BULLETIN N° 88
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T.I.C.

TANTALUM-NIOBIUM INTERNATIONAL STUDY CENTER

PRESIDENT'S LETTER

Dear Members and Friends,

After the very successful meeting in Greenville, thanks to the organising effort of our host Kemet Electronics Corporation, headed by Mr David Maguire, we now look forward to our future plans and programmes.

The recent signs of recovery of the PC market in the United States will definitely give hope for a stable tantalum market for the next year. As tantalum is used very much in the communication industry, I think it is time we investigated the cost/benefit of putting T.I.C. on the Internet. I will discuss this matter further with our Technical Adviser and with other delegates to determine the extent T.I.C. might make our information available on the Internet. After all, worldwide access to information regarding our association should benefit members, and maybe it will even increase our membership.

As China has in the recent decade opened its door to the outside world, and given its increasing importance in tantalum, we are fortunate to have received an invitation from our member company Ningxia Non-ferrous Metals Smelting which offers to host the next General Assembly in the historic city of Xian from October 5th to 8th 1997, with a visit to the tantalum facility in Ningxia. Much preparation still needs to be finalised but I am sure members will find this visit exciting and rewarding.

As this Bulletin should reach you before the end of the year, I should like to take this opportunity on behalf of the Executive Committee to wish everyone a very happy and prosperous New Year, and especially Mr Hubert Hutton who will be retiring from the business after almost half a century of hard work.

Sincerely,

S.S. Yeap
President

SYMPOSIUM PROCEEDINGS

The proceedings of the International Symposium held in Goslar in September 1995 are available from the T.I.C. $150 including postage and packing.

SUMMARY

MEETING IN GREENVILLE

More than 140 delegates and guests gathered at the Hyatt Regency Hotel in Greenville; South Carolina, for the Thirty-seventh General Assembly and the meeting associated with this, from October 20th to 22nd 1996, hosted by Kemet Electronics. Set in pleasant countryside of low hills with rolling woods just beginning to display their autumn colours at the time of our visit, Greenville is a rapidly growing town for business, and home to companies from seventeen foreign countries as well as numerous well-known American firms.

The General Assembly carried forward the administration of the association, approving the annual accounts which showed a good result for the past year, with a financial position considerably strengthened by the success of the International Symposium. Four new members were elected by the Assembly, which was chaired by Mr David Maguire, acting as President following the departure of Mr Robert Barron.

Mr Yeap Soon Sit was elected President for the coming year, and Mr Charles Culbertson II, of Kemet Electronics, Mr Michael Herzfeld, A&M Minerals and Metals, and Dr Axel Hoppe, H.C. Starck GmbH & Co KG, were elected to the Executive Committee. Members of the Committee who retired at this Assembly were Mr David Maguire, after nine years of service culminating in this excellent conference, Mr Peter Kählert who headed the organisation of the Symposium in Goslar, and Mr Hubert Hutton, retiring after a long and successful career in the metals industry: the T.I.C. is grateful for the time and effort they have devoted to promoting and developing the activities of this association. Members re-elected to a further term in office are Mr Jacques Hennevaux, Mr John Linden, Mr Peter Maden, Mr William Millman, Dr Harry Stuart and Mr Yoichiro Takekuro.

The conference opened with a reception hosted by the T.I.C. and held in the spacious and elegant salons of the Commerce Club. On the evening of Monday the party was generously entertained with legendary Southern hospitality at a gala dinner at the Poinsett Club, as guests of Kemet Electronics. This colonial-style house, dating from the turn of the century, was named for Mr Joel R. Poinsett, diplomat and Minister to Mexico, where he found the plant with distinctive red bracts now called the Poinsettia, and brought it back to South Carolina. The house and dining room were, appropriately enough, lavishly decorated with flowers and set the scene for a splendid evening.

A special sightseeing programme for those accompanying the meeting participants featured a tour of the Biltmore House in Asheville, North Carolina, a mansion built in 1889 in the Blue Ridge Mountains which would hardly look out of place beside the Loire in France. A group of delegates and spouses also enjoyed a guided tour of Greenville South and learned something of the history of the area.

On Tuesday April 22nd 1997 the executive Committee will meet in Brussels. Other delegates are welcome to join them for lunch

VISIT TO KEMET

On Tuesday morning the majority of delegates visited the production facilities of Kemet near Greenville. In an excellently organised tour, the delegates saw the production of tantalum capacitors from the receiving of raw materials, through the pressing and sintering of tantalum pellets, followed by anodisation, impregnation, pyrolysis, the silvering process and intermediate testing. The final encapsulation of the units is performed at Kemet facilities in Matamoros, Mexico.

