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TANTALUM-NIOBIUM INTERNATIONAL STUDY CENTER

PRESIDENT'S LETTER

The Symposium 2000 continues to present itself as an excellent conference. Speakers have now been selected and all events are being finalized.

Our business picture demonstrates the importance of supply chain management and how we as an industry must support each other. We will discuss in more detail these aspects of our business at the Symposium. In today's market, the need for total supply chain management from the ore to O.E.M. is re-emphasized. All aspects of our industry continue to grow at record pace.

Symposium 2000 proves to be at this point a dynamic meeting, so please plan on attending.

Charles Culbertson II
President

SYMPOSIUM 2000

From October 22nd to 25th 2000 the world of tantalum and niobium will centre on San Francisco for the next International Symposium organised by the T.I.C.

On Sunday October 22nd the registration desk will be open from 10a.m. to 5p.m. From 6p.m. to 8p.m. all participants are invited by Kemet to a cocktail reception to welcome everyone to the conference. We appreciate the generosity of Kemet in sponsoring this event.

On Monday October 23rd the Forty-first General Assembly of the tantalum-Niobium International Study Center will take place from 8.30a.m., for the delegates of member companies. The business of the association will be carried out, including the election of new members.

At 9.45a.m. the President of the T.I.C., Mr Charles Culbertson II, will open the International Symposium, which is intended for everyone with an interest in tantalum and niobium, from member and non-member companies. The presentation of technical papers will take place during the rest of the day, with a break for lunch. Abstracts for the papers are printed in this issue of the Bulletin.

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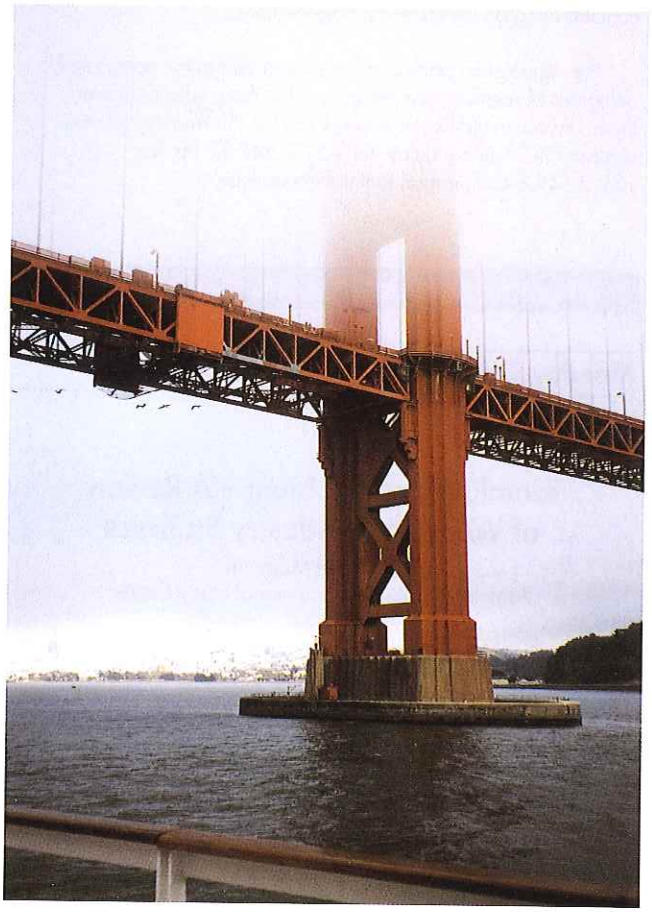

In the evening a gala dinner will be arranged by H.C. Starck: cocktails at 7p.m. will be followed by dinner, then entertainment by the Pink Flamingos. All participants are invited by the host companies, and we are grateful to the Starck group of companies for offering what promises to be a memorable evening.

The technical presentations will resume on Tuesday, and continue on the morning of Wednesday October 25th. The formal proceedings will be closed by Mr Culbertson at the end of the morning session.

In the afternoon of Wednesday October 25th the group will visit the facility of Flextronics International, contract manufacturer of electronics materials, and also the Intel Museum, a notable collection illustrating the history of computer chips and the rapid development of their use.

The programme will include continental breakfast, lunch and coffee breaks on each of the three days, as well as attendance at

all technical sessions and the plant tour, and the welcome cocktail and gala dinner. The participation fee will cover a copy of the Proceedings, to be printed as a hard-cover book after the conference.

On Thursday October 26th there will be a special opportunity to visit the niobium facility of Wah Chang at Albany, Oregon. This optional tour will be available for a small group, and numbers will be limited, so those interested should apply early.

