1996, Allegheny Ludlum and Teledyne Industries merged and formed Allegheny Teledyne Inc. (ATI), and Wah Chang became part of the High Performance Metals Group (HPMG) of this new entity. Then in March of 1998 ATI merged with Oremet Corporation (also located in Albany, Oregon), one of the world's leading producers of titanium sponge and ingot. This merger both strengthened and diversified ATI's position in the international titanium community, due to the combined capabilities of Oremet, Wah Chang and Allvac.

### OREMET-WAH CHANG (OCW) TODAY

Today, Oremet-Wah Chang is part of Allegheny Teledyne Inc.'s High Performance Metals Group and consists of the following companies and products:

- Oremet – Ti sponge, ingot, castings and mill product
- Wah Chang – Zr, Hf, Ti, V, some Ta, and, of course, Nb in various mill product forms
- International Hearth Melting (IHM) – Ti and Zr melting by EB cold hearth
- OWC-Alabama – producing NbTi rods for MRI customers and NiTi memory metal rod
- Rome Metals – finishing facility for flat-rolled products, and
- Titanium Industries – distributor and first-stage processor of titanium mill products

### AEROSPACE AND SUPERCONDUCTOR APPLICATIONS

In today's world there are as many different and varied applications for niobium and niobium alloys as there are different alloys within the niobium family. Two unique areas that fit the role of vital applications include aerospace and superconductivity. In the grand scheme of things in the niobium world, only a small portion of niobium feeds these two critical applications – very probably less than 5% goes into niobium metal and niobium alloy products. For many aerospace needs, WC-103 is the material of choice by design people, while physicists world-wide depend on Oremet-Wah Chang's alloys in the form of Nb47Ti and, to a lesser extent, Nb7.5Ta to power the tools of the HEP trade.

#### Aerospace Applications

Early Wah Chang leadership recognized the benefits that diversification would bring towards expanding business opportunities. The end result was expansion of facilities for niobium production taking advantage of the current technology employed for the separation of hafnium oxide from the zirconium oxide necessary for nuclear application.

The justification for this expansion was fueled in part in the late fifties through Wah Chang's recognition of future programs involving niobium and niobium alloys. One of the first programs was a push by the U.S. Government for the development of space age metals for NASA based programs. The Soviet Union had launched 'Sputnik' in 1957, and the Space Race had officially begun.

With government support there came about an intense research and development effort. Many top U.S. companies were



involved in various alloy development programs. These companies composed a veritable Who's Who of American business and include Boeing Airplane Company, DuPont, Fansteel, General Electric, Imperial Metals, Pratt & Whitney, Stauffer, Union Carbide, Westinghouse, and, to a certain degree, Wah Chang. Even though Wah Chang was in its infancy it had already developed a high reputation for its ability to produce quality reactive and refractory metals. These companies produced a multitude of alloys looking for the right combination of properties.

### **Development of WC-103 Columbium Alloy**

The Boeing Airplane Company and Wah Chang established a co-operative program in 1959 to develop sheet alloys of columbium, tantalum, molybdenum, and tungsten which could be used for high temperature structures.

During 1959 and 1960, a total of 23 different columbium alloy compositions were prepared at Wah Chang by the melting of buttons, with subsequent forging and rolling of the buttons into sheet specimens. Eleven of these alloys had adequate fabricability to produce sheet samples, which could then be used for evaluation of mechanical and physical properties. The sheet specimens of the 11 alloys were prepared and tensile tested at room temperature, at 2000°F, and at 2500°F. The alloy found to have the most promising combination of elevated temperature strength and fabrication characteristics was designated as WC-103 alloy.

The summary written for the co-operative program described WC-103 as follows: 'The alloy exhibits strength, fabricability, and other properties which indicate potential design advantages for high temperature structure applications such as re-entry vehicles'. The same attributes required in 1959 are still valid for today's aerospace applications.

