TANTALUM-NIOBIUM INTERNATIONAL STUDY CENTER

BULLETIN N° 59 SEPTEMBER 1989 THIRD QUARTER

Thirtieth General Assembly and associated meeting

The Thirtieth General Assembly and formal sessions of the meeting, and also the social events, on October 18th and 19th 1989 wil be held at the Gravenbruch Kempinski Hotel, near Frankfurt, Federal Republic of Germany. A large number of rooms has been reserved for delegates to stay at this hotel, which combines a rural setting in its own park with all the facilities expected of a modern hotel. Participants should enjoy the country-house atmosphere, the view of the grounds and the lake, the variety of restaurants and bars, and the indoor swimming pool — even if the season is not quite right for the outdoor pool. There are tennis courts in the grounds, and a golf course nearby. The hotel is situated about 15 minutes' taxi ride, or drive, from Frankfurt's international airport.

On Wednesday October 18th delegates will be able to register at the T.I.C. desk at the hotel, and in the evening there will be a cocktail party to open the meeting.

On October 19th the General Assembly (with attendance restricted to delegates of member companies) will be followed by a programme of technical presentations for the rest of the morning and afternoon sessions, with a break for lunch. In the evening there will be a banquet dinner.

The participants will go to nearby Hanau on Friday October 20th for a tour of the metallurgical plant of W.C. Heraeus GmbH, where they will also be the guests of Heraeus for lunch. The meeting will close at about 3.30 p.m.

Interesting tours for the ladies accompanying delegates have been arranged. On Thursday there will be a short sightseeing tour of the old centre of Frankfurt, followed by lunch at the Henninger-Turm — watching the world go round... In the afternoon the group will take a tour by bus through the Taunus region, stopping for a visit of the Hessenpark. On Friday the ladies will visit the picturesque town centre of Hanau, with its 'Goldschmiedehaus' (goldsmiths' hall) and ancient churches, before going on to Schloss Philippsruhe, a splendid early 18th century castle and historical museum, beautifully decorated. They will rejoin the men's group at Heraeus where they will be guests of the company for lunch and be present at the closing of the meeting.

TECHNICAL PROGRAMME

Papers will include an outlook on supply and demand for tantalum and niobium, by Mr L.S. O'Rourke, and an update on the development of the market for capacitors, with future forecasts, by Mr David E. Maguire, Kemet Electronics Corporation. Dr I. Gaballah of the Centre de Recherche sur la Valorisation des Minerais will speak on the characterisation and mineral processing of certain European ore deposits. A paper entitled 'Tantalum powder dopants and the effect of their residues on tantalum oxide quality of low oxygen tantalum surfaces', by Mr John VanVoorhis, Mr James Bates and Mr Frédéric Brindel of Sprague Technologies, Inc., will be presented. Also planned are a review and comparison of markets in Europe, the United States and Japan, a paper on the analysis of impurities, and a survey of new projets in electron-beam melting.

A panel discussion will close the technical session.

Invitations have been sent to the nominated delegates of member companies, and many participants have shown their interest in the meeting by completing the pre-registration procedure.

HERAEUS

W.C. Heraeus GmbH is 100 % owned by Heraeus Holding GmbH, the parent of a worldwide network of subsidiaries and associated companies, employing over 9000 people. Sales have almost doubled in value in the past ten years, reaching the order of DM 4000 million, in 1988. Of this, precious and refractory metals accounted for about 34 %.

Heraeus works with gold, silver, platinum and platinum metals, as well as with special metals such as titanium, tantalum, niobium, zirconium and beryllium. It is in the forefront of development and production of materials and equipment for advanced technologies and prides itself on a constant pursuit of progress.

The staff of Heraeus have given much attention to their plans for the plant tour by T.I.C. delegates, and the visitors should it very interesting.