Also on Thursday October 26th a private tour to the Wine Country is an option. A special programme including wine tasting, a visit to the winery and the cinema museum at Niebaum-Coppola, buffet lunch with wine at Clos Pegase, on a full day tour has been arranged for the pleasure of the delegates as they relax after concentrating on the technical presentations.

Pre-registration packages have been sent to the nominated delegates of member companies, and to those who requested them. If you would like us to send you the information, please contact T.I.C. without delay: tel. +32.2.649.51.58, fax +32.2.649.64.47, e-mail tantniob@xs4all.be.

SYMPOSIUM 2000 ABSTRACTS

Monday October 23rd 2000

Tantalum and Niobium – A Review of Worldwide Industry Statistics

C. Edward Mosheim
Tantalum-Niobium International Study Center

The utilization of increasing quantities of tantalum and niobium containing materials during 1999 in telecommunications equipment, computers, metallurgical and consumer products continued to drive the requirements for products all the way down through the 'food chain' to the raw material suppliers.

The tantalum capacitor segment has been the leading driver for the tantalum industry with the consumption of approximately 65% of total shipments. The growth of niobium is highly influenced by demand for ferro-niobium in the microalloyed steels, stainless steels and superalloys.

Recent data collected by the T.I.C. will be reviewed to show the trends observed for this past year through June 2000.

Significant industry announcements will be reviewed in an effort to provide some insight into future direction and requirements for these two elements.

Tantalum Raw Materials

John Linden
Sons of Gwalia

Tantalum is required for many uses, and applications constantly expand. The supply of raw materials will be reviewed in the light of present demand.

The Use of Tantalum and Niobium in the Manufacture of Superalloys

John M. Eridon
Cannon-Muskegon Corporation

Superalloys are a class of engineering materials developed for use at elevated temperatures where high mechanical stresses are encountered. These materials are primarily used in the hot section of gas turbine engines, and many of the compositions contain tantalum or niobium as alloying elements. These alloys are produced by the vacuum induction melting (VIM) process.

This paper will describe the VIM process, how tantalum and niobium are used, the forms used and the chemistry considerations relating to the selection of different grades for different types of superalloys. An explanation will also be given on why tantalum and niobium are used in superalloys.

Technical Review of Tantalum High CV Powder for Capacitors

Tomoo Izumi, Yoshikazu Noguchi,
Yuziro Mizusaki, Isayuki Horio
Showa Cabot Supermetals KK
Presented by Tomoo Izumi

Recent information on tantalum powder for capacitors is introduced. There are two trends in up-to-date tantalum chips: anodes are tending to be either extra small or extra large in size. Even for the same CV level powder, some new solutions will be proposed concerning powder properties to obtain good performance of the sintered anode.

Development of Niobium Capacitors using Conductive Polymer

Toshihiko Nishiyama, Katuhiro Yoshida,
Tadamasa Asami, Masaki Fujiwara, Yoshihiko Saiki
NEC Corporation
Presented by Toshihiko Nishiyama

To meet market demands for high capacitance, low ESR and low prices, NEC has developed a niobium capacitor instead of tantalum. Niobium is cheap and in abundant supply compared with tantalum, but it is difficult to use for capacitors because of its unstable properties. To solve this problem, NEC has used conductive polymer for the cathode layer.

In this report, the characteristics of niobium capacitors using conductive polymer in comparison with tantalum and aluminium capacitors are described.

E-MAIL ADDRESS

Please note that the e-mail address of the T.I.C. is tantniob@xs4all.be, although the former address 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

e-mail to tantniob@xs4all.be

Something New in the World of Oxide Films: the Non-thickness-limited Anodizing of Valve Metals

Brian Melody, Tony Kinard
Kemet Electronics
Presented by Brian Melody

This paper describes the totally unanticipated discovery of the non-thickness-limited anodic growth of non-porous oxide films on valve metals by the application of this technique. So-called barrier anodic films may be grown to thicknesses previously unattainable. Some potential applications of the technique are also suggested.

Recent Developments in Solid Electrolytic Capacitors

W.A. Millman, T. Zednicek, Z. Sita, J Gill
AVX
Presented by William A. Millman

Greatly in demand for up-to-the-minute applications, tantalum capacitors continue to have their excellent properties further improved.

Metallurgical Factors Affecting the Sputtering Performance of Tantalum

Christopher A. Michaluk
Cabot Performance Materials

Tantalum-based thin films are playing a more critical role in semiconductor applications, thanks to the emergence of damascene technology and the subsequent shrinkage in device geometries. With escalating demand for high-reliability tantalum PVD materials comes a need for a greater understanding of the technology of this uncommon refractory metal. The methodologies for achieving the specific microstructural and textural attributes necessary for assuring reliable performance of tantalum sputtering targets are presented.