The extensive automation, electronic and computer control of the process and the cleanliness of the facilities were very impressive.

TECHNICAL PROGRAMME

The technical programme followed the outline which was published in number 87 of the T.I.C. Bulletin.

The overview of the developments in the tantalum/niobium industry in the last twelve months by G.J. Korinek, which is reprinted in this issue, was followed by three papers on different aspects of superconductivity as related to Nb/Ti and Nb/Sn alloys.

The afternoon session started with a paper on tantalum raw materials by R.O. Burt of Tanco and continued with four papers on tantalum capacitors and their applications. The paper on tantalum capacitor trends in the hard disc drive industry by R.L. Hofmaier of Seagate Technology is also reprinted in this issue.

It is planned that the remaining papers will be published in future issues of the Bulletin.

DEVELOPMENTS IN TANTALUM AND NIOBIUM DURING THE LAST YEAR

This paper was presented by Dr George J. Korinek, Technical Adviser to the T.I.C., at the meeting in Greenville, South Carolina, on October 21st 1996.

During the International Symposium on Tantalum and Niobium in Goslar in the fall of 1995, developments in recent years and prospects for the future in our industry were covered in detail by many internationally recognized experts, and the proceedings have since been published.

I will therefore concentrate only on developments since our symposium took place. I would like to address the following three topics :

1) Structural changes in our industry;
2) Demand development in niobium; and
3) Demand development in tantalum.

I will refrain from any comments on the raw material supply of tantalum, as this will be covered by Mr Dick Burt of Tanco in his paper.

STRUCTURAL CHANGES IN OUR INDUSTRY

During the last twelve months, changes occurred in the structure of our industry which will have implications for many years into the future.

1) In the fall of 1995, a transfer was announced of the London & Scandinavian Metallurgical Company Limited's (LSM) carbide powder business for use in hardmetals, to Treibacher Industrie AG, Austria (TIAG). For a number of years, both companies had served the hardmetal industry as Ta and Ta/Nb carbide suppliers.

2) It was reported that, in cooperation with Madal S.A.R.L. and Lydenburg Exploration, Cabot Corporation is planning to complete a feasibility study on the Morrua tantalum property in Mozambique. This property is 340 kilometers from Quelimane, and it was a major producing area for tantalum raw material from the late 1950's to the early 1980's, when, because of civil war, production ceased. It is expected that the study will be completed by early 1997, and the companies are confident that they can develop this property into a major tantalum raw material producing area.

3) In the spring of 1996, after several months of negotiations, H.C. Starck GmbH & Co. KG of Goslar, Germany, a wholly owned subsidiary of Bayer AG, Leverkusen, Germany, acquired a majority holding in Thai Tantalum Company Limited (TTA), whose headquarters are in Map Ta Phut, Thailand. The agreement, which was reached with the remaining Thai shareholders, was announced in Bangkok on March 28th by Dr Manfred Schneider, Bayer Chairman, and Mr Peter Kählert, Chairman of the Executive Board of H.C. Starck.

   The acquisition includes a facility for the production of potassium fluorotantalate and tantalum metal powder in Map Ta Phut, an industrial park some 180 kilometers southeast of Bangkok. About 170 people are employed at the 220 000 square meter site, which is equipped with infrastructure and environmental protection in line with the latest technological developments.

   With the acquisition of Thai Tantalum, H.C. Starck gains a second location for chemical production, in addition to its Goslar plant. The name of Thai Tantalum has been changed to H.C. Starck (Thailand) Co., Ltd.

4) In May 1996,Gwalia Consolidated Ltd announced that it was entering into an agreement with Goldrim Mining Australia Ltd to acquire 100% of the Wodgina Tantalum Project, including the 50% interest previously owned by Pan West Tantalum Pty Ltd. Gwalia is purchasing the assets of the Wodgina Project, as well as other mining tenements, including those of Strelley and Tabba Tabba, held by Goldrim in the vicinity of that Project, together with the benefit of various product sales agreements.

   The Project comprises an open cut tantalite mine and plant, campsite and equipment situated at Wodgina, approximately 100 kilometers south of Port Hedland. The mine is currently producing about 170 000 pounds of tantalite concentrate per year.