FRANKFURT

Many will know Frankfurt best as a centre of trade and business, or as a connection point for European and international flights, but it has more to offer too. There are many art galleries and more than twenty museums, indeed there is a riverbank lined with these, the *Museumsufer*. The *Zeil* boasts of being Germany's highest-turnover shopping precinct. The old quarter has traditional style cafés, and there are gourmet restaurants as well as discos, jazz cellars and piano bars to be found. Delegates will have the opportunity to seek out some of these on Wednesday evening, perhaps, and to visit some galleries, theatres or shops before or after the conference.

THIRTIETH GENERAL ASSEMBLY

to be held at 9.00 a.m. on Thursday October 19th 1989 at the Gravenbruch Kempinski Hotel, Frankfurt, Federal Republic of Germany

AGENDA

1. Voting proxies
2. Address by the President of the T.I.C., Dr Harry Stuart
3. Minutes of the Twenty-ninth General Assembly
4. Membership : applications, resignations
5. Financial matters, including approval of the audited accounts for the year ending June 30th 1989
6. Report of the Executive Committee
7. Statistics
8. Statutory elections
9. Forthcoming General Assemblies
10. Other matters

President's letter

Despite the fact that we lost our technical officer earlier in the year, the T.I.C. staff continues to serve our association in fine fashion. We are all working hard preparing for our meeting in Frankfurt and looking forward to an outstanding attendance, even though we do not expect to match that of Orlando. Please make every effort to join us.

Harry Stuart
President

July 14th 1989

T.I.C. statistics

TANTALUM

PRODUCTION AND SHIPMENTS

(quoted in lb Ta_2O_5 contained)

1st quarter 1989

	Production	*Shipments*
Tin slag (over 2 % Ta_2O_5)	253 751	94 944
Tantalite (all grades), other	125 712	171 109
Total	379 463	266 053

Note :

17 companies were asked to report, 15 replies were received. The companies which reported included the following, whose reports are essential before the data may be released :

Datuk Keramat Smelting, Greenbushes, Malaysia Smelting, Mamoré Mineração e Metalurgia, Metallurg Group, Tantalum Mining Corporation of Canada, Thailand Smelting and Refining.

QUARTERLY PRODUCTION ESTIMATES

(quoted in lb Ta_2O_5 contained)

LMB quotation :	*US $ 30*	*US $ 40*	*US $ 50*
2nd quarter 1989	230 000	363 500	421 500
3rd quarter 1989	220 000	353 500	421 500
4th quarter 1989	217 000	351 500	446 500
1st quarter 1990	212 000	331 500	446 500
2nd quarter 1990	212 000	311 500	446 500

Notes :

The quarterly production estimates are based on information available, and do not necessarily reflect total world production.

PROCESSORS' SHIPMENTS

1st quarter 1989

Product category	*lb Ta contained*	*lb Ta_2O_5 equivalent*
Ta_2O_5, K_2TaF_7	22 510	30 389
Alloy additive	20 628	27 848
Carbides	138 313	186 723
Powder/anodes	229 587	309 942
Mill products	89 203	120 424
Ingot, unworked metal, other, and scrap	19 712	26 611
Total	519 953	701 937

Notes :

1. 16 companies were asked to report, 16 replies were received. Reports by the following companies are essential before the data may be released :

   Cabot Corporation - Electronic Materials and Refractory Metals, Fansteel, W.C. Heraeus, Kennametal, Metallurg Group, Mitsui Mining and Smelting, NRC Inc., Showa Cabot Supermetals, Hermann C. Starck Berlin, Treibacher Chemische Werke, Vacuum Metallurgical Company, V-Tech

2. Reports were made in lb tantalum contained.

Capacitor statistics

EUROPEAN TANTALUM CAPACITOR SHIPMENTS

(thousands of units)

1st quarter 1989 170 530

(Data from ECTSP)

JAPANESE TANTALUM CAPACITOR PRODUCTION AND EXPORTS

(thousands of units)	*Production*	*Of this, exports*
1st quarter 1989	885 371	205 857