A New Process for the Production of Tantalum and Niobium Powders from Oxides

L. Shekhter, L. Lanin, T. Tripp, H. Goldberg
H.C. Starck Inc.
K. Reichert, R. Wolf, C. Schnitter
H.C. Starck GmbH & Co KG
Presented by Howard Goldberg

For more than forty years the majority of the world's supply of capacitor grade tantalum powder has been made by the reduction of potassium heptafluorotantalate (K_2TaF_7) with sodium. The process is normally carried out in a stirred molten salt medium at temperatures in excess of 800°C. During this time the tantalum producers have learned how to produce powders with more and more surface area to meet the needs of the electronics industry for higher volumetric efficiency capacitors. Sodium reduction process technology has reached a level of maturity at which it is difficult to continue to improve powder properties.

Recently, H. C. Starck began a program to look at other potential methods of producing the next generation of tantalum powders to satisfy the continuing demand for higher surface areas. The possibility of producing other metal powders, such as niobium or alloys, for use in capacitors was also investigated. This paper will describe a new process for producing tantalum and niobium powders by the reduction of the appropriate oxide. Examples of reduction routes will be presented. We will examine the properties of typical oxide reduced powders in the context of their potential use as substrates for solid capacitors.

Industrial Applications of Niobium

David Rowe
Special Metals Fabrication
Presented by Robert Desberg
CSM Industries

The corrosion resistance of niobium is almost as good as tantalum and it can be used as a cheaper alternative in many applications. The resistance of niobium to compounds such as gallium arsenide is opening up new applications in the semi-conductor industry. Mechanical and corrosion resisting properties of tantalum and niobium are compared and possible applications in the chemical process, furnace and electronic industries are discussed.

Application for Ti-45Nb Beyond the Aerospace Industry

Rob Henson
Wah Chang

The unique properties of titanium 45 niobium have recently led to the development of a number of diverse new applications for the alloy. Spanning a range of markets from implantable medical devices to the hydrometallurgical treatment of metal ores, the alloy has proved to be the solution to a number of varied engineering challenges.

By exploiting the alloy's corrosion resistance together with physical properties such as low thermal expansion and modulus, engineers have reduced the size of implantable electronic devices and increased efficiency in process plants. The author will detail the physical properties of the alloy and describe applications that have recently specified Ti-45Nb.

Evening: Gala Dinner
Entertainment by the Pink Flamingos
All delegates are invited as the guests of H.C. Starck

Tuesday October 24th 2000

Keynote speech:

Latest Developments in the World of Niobium

Harry Stuart
Reference Metals

The most important traditional use for niobium is as a microalloying element to strengthen high-strength-low-alloy structural steels (HSLA) used to build automobiles and gas transmission pipelines. Important secondary uses include stabilization of ferritic stainless steel used for automobile exhaust systems and strengthening of superalloys for aircraft gas turbine engines. Other applications include niobium-based alloys such as niobium-titanium alloys for superconducting magnets. Minor amounts of niobium are used in electronic ceramics and optical lenses.

This paper discusses recent developments in all these areas but principally emphasizes its applications in steel. Trends in steel compositions that have been adopted for a number of niobium-containing steel products and niobium's beneficial effect on the mechanical properties and processability of these products are briefly highlighted. Some potential areas for substitution of other microalloying elements by niobium are also mentioned for comparison and interest. Marketplace supply and demand dynamics are illustrated.

Recent Developments in Niobium Manufacture at CBMM

Clovis Antonio de Faria Sousa, Antonio Telhado Pereira
Companhia Brasileira de Metalurgia e Mineração
Presented by Clovis Antonio de Faria Sousa

The pyrochlore deposit of Araxá is the world's largest known niobium mine in operation. This mineral deposit, which represents more than 60% of the economically extractable reserves known in the world, has been mined since the early 1960's by CBMM (Companhia Brasileira de Metalurgia e Mineração).

Ore reserves amount to 461 million tonnes with an average of 2.5% Nb_2O_5. This ore reserve will provide more than 500 years of mine life.

Since last December CBMM has been operating a second line of ore grinding, thus doubling the annual production capacity, reaching 84 000t of pyrochlore concentrate containing 60% Nb_2O_5 (34 000t of contained Nb metal).

Ferro-niobium has been produced since 1994 in an electric arc furnace. Present annual production capacity is 30 000t of FeNb (20 000t of contained Nb metal). A second line of FeNb production is being planned for operation in 2002.

CBMM also produces pure niobium pentoxide, high purity nickel-niobium, and pure niobium metal. In May 1998 CBMM started the production of optical grade niobium oxide with a present annual capacity of 150t.

In June 2000 CBMM initiated the operation of the Pyrometallurgical Complex. This complex is comprised of two plants, a sintering plant and a desphosphorization plant. The objective is to refine the niobium concentrate with respect to phosphorus, lead and sulphur. Current annual capacity is 84 000t of concentrate.