   Gwalia Consolidated is expecting to produce 650 000 pounds of tantalum concentrates in 1996. In 1995, the company produced 569 000 pounds, while the target for the financial year ending June 30th 1997 is 720 000 pounds. The increase in the annual output rate will come from additional production of approximately 160 000 pounds from the company's Wodgina mine.

The acquisition has been approved by shareholders of Goldrim and Gwalia. The takeover of the Wodgina Project and additional properties by Gwalia makes it by far the most important supplier of tantalum mineral concentrates worldwide.

5) Also in May, Dr Felix Zandman, Chairman and CEO of Vishay Intertechnology, Inc., announced that a partnership formed by Vishay and the Eisenberg Group of Companies had signed a Cooperation Agreement with the China National Non-Ferrous Metals Industry Corp. (CNNC), a Chinese government agency. The agreement provides for the comprehensive development of the tantalum industry in the People's Republic of China, including the mining and refining of tantalum ore and the production of tantalum capacitors in China through several joint ventures.

   This multifaceted project, when implemented, should lead to an increase in the supply available to the current producers of tantalum powder and wire outside China, and to supplement the production of tantalum powder and wire in China.

   The parties are finishing the definitive terms of the cooperation agreement, which contemplates a separate joint venture for each aspect of the project.

6) In July, Vishay Intertechnology announced that Kemet Corp., a rival capacitor maker, had rejected its offer to buy Kemet for $22 per share, or about $850 million. Vishay, based in Malvern, Pennsylvania, has been pursuing Kemet, based in Greenville, South Carolina, since June, when it suggested a friendly merger, without specifying a price. Vishay is the largest American maker of passive electronic components, including capacitors, while Kemet is the largest American maker of tantalum capacitors.

7) In August, it was announced that Metallurg had acquired an undisclosed shareholding in Russian magnesium and rare metals producer Solikamsk Magnesium Works, located in the Perm region of Russia. Besides magnesium and its alloys, Solikamsk produces titanium oxide, rare earth compounds, and what is of special interest to our industry, 55 to 60 tons per year of tantalum oxide, and 700 to 750 tons per year of niobium oxide. Metallurg purchased tantalum and niobium oxide from Solikamsk in the past, and this recent step certainly indicates a closer liaison between the two companies.

As can be seen from the above examples, the consolidation and globalization which has occurred in different business branches worldwide is also taking place in the tantalum-niobium industry.

NIOBIUM DEMAND

After a very successful year in 1994, with an increase in consumption of 18% over 1993, niobium had another good year in 1995. Consumption increased by 12% over 1994, and was at a record level since T.I.C. began keeping niobium statistics. Healthy demand for niobium continued in the first half of 1996, even when there was a decrease of about 9% compared to the first half of 1995.

Niobium production is primarily from two distinct sources: pyrochlore mines, and as a byproduct of tantalite/columbite mines and tantalum-containing tin slags. Pyrochlore production generated more than 98% of the niobium contained in concentrates for further treatment.

By far the single largest source of niobium is the Araxa Mine of CBMM in Minas Gerais State of Brazil. During 1995, CBMM produced 18 300 metric tons of Nb_2O_5 in concentrate. Most of the concentrate is reduced by alumino-thermic process into standard ferro-niobium.

Brazil's second largest producer of niobium is Catalao in Goias, a member of the Anglo Group. Here, pyrochlore is processed on site into standard grade ferro-niobium. Catalao shipped 3600 tons of material in 1995.

The Niobec Mine in Quebec, Canada, is the largest North American primary producer of niobium. This mine is associated with the Teck Group, and Cambior Inc. of Quebec. In 1995, production was 3224 metric tons of Nb_2O_5 contained in concentrate.

At the beginning of 1995, all exports of concentrate ceased, and production of ferro-niobium successfully commenced. The converter is capable of producing 3200 tons of ferro-niobium per year, grading an average of 65% niobium from 5520 tons of pyrochlore concentrate.

The consumption of niobium in Standard (HSLA) grade of ferro-niobium is shown in Figure 1. The peak consumption was reached in the 2nd quarter of 1995. The first half of 1996 declined by about 9%, when compared to the first half of 1995. Not surprisingly, that is the same decline as for total niobium demand, since nearly 90% of niobium is consumed in that form.