So, the question is: 'Just what is WC-103?' First of all, it is a refractory metal alloy. It has excellent fabrication capabilities and it is considered the most 'forgiving' niobium alloy for welding and shape forming. Lastly, it maintains its work ethic for temperatures up to 1500°C.

The composition of this alloy is, as noted earlier, hafnium 10%, titanium 1%, balance Nb. This new alloy composition became the metal of choice for the U.S. Space Program under the direction of the National Aeronautics and Space Agency. Some of the applications where this composition found a home include the F-1 engines for Saturn V rocket, the Apollo 11 Lunar Module rocket thruster nozzles, the Space Shuttle navigational thrust augmentors, and the nozzle flaps, or thrust augmentors, for the F-16 Fighter powered by the Pratt & Whitney PW 1120 F-100 engine.

### **Communications Satellites**

Another key aerospace application in which businesses are involved today revolves around communication satellites. In today's world, wireless technology seems to be one of the key phrases. Wireless technology requires the latest in communication links. The reasons are many but include exponential growth in cell phones and pagers, a tremendous expansion in business computers, and a noticeable global increase in personal home computers.

As a prime example, let's talk briefly about China and its 1.2 billion inhabitants. In the opinion of many experts, China cannot afford either the time or the money to build the necessary infrastructure to modernize an antiquated (by Western standards) telephone system. As a result, cell phones and pagers are a necessity, if not the rage. Hence, the potential for additional WC-103 nozzles and thrusters exists as we put more satellites into orbit to help bridge this communication link into the third millennium.

### **Superconductor applications**

As noted earlier in this presentation, Oremet-Wah Chang has been involved in superconductors since the inception of Wah Chang in the late 1950's. At that time, Wah Chang was making a relatively ductile superconductor material using pure niobium and later the binary alloys Nb-25Zr and Nb-33Zr. In the mid-1960's, a change took place as physicists worldwide converted to the use of NbTi alloy to build their superconducting magnets.

The initial question that requires an answer is: 'What is Superconductivity?' In technical terms we define superconductivity as the phenomenon that occurs when a material loses all resistance to the flow of electricity. This attribute was originally found to occur in certain pure metals and at temperatures near absolute zero, which if you're into numbers is minus 459.67°F, or minus 273.15°C, or zero degrees Kelvin. At Oremet-Wah Chang we define superconductivity in positive terms relating to the future growth of our niobium business.

The primary applications for Type II superconducting magnets (Nb or NbTi based) are Magnetic Resonance Imaging (MRI), Nuclear Magnetic Resonance (NMR), ore separators, experimental MagLev trains, Superconducting Magnetic Energy Storage Systems (SMES), SQUIDs, and particle accelerators/colliders.

### **Magnetic Resonance Imaging (MRI)**

MRI provides medical diagnostic tools designed for looking into the human body without the use of potentially harmful radiation or without invasive surgery. Today the medical community is working on second and third generation machines that are becoming more and more sophisticated with regard to soft tissue resolution. Currently, about 60% of our workload in niobium is geared to the MRI business.

### **Nuclear Magnetic Resonance (NMR)**

Twenty years ago MRI techniques were known as NMR, but in an effort to separate this new technology from the 'Nuclear' business a subtle change took place deleting that reference. Today, NMR generally implies use for research activity and is a useful tool in the analysis of both organic and inorganic materials.

MagLev is an abbreviation for Magnetic Levitation, whereby superconducting magnets enable experimental trains to have the ability to hover above the tracks and then are able to propel the train at speeds approaching 500km/hour. Japan Railway is keenly interested in this technology, and most of the R & D effort, with a few exceptions, takes place in Japan.

### **Superconducting Magnetic Energy Storage (SMES)**

SMES Systems are now a reality as American Superconductor Corporation recently announced another order for a SMES unit bringing its order backlog to eight units. What does a SMES unit do? Direct current is passed through a NbTi coil to create an immense, sustained magnetic field that is designed to store energy until peak demand requires that it be fed back into the power grid.