This paper describes CBMM's processes, focusing on the new developments.

Application of High Purity Niobium for Superconducting TESLA Cavities

W. Singer, H. Kaiser, D. Proch
Deutsches Elektronen-Synchrotron DESY
Presented by Waldemar Singer

The 33km long linear accelerator TESLA with about 20 000 superconducting cavities is being planned for construction beginning in 2002. A test section for TESLA is now being built at DESY.

The main aim in the development of the cavities is to reach the accelerating electric field (Eacc ≥ 25 MV/m). This calls for extremely pure niobium with RRR>300. Clusters of foreign material, even if only a few tenths of a millimetre in size, can drastically lower the accelerating electric field. Several methods of non-destructive inspection of niobium (X-ray radiography, neutron radiography, neutron activation analysis (NAA), synchrotron fluorescence analysis (SURFA), ultrasonic inspection) were applied. A system based on a SQUID detector shows very high sensitivity. An eddy current scanning system with special probes has been built and about 1000 niobium sheets are being tested.

The traditional fabrication procedure of the cavity is deep drawing of the half cells from sheet, and welding with electron beam. Development of an alternative fabrication of seamless cavities by hydroforming is in progress. Several single cell 1300MHz cavities have been formed from seamless niobium tubes. The tubes have been made either by back extrusion and flow forming, or by spinning or by deep drawing. The value of the accelerating electric field so far achieved is 33MV/m.

Recent Advancements in the Production of Tantalum for Sputtering Targets

Prabhat Kumar, Peter Jepson
H.C. Starck Inc.
Presented by Prabhat Kumar

The use of tantalum as sputtered films is increasing, particularly as a barrier layer before copper metallization of integrated circuits. Properties of sputtering targets affect the sputtering process as well as the properties of the film.

This paper will discuss recent developments in the processing of tantalum and their impact on chemical composition, microstructure, and crystallographic orientation of targets. Results of an on-going research to understand the interactions between target properties, the sputtering process and the properties of the sputtered films will also be reviewed.

Hand Held Devices Market: 'Today and Tomorrow'

Patrick McGivern
Palm

This paper will define 'Hand held devices', show their technical development and market development, project the future growth for this market and its need for passive components. It will focus on the future growth of Palm, its products and need for tantalum capacitors.

Development of New Nb_3Al Multifilamentary Superconductor

K. Inoue, T. Takeuchi, Y.Iijima, A. Kikuchi,
N. Nakagawa, G. Iwaki, H. Moriai
National Research Institute for Metals
Presented by Kiyoshi Inoue

We have successfully developed a new Nb_3Al multifilamentary conductor through a rapidly-heating/quenching process. The conductor shows the best values for Tc, Hc_2(4.2K), and Jc(4.2K, 20T) of 17.9K, 26T, and 240A/mm², respectively. The Jc value is 3-5 times larger than those of the commercialized Nb_3Sn multifilamentary conductor, while its Tc and Hc_2(4.2K) are comparable to those of the Nb_3Sn conductors. In addition the Nb_3Al conductor shows excellent tolerance to mechanical strain. We have already performed several tests of small coils in high fields using the new Nb_3Al multifilamentary conductors, and results indicate that the new superconductor is very promising for new-generation superconducting applications. Recently we fabricated Nb_3(Al,Ge) multifilamentary wire through the rapidly-heating/quenching process. The Ge addition improved Tc from 17.9K to 19.4K, and Hc_2(4.2K) from 26T to 40T. The Nb_3(Al,Ge) multifilamentary wire will be used for generating high fields up to 29T. The fabrication costs of Nb_3Al and Nb_3(Al,Ge) wires seem to be much less than those of Bi-system oxide superconductor wires.

Niobium-base Superconductors for the Next Generation High Energy Physics Colliders

R.M. Scanlan
Lawrence Berkeley National Laboratory

One promising path toward a cost-effective next generation hadron collider is to use high field superconducting magnets in order to reduce the size of the storage ring. At present, two types of superconductor are being studied – the Nb-based A-15 compounds Nb_3Sn and Nb_3Al, and the high temperature superconductors (HTS). In this paper, the status of the A-15 compound superconductors will be reviewed. Several laboratories

are developing the magnet technology required to fabricate coils from the brittle materials, and these programs will be reviewed as well. In order to improve performance and cost-effectiveness of the A-15 superconductors, DOE High Energy Physics has launched a conductor development program. The goals, strategy, and status of this new program will be discussed.