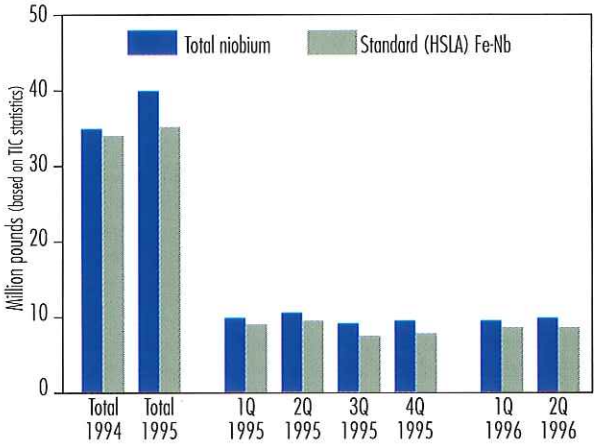

Figure 1: Total niobium, and ferro-niobium, shipments (millions of pounds)

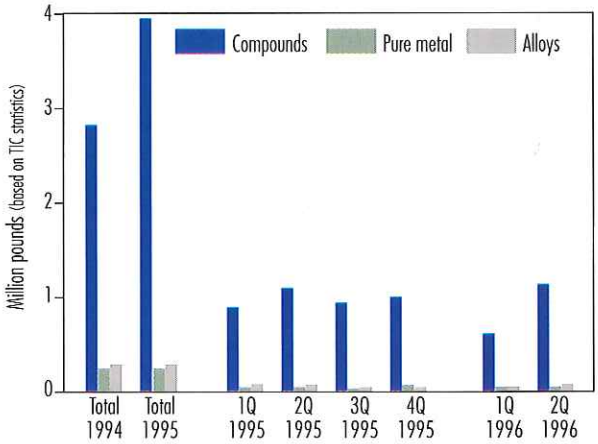

Figure 2: Niobium shipments : compounds, pure metal, alloys (millions of pounds)

Niobium oxide shipments, mainly for the production of vacuum grade ferro-niobium and nickel-niobium, increased sharply from 1994 to 1995, by about 1.3 million pounds of niobium contained. This reflects a recovery in the superalloy industry, which is the main user of vacuum grade ferro- and nickel-niobium. Whereas in the past this industry depended heavily on the jet engine industry for aircraft, a non-aerospace application continues to gain importance, mainly for stationary turbines and

corrosion resistant superalloys. Even though there was a slight decrease in the first half of 1995, demand remained strong.

Shipments of pure niobium metal and alloys remained essentially the same from 1994 to 1995, and continued at the same level for the first half of 1996. A very substantial increase had been expected, mainly in the area of Nb/Ti superconducting alloys, but the cancellation of the SSC project in Texas negatively affected this development. Magnetic Resonance Imaging (MRI) continues to be the mainstay for this application. The final approval of the building of the Large Hadron Collider (LHC) by CERN in Geneva should have a positive effect, and the LHC should be a significant consumer of Nb/Ti superconducting alloy.

Unfortunately, there are some dark clouds on the horizon for this project, as well. A recently announced plan of Germany's Ministry of Research to reduce Bonn's contribution to European scientific projects could endanger the future of the LHC, or at least lead to substantial delays.

TANTALUM DEMAND

Tantalum had an excellent year in 1995. The consumption increased from 2241 million pounds in 1994 to 2872 million pounds in 1995. As can be seen from figure 3, tantalum shipments steadily increased for five consecutive quarters, and reached a peak in the 4th quarter of 1995, and the 1st quarter of 1996.

All the product categories contributed to this growth, but it was mainly shipments of the powder and wire to the capacitor industry which were responsible for the growth. Tantalum powder shipments increased from 1086 million pounds in 1994 to 1377 million pounds in 1995.

The tendency for shipments of tantalum powder is very similar to that for total tantalum, i.e. continuous increase for five quarters, peaking in the 1st quarter of 1996. Because tantalum powder shipments amount to 50% of the total, it is not surprising that the development is parallel. Demand for tantalum powder weakened in the 2nd quarter of 1996, partially due to a weaker demand for personal computers and some telecommunication equipment, such as portable telephones. This development has been further affected by the liquidation of inventories which were accumulated later in 1995. During the very strong demand for capacitors in the middle of 1995, which resulted in the stretching of deliveries for tantalum capacitors, some excessive ordering took place, resulting in inventory buildup. The slowdown in powder shipments continued into the 3rd quarter of 1996. It is the general opinion of knowledgeable people in the industry that the correction should be completed during the 4th quarter, and growth should resume in the 1st quarter of 1997, although predicted at a slower rate than in 1995.