### **SQUIDS**

Some people might be inclined to ask what is a squid? In gastronomic circles a squid may be considered a delicacy. In the superconducting world, a SQUID is a Superconducting Quantum Interference Device. It has a unique capability to detect magnetic fields as weak as one ten-billionth of the earth's magnetic field. In medical diagnostics, SQUIDS are used to pin-point the location of magnetic fields and thus identify electrical activity in the brain. In geophysics, SQUIDS are used to track the magnetic signatures of subterranean minerals to locate oil deposits.

(continued on page 6)



PRODUCTS AVAILABLE FROM T.I.C. MEMBERS	Raw materials							Compounds									Carbides				
	Tantalite	Columbite	Struverite	Tin slag	Pyrochlore	Synthetic concentrate	Other	Tantalum oxide, standard- grade	Tantalum oxide, optical-grade	Tantalum oxide, ceramic-grade	Potassium fluotantalate	Niobium oxide, standard-grade	Niobium oxide, optical-grade	Niobium oxide, ceramic-grade	Potassium fluoniobate	Other	Tantalum carbide	Niobium carbide	Binary carbides	Mixed carbides	Carbide tools
A&M Minerals and Metals	●	●	●	●	●			●			●	●									
AVX																					
AVX Tantalum Corporation																					
BEH Minerals			●																		
Cabot Performance Materials											●										
Mineracao Catalao de Goias																					
Cluff Mining	●		●	●																	
Crystal Technology																●					
Epcos																					
Ethiopian Mineral Development Enterprise	●							●													
Fujitsu Media Devices																					
Sons of Gwalia	●			●																	
W.C. Heraeus																					
Hitachi AIC																					
Kemet Electronics																					
Kennametal																	●	●	●	●	
King Metallurgical								●									●			●	●
Alfred H.Knight																					●
Malaysia Smelting				●																	
Mamore Mineracao e Metalurgia		●					●	●				●									
Matsushita																					
Metallurg	●	●		●				●	●	●	●	●	●	●							
Mitsui Mining & Smelting								●	●	●	●	●	●	●			●	●	●	●	
NAC Kazatomprom																					
NEC																					
Nichicon-Tantalum																					
Ningxia Non-ferrous Metals Smelter										●	●	●	●	●			●	●	●	●	
Northwest Inst. Non-ferrous Metals Research																					
Oremet Wah Chang																					
Osram Sylvania																	●		●		
Pacific Ores Metals & Chemicals	●	●									●	●									
Plazaminerals	●	●																			
Reference Metals												●	●	●							
S.A. Minerals	●	●	●	●									●								
Sandvik Coromant																					●
Seco Tools																					●
Showa Cabot Supermetals																					
Silmet		●					●					●				●					
Sogem	●		●	●																	
Special Metals Fabrication																					
Specialty Metals Company	●	●			●			●			●	●									
H.C. Starck GmbH & Co KG								●	●	●	●	●	●	●	●	●	●	●	●	●	
H.C. Starck Inc.								●	●	●	●	●	●	●			●	●	●	●	
H.C. Starck (Thailand)								●			●	●									
Alex Stewart (Assayers)																					
Thailand Smelting & Refining				●																	
Trademet	●	●	●	●																	
Treibacher Industrie	●	●	●					●	●			●	●				●	●	●	●	
Vishay Sprague																					
H.C. Starck - V Tech								●	●	●	●	●	●	●	●		●	●	●	●	

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## Particle Accelerators/Colliders

Accelerators/Colliders are massive research tools designed and invented by particle physicists to accelerate subatomic particles and then cause them to collide, in an effort to study matter and its origins.

Why niobium-titanium alloy? The next question that bears investigation is: 'What attributes make NbTi alloy such a great superconducting type of material?' The answer is that it is the strength, ductility, critical current density, and relatively low cost of this material that make NbTi alloys stand out as commercially viable superconductor material. From a fabrication perspective it is the ductility that is the critical parameter.