Microstructure and Mechanical Properties of Niobium-based Refractory Metals

A. Kasama, H. Tanaka, Y. Tan, C.L. Ma,
K. Sakamoto, H. Tanahashi, M. Fujikura, R. Tanaka
Japan Ultra-high Temperature Materials
Research Institute (JUTEMI)
Presented by Akio Kasama

At the present time, the major materials for the blades of aero- and gas-turbines are nickel-based superalloys. These alloys are generally limited in their working temperature as they have a comparatively low melting point. Therefore there are great demands to replace these by new materials which it is possible to use at higher temperatures. In order to develop innovative materials of refractory metals, the microstructure and mechanical properties of niobium-based alloys have been studied and will be described in this paper.

Industrial-scale Development of Gamma Titanium Aluminides for Specific Products in Advanced Aircraft Engines

Edward A. Loria, Tadeu Carneiro
Reference Metals Company
Presented by Edward A. Loria

Gamma titanium aluminide alloys show a high potential as prospective structural materials because of their low density, high temperature properties, stiffness and oxidation resistance. After a decade of effort on their scientific development, two alloys have now reached the engineering implementation level via specific products for aircraft engine, aerospace and automotive applications. Industrial-scale production of Ti-47Al-2Cr-2Nb and Ti-45Al (or 47Al)-2Nb-2Mn-0.8 vol % TiB_2 has been perfected via investment casting of turbine blades, transition-ducts and radial diffusers for advanced engine components and corner-beam and close-out beam castings for the outlet-nozzle of a very large engine. Also included are the development of sheet corrugations for formed subcomponents and the perfection of cast turbine wheels for automotive turbochargers. The engineering technology that must be developed is discussed for the desired final product. The maturity for a cost-effective production route and a uniformly reliable product are needed as well as a match (balance) between cost and benefits. Cost is a major constraint along with real and perceived risk. Within five to ten years, systematic reduction of certain hardware costs will occur as familiarity builds and expands production. The paper concludes with a summary of new alloys that contain 4 to 10 at % niobium and are being studied for improved performance above 750°C, the limit for the subject alloys.

A New Platform Technology for Orthopaedic Implant Surgery: Hedrocel Trabecular Metal

J. Dennis Bobyn
Montreal General Hospital, McGill University
Joseph R. Vargas
Implex Corp.
Presented by Joseph R. Vargas

Technological developments have improved the reliability and durability of orthopaedic implant surgery. Although porous biomaterials have proven to be effective for skeletal attachment in various orthopaedic reconstructive procedures during the last two decades, conventional porous materials often do not have the combination of characteristics that are necessary for certain applications. In areas of bone augmentation, tumor resection/reconstruction, fracture fixation, spine fusion and joint replacement, there is a great need for a porous biomaterial possessing high porosity, good tissue ingrowth characteristics, high bulk strength and ductility, low modulus of elasticity, and manufacturing flexibility. Implex Corp, Allendale, NJ, USA has developed a unique porous tantalum biomaterial called Hedrocel®. The material is fabricated by the chemical vapor deposition of commercially pure tantalum onto a latticework of vitreous carbon struts. Tantalum is exceptionally biocompatible and has a 50-year history as an implant material in humans. The Hedrocel® porous structure is a repeating network of interconnecting pores typically possessing a high volume porosity of about 80%. Hedrocel® mechanical tests show it to be very tough and ductile, with static and fatigue properties well in excess of those required for most reconstructive procedures. The strut geometry resembles trabecular bone and possesses a surface roughness that results in a higher coefficient of friction against hard and soft tissues than conventional porous materials, a property that augments initial implant stability. The manufacturing process is highly reproducible and the material can readily be formed into any implant shape or size.

Adjusting Micromorphology of Sodium-reduced Tantalum Powders to Achieve High Performance

He Ji Lin, Pan Lun Tao, Lu Zhen Da
Shi Wen Feng, Shu Yong Chun, Zeng Fang Ping
Ningxia Non-ferrous Metals Smelter
Presented by Zeng Fang Ping

Sodium-reduced tantalum powders are aggregates composed fundamentally of agglomerates. The micromorphology of these agglomerates governs the physical properties of the powder. When altering the process parameters, especially the ones in the after-reduction process steps, the micromorphology of the powder could be adjusted and the powder will hence have proper Scott bulk density, good flowability and enough particle robustness, which are good for making high performance tantalum capacitors.

Statistical Modeling of the Effect of Nitrogenation on the Electrical and Physical Properties of Tantalum

Donald J. Clancy
Cabot Performance Materials

Nitrogenation is a novel way of modifying the electrical properties of tantalum. This study investigates and quantitatively models the effect of nitrogenation on the electrical and physical properties of tantalum. Additionally, there have been questions in the industry regarding whether the nitrogen should be located primarily on the surface, or diffused throughout the bulk of the tantalum particle. This study seeks to answer this question by comparing the effects of bulk versus surface nitrogen content.