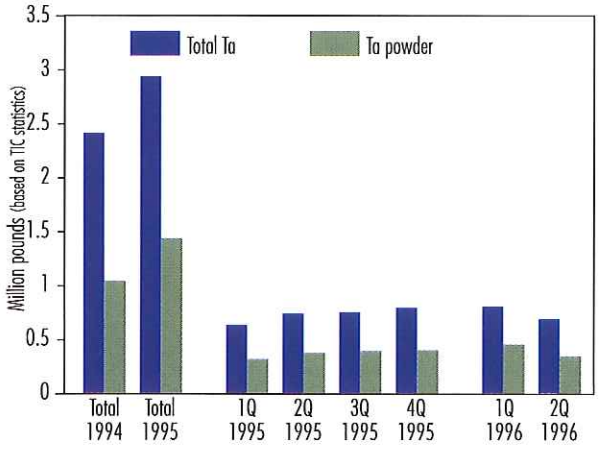

Figure 3: Tantalum shipments : total tantalum and tantalum powder (millions of pounds)

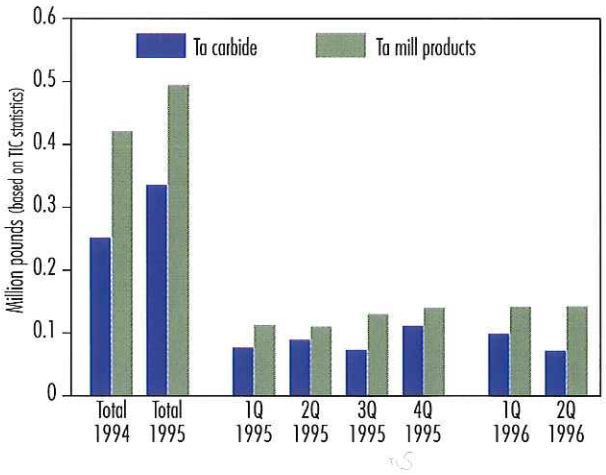

Figure 4: Tantalum shipments : carbide and mill products (millions of pounds)

Tantalum carbide shipments were also very strong during 1995 and the 1st quarter of 1996, with a slight downturn in the 2nd quarter.

Tantalum carbide consumption in cemented carbides is related to the performance of the cutting tool sector, and 1995 and the first half of 1996 were excellent for this business. The cutting tool sector is closely related to automotive and heavy machinery production.

Tantalum mill products showed similar increases for 1995 and the 1st and 2nd quarters of 1996. The main contributors to this sector are tantalum wire for capacitors, and sheet and tubing for the chemical equipment sector. The tantalum mill product sector continues to be very strong.

Tantalum for superalloys also had a very strong year in 1995. The consumption for this sector in 1996 is estimated at 225 000 to 250 000 pounds of tantalum worldwide. Both superalloys for jet engine blades and stationary turbines contributed.

SUMMARY

Since our meeting in Goslar, several major changes occurred in our industry, with a trend towards concentration in several major players, similar to developments in many other industrial areas of the world economy.

The years 1994 and 1995 and the first half of 1996 have been good for niobium, mainly in the standard ferro-niobium and niobium oxide sectors. On the other hand, pure niobium metal and niobium alloys seem rather stagnant, accounting for only 1.5% of total Nb use volume-wise.

Tantalum had a record year in 1995, continuing into the 1st quarter of 1996, based on good performances in all tantalum sectors. Leading the growth was the capacitor industry and its requirement for powder and wire. Some correction took place in the 2nd and 3rd quarters of 1995, but a resumption of growth is expected beginning in the 1st quarter of 1997. The intermediate outlook for tantalum demand remains positive.

TANTALUM CAPACITOR TRENDS IN HARD DISC DRIVES

This paper was presented to the meeting in Greenville by Mr Reginald L. Hofmaier of Seagate Technology.

In order to achieve the storage densities required to meet the growing needs of data storage markets, hard disc drives with the necessary storage capacity require printed circuit boards with increased component densities. To achieve these component densities, capacitors used to populate these printed circuit boards are typically multilayer ceramic chip capacitors (MLCC) and surface mount tantalum capacitors. In those few instances where the desired capacitance and voltage ratings are not available in one of these capacitor types, either surface mount aluminium or leaded tantalum capacitors are used.