There are multiple stages of fabrication that take place, not only at Oremet-Wah Chang, but at the various wire strand manufacturers. NbTi alloy is an extremely ductile material and can be drawn down to fine filaments, formed into wire, woven into cable, and finally wound into complex coils by the magnet manufacturing people. Much research has been undertaken in ceramic superconductors. The single limiting factor at this point for oxide-type superconductors is the lack of ductility owing to the fact that ceramic composites are brittle and difficult to fabricate into wire and cable.

## High Energy Physics (HEP) Programs

Over the last quarter-century, Oremet-Wah Chang's superconducting alloys have found great success in many of the world's High Energy Physics programs. These include the Mirror Fusion Test Facility at Lawrence Livermore Laboratory in California, the Fermilab Tevatron Accelerator in Illinois, the Stanford Linear Accelerator Center in California, KEK (Koh-Energy Butsurigaku Kenkyusho) in Japan, the DESY-HERA project in Germany, the ill-fated Superconducting Super Collider, scheduled to be built in Texas (but not constructed), RHIC (Relativistic Heavy Ion Collider) at Brookhaven National Laboratory in New York State, and CERN's various projects, specifically the Large Hadron Collider (LHC).

CERN (European Laboratory for Particle Physics), located in Geneva, Switzerland, is an international laboratory consisting of over twenty member countries where the W and Z bosons were discovered. And, for your information, CERN is considered the birthplace of the World Wide Web. The Large Hadron Collider (LHC) will search for Higgs bosons and other fundamental particles and forces. This specific collider was approved by CERN's governing council in December 1994. One of the key questions to be explored by CERN's research teams is the mechanism that gives matter its mass. LHC is being built to provide proton-proton collisions at energies ten times greater than any previous machine and will utilize over 5000 superconducting magnets, taking advantage of the latest technology available to particle physicists today. The amount of NbTi alloy to be used for this project is estimated at just over 400MT – 360MT for the original project and an additional 30-40MT for various detector magnets. We expect to be making Nb47Ti alloy for this project through fiscal year 2003.

The LHC will consist of two colliding synchrotrons installed in the 27-kilometer long tunnel ring. Two superconducting magnetic channels will accelerate the protons around the ring. In addition to the 1296 dipole magnets, LHC will use over 2500 other bending and focus magnets to conduct its many varied experiments.

## SUMMARY

To summarize, Oremet-Wah Chang's WC-103 niobium alloy has been the alloy of choice for over forty years for various NASA and other aerospace related ventures. We fully expect this alloy

to perform well into the next millennium. Similarly, Wah Chang's Nb47Ti and Nb7.5Ta alloys have provided a whole new dimension with regard to important discoveries in particle physics as well as having a profound impact on medical diagnostics and also on energy related activities.

## BOOKS

### *Handbook of Extractive Metallurgy*

edited by Fathi Habashi, an updated collection of articles from Ullmann's Encyclopedia of Industrial Chemistry, is available from Wiley-VCH at DM1998. Tantalum and niobium are featured in Volume III, in the section Refractory Metals. See [www.wiley-vch.de/home/ullmanns/](http://www.wiley-vch.de/home/ullmanns/) for more information. ISBN 3-527-28792-2.

### *Alloys: Preparation, properties, applications*

is another work based on articles from the same Encyclopedia, also edited by Prof. Habashi. ISBN 3-527-29591-7, price DM298, also from Wiley-VCH.

## DETECTOR TECHNOLOGY

A new development in detector technology is good news for astronomers, reported CERN Courier. Designed by a team in the space science department of the European Space Agency's Science and Technology Centre, the detector saw first light early in 1999 at the William Herschel Telescope on La Palma.

The detector is based on an array of tantalum superconducting tunnel junctions, operating at about 0.3K. The instrument is interesting to astronomers because it allows single photon counting, imaging capability and the possibility to determine the energy of the incoming photon, all at the same time.

## MEMBER COMPANY NEWS

### Products available

The chart on pages 4 and 5 of this Bulletin summarises the response of our member companies to a questionnaire asking them to list the products they have available to customers. Members which replied are included in the chart.