Battle for High CV Tantalum Capacitors

Yuri Pozdeev-Freeman
Vishay-Sprague

Tantalum capacitors have been manufactured for more than 40 years: during this time the major trend has been to increase the CV of powder.

The present work deals with the physical barriers caused by the use of fine tantalum powder that affect capacitor performance and reliability. In particular, over-saturation of tantalum anodes with oxygen becomes a serious problem when the efficient radius of tantalum particles approaches 1 micron. The critical oxygen content depending on powder CV, specific of bulk and surface oxygen, impact of lead to pellet attachment (embedded versus welded leads), tantalum doping with nitrogen (powder versus sintered anodes), etc. is under discussion.

Capacitor Trends in the Computer Industry

Michael Lauri
IBM Corporation

This presentation will cover all types of capacitor technology trends going on in the computer industry today and in the future. Topics to be discussed will be an overview, IBM hardware development, capacitor drivers, capacitor usage and trends, and general capacitor challenges.

Wednesday October 25th 2000

Keynote speech:

Role of the Contract Manufacturing Supplier in Today's Electronics Market

Dave Otterness
Flextronics International

The speaker will define the meaning of 'contract manufacturing' as part of the supply chain in today's electronics industry, and show the development and growth of this market, including its need for passive components. He will project the future needs of the market for passive components, with emphasis on tantalum capacitors and Flextronics.

Tantalum Capacitors – Today and Tomorrow

Josef Gerblinger
Epcos

Based on the current technology for tantalum capacitors including recent developments and optimisation of processes within EPCOS, a way will be shown how new or further improved technologies will help to fulfil tomorrow's market demands.

The Effects of Nitrogen on the Performance of Tantalum Capacitors

Terrance B. Tripp
H.C. Starck Inc.

Tantalum is the substrate of choice in solid electrolyte capacitors. However, because of the inherent instability to oxygen migration at the metal-anodic oxide interface, capacitor performance can degrade during exposure to elevated temperatures. Capacitors made using nitrogen-containing tantalum can have reduced DC leakage and improved high temperature performance. This paper will review the influence of nitrogen on capacitor characteristics using examples of substrates containing from 300 ppm to over 7% nitrogen. Potential advantages of tantalum nitride (TaN) as a substrate for solid electrolyte capacitors will be described.

The History of Conductive Polymer Capacitor and Future Trends

Yoshihiko Saiki, Kazuo Watanabe,
Toshihiko Nishiyama, Takasi Fukaumi
NEC Corporation
Presented by Yoshihiko Saiki

NEC has developed a new type of tantalum capacitor called NEOCAPACITOR which uses conductive polymer as the cathode electrolyte for the first time in the world. This paper introduces the history of conductive polymer capacitor and discusses the future trend.

Heat- and Moisture-stable Low-ESR Tantalum Chip Capacitors

Erik K. Reed, Jim C. Marshall
Kemet Electronics

Microprocessor speeds are increasing and operating voltages are decreasing. This combination of factors dictates that the ESR of power supply filter capacitors must fall by half every 1 to 1.5 years to satisfy the needs of those who design modern computer power supplies. Not only must ESR be ever lower with each new generation of low-ESR capacitors, but also it is becoming ever more crucial that the ESR of these capacitors remain stable during the circuit-assembly process and over their operational life.

The low-ESR tantalum chip capacitors described here take advantage of an optimal combination of materials and methods to produce devices that not only have exceptionally low ESR, but also have ESR stability that is nothing short of phenomenal in the face of severe environmental stress. The general principles and strategies used to develop these new capacitors are described and data are presented to document the stability of the resulting devices when they are exposed to multiple IR reflows, moisture, thermal shock, and long-term lifetest at elevated temperatures.

Closing remarks: Charles Culbertson II President of the T.I.C.

Plant Tours: Flextronics International and Intel Museum

The industrial park strategy of Flextronics International offers supply chain integration through the co-location of vendors. This structure increases flexibility, minimises cost and allows Flextronics to deliver the finished product in an expedient and cost-effective manner. Key customers include IBM, Intel, Nokia, Cisco, Compaq, Motorola, Alcatel, Nortel, Ericsson, HP, Lucent and 3 Com.

The Intel Museum in Santa Clara, recently expanded to a 10 000 square foot facility, includes more than 30 of the most popular hands-on exhibits from the previous museum collection, exploring how computer chips are developed and the impact they have on our lives. It features a computer-equipped learning lab designed for digital storytelling and educational presentations on topics such as the power of the Internet, art, science and technology. A conservation area for the preservation and storage of much of the museum's collection of some 45 000 chips, photos, computers, documents and artefacts is set aside. You will be guided through this world of computer chips, where millions of electronic components are packed on to quarter-inch squares and time is measured in billionths of a second.