As can be seen from Figure 1, over the past five years the percentage of tantalum capacitors used by Seagate averaged approximately 9%, with a slight increase projected over the next three years to an average of 10%. It should be noted that the projected trend is based on current disc drive designs and capacitor types available today. These projected trends, which will be discussed in further detail below, will change as higher capacitance value MLCCs and tantalum capacitors in smaller case sizes become commercially available.

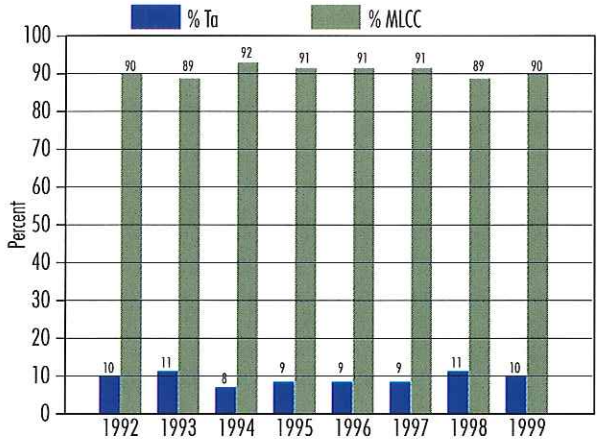

Figure 1: Comparison of Seagate's actual and projected percentage usage of multilayer ceramic chip capacitors, 1992 through 1999.

The number of tantalum capacitors presently used per Seagate drive varies from as few as 2% to approximately 15% of the total capacitor population. Competitive analysis reveals that there are drives on the market designed with no tantalum capacitors and others with less than 10% of the total capacitor population. For applications requiring high capacitance values in these competitive drives, some, if not all, of the tantalum capacitors have been replaced with high capacitance MLCCs.

Before looking at future capacitor usage trends in Seagate hard disc drives, it might be worth while to look briefly at the historical usage. For MLCCs, the trend has been to go to 100% surface mount chips in the smallest chip size possible. This is illustrated in Figure 2, where it can be seen that the 0805 chip size is currently the most popular one but is slowly being replaced by the 0603 chip size.

From Figure 3, it can be seen that unlike MLCCs there has not been one case size tantalum capacitor which has been obviously more popular than another. If any one has been more popular, it is the larger D case size due to the required capacitance values and voltage ratings available in this case size.

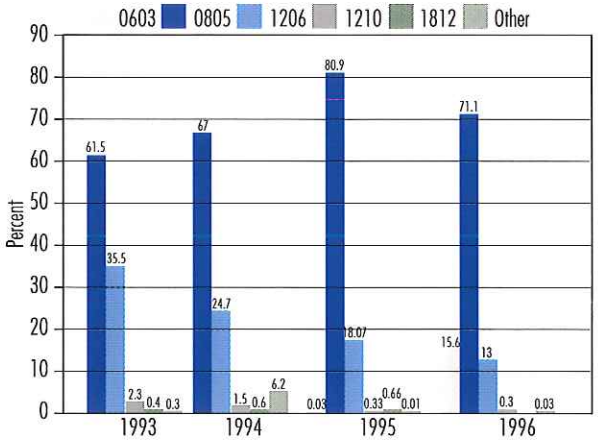

Figure 2: Actual popularity of multilayer ceramic chip sizes Seagate used, 1993 through 1996.

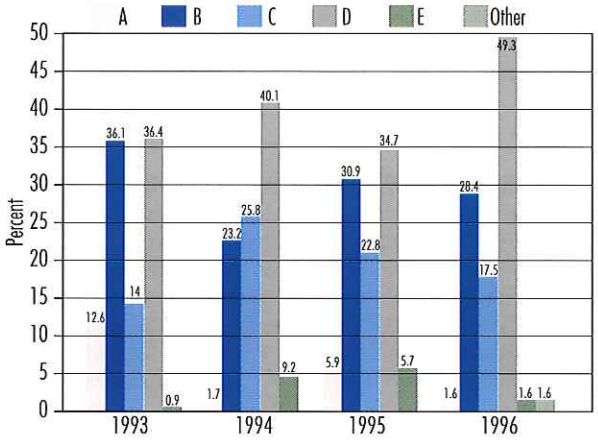

Figure 3: Actual popularity of tantalum capacitor case sizes Seagate used, 1993 through 1996.