The products are grouped in categories, ranging from raw materials through processed and manufactured products to services of analysis and assaying.

### AVX

On July 13th AVX Corporation reported net sales worth US\$602.4 million in the quarter ended June 30th 2000, compared with US\$343.1 for the same quarter in the previous year. Chairman and CEO Mr Dick Rosen stated that orders for the quarter were the highest in the company's history. As a result, AVX's investment to expand production capacity was also at a record level. The outlook for the remainder of the fiscal year (that is, to end March 2001), Mr Rosen went on, 'looked good'.

AVX has been the happy recipient of several honours lately. One of the Corporation's customers, a world leader in the design and development of cardiovascular medical products, awarded AVX its Quality and Leadership Award, mentioning individual facilities at Biddeford, Myrtle Beach and Paignton for quality, including that of tantalum capacitors. Another customer also honoured AVX with its Global Supplier Award for its 'ability to sup-



port the customer's supply chain management objectives'. AVX Corporation has been listed in Business Week's Information Technology Annual Report as one of the world's 100 best performing information technology companies.

#### Cambior

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Work on Phase I of the expansion to the Niobec mine continued on schedule and on budget, and was completed by mid-July of 2000, Cambior reported on July 27th. Cambior's 50% share of production from the mine in the second quarter of 2000 was 266 tonnes of niobium, bringing the total for the first six months of the year to 546 tonnes.

#### Cluff Mining

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In a press release dated June 28th 2000, Cluff Mining reported progress on its tests on the niobium deposit at Mabounié. In Bulletin 101 we noted its announcement of a niobium carbonate resource of 14.8 million tonnes at a grade of 1.69% Nb<sub>2</sub>O<sub>5</sub>.

The pilot plant test work on a representative bulk sample of 1080 tonnes excavated in February from the company's Mabounié niobium joint venture in Gabon commenced at the VTT Research Centre in Finland on 8th May and was completed on 19th June 2000. Although final results are not yet available, the initial results have been encouraging and the partners now plan to initiate a feasibility study into the development of the project', the statement read.

Cluff Mining has a 35% net interest, Treibacher Industrie AG (also a T.I.C. member company) 14%, Niobium Mining Company 21%, with the balance of shares being held by a group of Gabonese private investors, it was reported.

Preliminary tests indicated that it was possible to concentrate the pyrochlore and produce a niobium concentrate.

#### Daewoo

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The delegate of Daewoo Electronic Components is now Mr Myung-Goo Hwang. Address: 19 Mangjea-dong, Jeongup-shi, Jeonlabuk-do, Korea 580-100. E-mail: mghwangpark@hanmail.net. There is a web site at www.daum.net, requiring Korean characters to be installed on your computer.

#### Epcos

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To contact T.I.C. delegate Dr Josef Gerblinger at Epcos AG, the telephone number is +49 7321 326 257, fax: +49 7321 326 334, e-mail: josef.gerblinger@epcos.com.

Epcos has a new home page on its web site, with a compact navigation bar on the left, and detailed search facilities for components. The site can be reached through its link to the T.I.C. membership list.

#### Sons of Gwalia

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In its report on activities for the quarter ended June 30th 2000, the company noted record tantalum production of 338 950 lb for the quarter. Extended tantalum sales contracts for at least the next five years would significantly increase sales and volumes, annual sales would increase to approximately 2.3 million lb from the present level of about 1.1 million lb.

Tantalum production would be more than doubled following major expansion of both the Greenbushes and the Wodgina

mines, the company announced. Capital costs for the expansion, planned to take place over the next three years, would be of the order of A\$100 million. At the Greenbushes mine, production would be increased from 0.7 million lb to 1.3 million lb per annum by expansion of the existing processing facility from 1.6 million tonnes to more than 2.75 million tonnes per annum. An underground mine would be developed, by way of a decline, to reach resources below the existing Cornwall open pit. Over the next two years, the current production levels at the Wodgina mine would be doubled to 1 million lb per annum, with throughput capacity being increased to 1.8 million tonnes per annum.