MEMBER COMPANY NEWS

AVX

AVX Corporation reported in April that net sales for the quarter ended March 31st 2000 were 56% higher than for the same quarter of 1999. For the full year the increase was 31%. Chairman and CEO Dick Rosen stated 'We are very pleased to report the second consecutive period of record sales and earnings. The investments we have made in capacity expansion and the development of new products continue to serve us well in this very robust market place. All facets of the communications business and other electronics markets are operating at record levels and discussions with our customers indicate that this activity should continue through at least the next year.' Unit production and bookings were also very high, he noted.

The company said that as 'one of the world's leading manufacturers and suppliers of passive electronic components, AVX is clearly moving strategically and dynamically in the right direction. With 27 manufacturing sites around the world AVX is continuously monitoring demand, adjusting production and responding to just-in-time delivery requirements, enhancing customer production and results'. Nevertheless its tantalum chip capacitors have 'an extended lead-time for delivery'.

On April 24th AVX Corporation announced a two-for-one common stock split in the form of a stock dividend: this was intended to increase and broaden AVX's shareholder base and improve market liquidity, stated the Chairman.

Cambior

In June Cambior announced that it had concluded an agreement with Jipangu Inc. and a financial institution for a mortgage loan, running for 4.5 years, on its 50% interest in the Niobec mine, and was in discussion with another financial body for an increase in this mortgage. The mortgage is subject to the consent of Teck Corporation, holder of the other 50% interest in the mine. The proceeds will enable Cambior to meet part of its obligations incurred in other sections of its business.

The Vice President, Exploration, and the Chief Financial Officer of Cambior both resigned in March, and the responsibilities of these officers were assigned to others in the company, as a reduction in Cambior's activities was foreseen.

Cambior confirmed that its 50% share of production from the Niobec mine in 1999 was 1147 tonnes of niobium, in ferro-niobium, slightly higher than 1998 as ore grades were higher. A feasibility study on the expansion of this mine was completed in November 1999, and expansion in two phases was planned. The first phase should increase production by 20% in the fourth quarter of 2000, and the second phase would gradually increase production by an additional 20% 'as a function of the world niobium demand'. Reserves of nearly 10 million tonnes are sufficient for more than 10 years of operation, noted the company in April 2000.

In the first quarter of 2000, Cambior's share of production from the Niobec mine was 280 tonnes of niobium contained in ferro-niobium. The company reported in May that 'work on Phase I of the expansion continued on schedule and on budget and should be completed in the third quarter of 2000'.

Epcos

The half-year figures presented by President and CEO Klaus Ziegler on May 5th 2000 were in very good shape, he said. 'In the booming telecommunications sectors, in Internet technology, and in automotive and consumer electronics, our business has been progressing exceedingly well in all regions. Demand for our products – capacitors, SAW filters, ceramic components and ferrite cores – remains high', he added. This expansion was expected to continue, with a sustained upswing in the global economy, and 'economic barometers pointing upward' in Europe in general and Germany in particular. The introduction of new products was proceeding ever faster, requiring the components manufactured by the firm.

Epcos was growing at well above the market rate: measured in terms of 'Economic Value Added' it had more than tripled its rate for the previous year. New orders had doubled in value over the period, and growth was strong in all sectors covered by the company's products.

The company states that it aims to play a leading role among the most competitive companies in the world in the field of electronic components. It has brought up to date its quality policy with a Total Quality Management system, to ensure optimum customer benefit.

Continuous improvement is intended to reduce existing process tolerances, improve quality and yields, optimise material and also resources both capital and human, and foster innovation and creativity by collaborating with customers to determine their needs.

Sons of Gwalia

In its quarterly report for the three months ending March 31st 2000, Sons of Gwalia said it had 'responded to growing demand for mobile telephony products with increased tantalum reserves and resources and contractual negotiations for increased production and sales'. Tantalum reserves and the Greenbushes and Wodgina Mines were put at 71 million lb, an increase of 66% over the figure for June 30th 1999.

A feasibility study had indicated that an economic underground operation below the current open pit mine at Greenbushes could be established. Combined with the expansion of existing processing facilities this would see production at Greenbushes increase to more than 1 million lb per annum from the present 650 000lb. The Advanced Minerals Division had achieved production of 284 632lb for the quarter, as well as record sales.

The Managing Director of Sons of Gwalia is now Mark Cutifani, while Peter Lalor is Executive Chairman.

Heraeus

At the end of May, Heraeus announced that W.C. Heraeus GmbH & Co KG had taken over PGP Industries, a recycling company with its headquarters in California and works in the United States and Ireland. This would improve its knowledge of the recovery and reprocessing of precious metals and its presence in the US market.