Based on current MLCC technology, it is projected that the 0603 chip size will become the dominant one by 1998 as shown in Figure 4. Projected usage of the 0402 chip size is not shown in this figure because it is only now being considered for new Seagate disc drive designs as the required capacitance values and voltage ratings are just becoming commercially available.

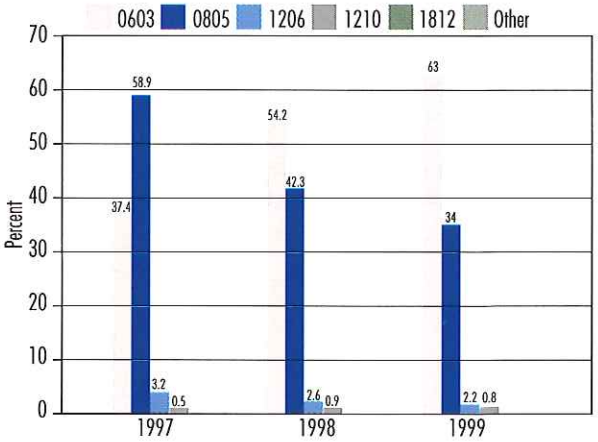

Figure 4: Projected popularity of multilayer ceramic capacitor chip sizes Seagate will use, 1997 through 1999.

As can be seen in Figure 5, for tantalum capacitors there is no one case size projected as being most popular. If anything, with the exception of the largest case size E, the projected trend indicates that the four remaining currently standard case sizes

approach equal popularity in 1999. As with the MLCC 0402 chip size, the molded 0805 tantalum case size is not shown since it is too new and has not been used in Seagate disc drive designs to date.

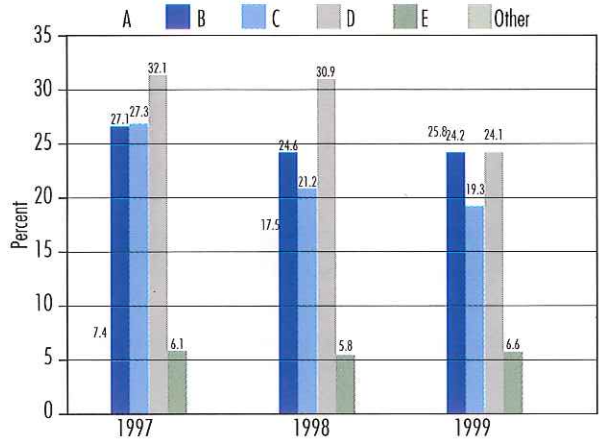

Figure 5: Projected popularity of tantalum capacitor case sizes Seagate will use, 1997 through 1999.

Both MLCC and tantalum capacitor product introductions are taking place so rapidly that it is very hard to predict with any confidence in which direction new drive designs are headed regarding these capacitor types. In order for a design to change from one capacitor type to another, there needs to be a benefit in doing so. Typically one of the following reasons is necessary before a capacitor type is changed: reliability enhancement, product availability, cost effectiveness or decreased size.

From a drive reliability enhancement point of view, there does not appear to be any obvious reason to switch from one capacitor type to another. Seagate currently uses substantially more than two (2) billion MLCCs and tantalum capacitors a year in the manufacturing of hard disc drives. The capacitor failure rate for both these capacitor types is less than 1 ppm for all failure modes. This includes capacitor failures seen during the manufacturing of the printed circuit board, the assembly and testing of the drive and in the field by the customer. This very remarkable low failure rate is attributable to several factors:

- Lay out of the printed circuit board to ensure the capacitor is not subjected to undue mechanical and thermal stress.
- Internal Seagate derating requirements to minimize the electrical stress placed on the capacitor.
- The excellent control and understanding our MLCC and tantalum capacitor suppliers have of their materials and processes.

Historically the electronic industry is a very cyclic one and because of this so is the availability of various component types. In 1995 a shortage of tantalum capacitors was experienced due to the sudden upturn in demand. Apparently during this period, some inroads into the A case size tantalum market were made by MLCCs with X5R or X7R temperature characteristics which can compete favorably with tantalum capacitors in terms of both electrical performance and cost. Because of the strategic relationships with our capacitor suppliers, Seagate did not experience shortages that necessitated switching from tantalum capacitors to other capacitor types.