Tantalum production at each mine was a record in the quarter, at 192 547 lb for Greenbushes, and 146 403 lb for Wodgina. A major upgrade of the gravity circuit in the primary tantalum concentrator at Greenbushes, and new sulphide flotation and magnetic separation circuits at Wodgina, contributed to these results. A new drilling programme to extend the current resource at Wodgina has begun, and is expected to be completed early in 2001.

#### Heraeus

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An extended article on the Heraeus group companies, their history and current range of activities in Metal Bulletin Monthly of June 2000 is illustrated by a photograph of devices called stents. 'By developing a process to laser-cut solid tantalum or niobium into stents - lattice tubes inserted by surgery to restore the flow through blocked major blood vessels - Heraeus says it has created a highly biocompatible product with advantages over stainless steel', reads the caption.

#### Hitachi

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The delegate of Hitachi AIC to the T.I.C. is now Mr Kazuyuki Iida. He may be contacted at 16 Kumagami-ohdaira, Miharu, Fukushima, Japan 963-7704. Telephone +81 247 62 8111, fax + 81 247 62 2463, e-mail HCN03750@nifty.ne.jp. Mr Susumu Wada, who has made active contributions to T.I.C. meetings, has moved to other responsibilities: we thank him for his contribution to the association.

#### Kemet

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At its Annual Meeting of Stockholders on July 26th, Kemet announced the 'addition of more than 85 000 square feet of manufacturing floor space dedicated to the production of solid tantalum and conductive polymer tantalum capacitors in Matamoros, Mexico, and Mauldin, Greenwood and Simpsonville, South Carolina'.

Mr David Maguire, Chairman and CEO, explained that 'customer demand for high-value, high-frequency capacitors has exploded, especially for broadband Internet infrastructure build-out. These capacity expansions will ensure that we will be able to provide high-value tantalum and high-frequency organic tantalum capacitors to meet our customers' needs, now and in the future'.

A large extension to be constructed at Matamoros, additions at Mauldin and Greenwood and a relocation of support functions would provide the extra manufacturing space. This will allow an increase in the production rates of solid tantalum surface-mount capacitors and also of 'KO-CAP', Kemet's conductive polymer tantalum capacitor whose sales are growing much faster than originally projected. Some 1100 new jobs would be created within a year.

Kemet reported record sales and earnings for the quarter ended June 30th 2000: sales for the quarter were US\$329.2 million, compared with US\$162.6 million for the same quarter

in 1999. These rates of growth were made possible by an increase in unit volume, an increase in selling prices, and an adjustment of product mix towards higher-valued capacitors for telecommunications, computers and Internet infrastructure markets. Customer concerns about future shortages were being met by long term supply agreements. Sales of surface mount capacitors, leaded capacitors and exports all increased strongly.

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#### **Mamoré Mineração e Metalurgia**

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In July, Metal Bulletin reported that parent company Parapanema was looking for strategic partnerships or joint ventures, and had set a mid-July deadline for receipt of proposals, but the time limit had later been relaxed. An international partner for Mamoré was being sought, commented LMB.

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#### **Plazaminerals**

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E-mail for Plazaminerals should be directed to [plazatour@plazagroup.ch](mailto:plazatour@plazagroup.ch).

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#### **Trademet**

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#### **VMC**

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Vacuum Metallurgical Company has announced that Dr Chikara Hayashi, Chairman of VMC, who served as the President of the T.I.C. in 1985/6, had retired from office at the Shareholders Meeting and Board of Directors Meeting held on June 22nd 2000.

Mr Yoichiro Takekuro, at the same meeting, retired as President and CEO, and succeeded Dr Hayashi as Chairman of the Board. Mr Takekuro continues to be a member of the Executive Committee of the T.I.C.

Mr Gen Imachi, a director of Ulvac Japan Ltd., was appointed President of VMC.