On April 27th good results for 1999 were announced by the group, with an upward trend and recovery on a broad front. Group sales had increased, as had earnings from ordinary business activities, it reported. It was noted, with some relief, that the crisis in Asia seemed to have passed.

Kemet

In April Kemet confirmed expectations by reporting record sales for the third consecutive quarter along with record earnings for the quarter ended March 31st 2000. Chairman and CEO David E. Maguire stated that earnings were 85% better than any previous quarter in the company's history. Robust growth in demand, reflected in increased sales and prices, was expected to continue in the following year. 'New capacity contributed to 25% of the sequential growth in revenues this quarter. The ramp of new capacity coming on line will accelerate in subsequent quarters', added Mr Maguire. The value of surface mount capacitors in the March quarter of 2000 was almost twice that of the equivalent quarter of 1999, while sales of leaded capacitors were about 10% higher in value. Unit volume increased 47%.

On May 15th Kemet announced a two-for-one stock split, each shareholder would receive one additional share of Kemet stock for each share held.

On May 24th Kemet commented that it was not aware of any company development responsible for the decline in the price of its common stock: it reiterated its statements that its current performance was strong and it saw a positive outlook for the future. It pointed out that stock prices of its principal competitors had also dropped.

As well as providing components of hardware, Kemet has introduced software for web users in keeping with its image at the forefront of developments. It announced the introduction of a web application called CapacitorEdge for determining the correct Kemet part number for use in electronic devices. This will be provided for tantalum surface-mount and leaded devices, among others, and can be found on the company's web page.

Kennametal

In June 2000 Kennametal said it expected to achieve strong earnings growth in its core businesses in the June quarter compared with the same quarter of 1999. Despite pressure exerted by the strengthening of the dollar, it continued to deliver on ambitious goals, and to undertake operational improvements to drive earnings.

Mitsui

In May Mitsui & Co. Ltd, parent of our member company Mitsui Mining & Smelting, reported Consolidated Business Results for the fiscal year ended March 31st 2000. Total trading transactions showed a small decrease from the preceding year, and there was a decrease in operating income, but an increase in net income was noted. The group expected business to recover in the coming year, it added.

Nichicon

Nichicon Corporation, parent of T.I.C. member Nichicon-Tantalum, is proud that its products – film capacitors – have been adopted for use in the Nozomi Model 500, a Bullet Train of supremely elegant design.
Its capacitors (but whether these are tantalum capacitors was not stated) are also used in the Super Proton Ring-8GeV, 'Spring-8', at Harima Science Park City. This machine is the world's largest accelerator of this kind, and it is used to carry out 'basic research in materials science, information and electronics technologies and life science'.

Sandvik

In its interim report for the first quarter of 2000, Sandvik AG, parent of Sandvik Coromant, our member company, reported that its profit had nearly doubled over that for the first quarter of 1999. In a strong business climate, it had achieved a sharply increased intake of orders.

Seco Tools

At the Annual General Meeting on May 2nd 2000, the President commented on a good market situation and a strong trend in the first quarter of 2000. 'Net sales rose by 14% and the current favourable demand is expected to continue.'

Sogem

In its annual report for 1999, Union Minière reported that its international trading arm Sogem, member of the T.I.C., had more than 30 subsidiaries and representative offices in some 25 countries. Benefiting from a more favourable business environment, with larger sales volumes and a stronger US dollar, the consolidated operating profit was more than 150% up on 1998, reflecting a 15% increase in gross margin. 'In Japan, in particular, a strong increase was noted in the demand for advanced materials for the electronics industry', the report added. Expert teams continued to make progress in sharing commercial and technical information with a view to further improving services and promoting new business.

H.C. Starck

Business results for 1999 showed an increase in sales. An 'appreciable upturn in the electronics sector, and especially the boom in the fields of microelectronics and telecommunications' had meant that 'the Electronics and Optics Business Group saw an increased demand for its tantalum metal powder, which had a positive effect on both sales and profits of this business group'.

H.C. Starck Inc.

We learned from Metal Bulletin in March that Gerard Villani was appointed director of business development, moving on from his previous position as director of sales and marketing. Lee Sallade left the operations sector to become the director of sales and marketing. Rick Larson was appointed director of operations, and Karen Cook was appointed manager of health environment, safety and security.

Vishay

Vishay Intertechnology declared a three-for-two stock split on May 18th.

It also, like Kemet, had suffered a decline in the price of its common stock, and put out a statement that it saw no reason in the company's activities which would cause this.

'Everyone' seems to have rushed for stocks and shares in any company with any kind of involvement in electronics, and when told that the prices have risen too sharply 'everyone' thinks of selling – fashion is indeed strange.