For several years manufacturers of MLCCs, primarily those without an interest in tantalum capacitor manufacturing, have touted their products as cost effective replacements for tantalum capacitors. Their focus has been that because MLCCs have inherently less electrical losses than tantalum capacitors, a high value tantalum capacitor can be replaced with a significantly lower value MLCC. This premise that MLCCs are a cost effective replacement for tantalum capacitors was tested in a Seagate Model ST31051N hard disc drive with 1 Gigabyte of formatted memory. All the tantalum capacitors were replaced with X5R temperature characteristic MLCCs of equal or lower capacitance values. With the exception of one capacitance value, a 1µF rated at 16 Vdc, which cost approximately the same in either capacitor type, all the MLCCs were significantly more expensive than the higher capacitance value tantalum capacitors they were replacing. In fact, for this particular model drive, the MLCCs cost more than two times the tantalum capacitors.

As the storage capacity for hard disc drives in a given drive form factor increases, the need for capacitors and other component types in increasingly smaller, lower profile packages will also increase. Manufacturers of both MLCC and tantalum capacitors are bringing to market new products that are attempting to meet these needs. For MLCCs, standard voltage ratings such as 6.3 Vdc and 10 Vdc that are direct replacements for tantalums are now available as industry standards from most suppliers. Additional lower voltage ratings, such as 4 Vdc, are also being considered by MLCC manufacturers as potential products to compete directly with tantalum capacitors. Molded surface mount 0805 case size tantalum capacitors are now available from some manufacturers, while others are considering supplying them. There is also development work underway by tantalum manufacturers for even smaller case size packages, like the 0603.

The future of tantalum capacitors in Seagate hard disc drives appears very promising. As long as tantalum capacitors continue to remain competitive in such areas as product offerings and cost, they should continue to enjoy at lest the same relative market share they currently do. However, manufacturers of tantalum capacitors need to be ever mindful of the fact that they have a very formidable foe in MLCCs that are constantly trying to take market share from them.

MEETING IN GREENVILLE

With thanks to John Gillespie and Lynn Ingram for the photographs

David Maguire,
chairing the first technical session

Audience listening
to the presentations

SPEAKERS

Reginald Hofmaier,
Seagate Technology

Kyoji Tachikawa,
Tokai University

Philippe Martin,
IBM

TOUR

Sightseeing tour of Greenville, South Carolina

PLANT

TANTALUM CAPACITOR FACILITY OF KEMET ELECTRONICS

GROUPS OF VISITORS

MEMBER COMPANY NEWS

Sominki

Following re-organisation, the membership of Sominki has been transferred to Cluff Mining, 29 St James's Place, London SW1A 1NR. The delegate is still Mr Bruno Deliens of Sogem in Brussels.

Cambior

Mr Alan Bolton has succeeded Mr Bruce Taylor as delegate of Cambior.

Wah Chang

Teledyne Wah Chang Albany has modified its name and will now be known as Wah Chang.

Metallurg/Solikamsk

Metallurg has acquired a shareholding in another member company, Solikamsk Magnesium Works (see the paper by Dr Korinek in this Bulletin).

Thai Tantalum/H.C. Starck

Following the acquisition of a majority holding in Thai Tantalum by H.C. Starck GmbH & Co KG, the name has been changed to H.C. Starck (Thailand) Company Ltd.

Cabot Performance Materials

Mr Thomas H. Odle has been appointed General Manager of Cabot Performance Materials from October 1st 1996: he will be the delegate of the company to the T.I.C.

NEW MEMBERS

These companies were elected to membership by the Thirty-seventh General Assembly:

BEH Minerals Sdn Bhd,
4 3/4 miles, Lahat Road, Locked Bag #2,
Post Office, 31500 Lahat,
Perak, West Malaysia.

King Metallurgical Industry Co Ltd,
1st Jiefang Road (E),
Changsha, Hunan, China.

Matsushita Electronic Components,
Capacitor Division,
25 Nishinaka, Kowata,
Uji City, Kyoto, 611 Japan.

Osram Sylvania Inc.,
Hawes Street,
Towanda, PA 18848, U.S.A.

Resignations from membership have been received from Goldrim Mining, Mamoré Mineraçao e Metalurgia, Technologies International, and also, since the Assembly, from Pan West Tantalum.

Tantalum-Niobium International Study Center,
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1050 Brussels, Belgium
Tel.: (02) 649.51.58
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