(Data from JEIDA)

WORLD TANTALUM CAPACITOR SHIPMENTS

(millions of units)

3rd quarter 1988 1362.0

4th quarter 1988 1342.7

(Data compiled by combining regional and export data)

U.S. TANTALUM CAPACITOR SALES

(thousands of units)

1st quarter 1989

Foil	163
Metal-cased	29 000
Moulded	80 679
Dipped	97 082
Chips	47 650
Wet slug	2 079
Total	256 653

(Data from EIA)

Note :

The data did not provide separate figures for U.S. shipments and exports for this quarter.

Letter to the editor

The following letter has been sent by Mr John Linden, Managing Director of Greenbushes Ltd., proposing changes in the way in which the T.I.C. collects tantalum statistics : comments are invited from readers, with a view to initiating an informed discussion at the forthcoming assembly in Frankfurt.

Dear Sir,

RE : TANTALUM PRODUCER STATISTICS

Statistics on the production and shipments of tantalum raw materials have been collected for more than ten years now in the following categories :

A Tin slag (2 %-10 % Ta_2O_5)
B Tin slag over 10 % Ta_2O_5
C Tantalite under 25 % Ta_2O_5
D Tantalite over 25 % Ta_2O_5
F Other materials.

The release of the data collected by Price Waterhouse is subject to two conditions :

1. That all "must report" companies have reported.
2. That no single company represents more than 65 % of a category otherwise categories must be amalgamated.

It is a fact that because of the second condition the results have only ever been released in two categories :

A Tin slag 2 % and over
C Tantalite (all).

While the above reporting format provided useful data in the past, I believe that because of fundamental changes in the tantalum industry a better production statistical questionnaire can be designed.

Basically the reasons for suggesting a change now are as follows :

— The reporting categories are no longer applicable.
— Production distribution between slags and concentrates is not very important.
— Raw materials with more than 10 % Ta_2O_5 represent direct feed into processing plants.
— Raw materials with less than 10 % Ta_2O_5 are feed for synthetic concentrate production.
— Synthetic concentrate production is not included in the current production statistics.
— Slags with 2 %-10 % Ta_2O_5 are included in current production statistics even though they do not become useable by processors until turned into synthetic concentrate.

My proposal is that the questionnaire to producers be changed to reflect this position and that the 65 % rule be dropped because under the revised reporting format it will not be required.

A Tantalum raw materials less than 10 % Ta_2O_5.

B Tantalum raw materials greater than 10 % Ta_2O_5.

Category A would include : Tin slags, Tantalite concentrates, Columbite concentrates, Struverites, Other.

Category B would include : Tin slags, Tantalite concentrates, Synthetic tantalite concentrates, Other.

As Category B would include all productions from Thaisarco, Tanco, Greenbushes, Starck and Metallurg there would be sufficient anonymity and the 65 % rule would never be breached.

In reporting statistics back to members it can be immediately seen that total production from Category B either matches or does not match demand statistics.

The Category A material would be shown but not totalled with Category B as this is essentially inventory material to be reprocessed into synthetic concentrates.

Shipments for both categories would continue to be reported and traders would be asked to report as well as producers.

The present reporting of all slags over 2 % Ta_2O_5 is a meaningless number as it includes low grade tin slags that may not be available to processors for one or more reasons.

It is felt that separating the low grade slags and incorporating synthetic concentrate production will give a more accurate and realistic supply and demand picture which is in the best interest of all serious members of the tantalum industry.

It may be useful to publish this letter in the next T.I.C. Bulletin requesting comment on the suggestion and seeking an informed discussion at the next meeting.

Yours faithfully,

J. Linden
Managing Director

Fansteel starts new 12 megawatt electron beam facility

This article was written for the T.I.C. Bulletin by Mr Thomas S. Carlile, General Manager of the Muskogee plant of Fansteel/Metals.

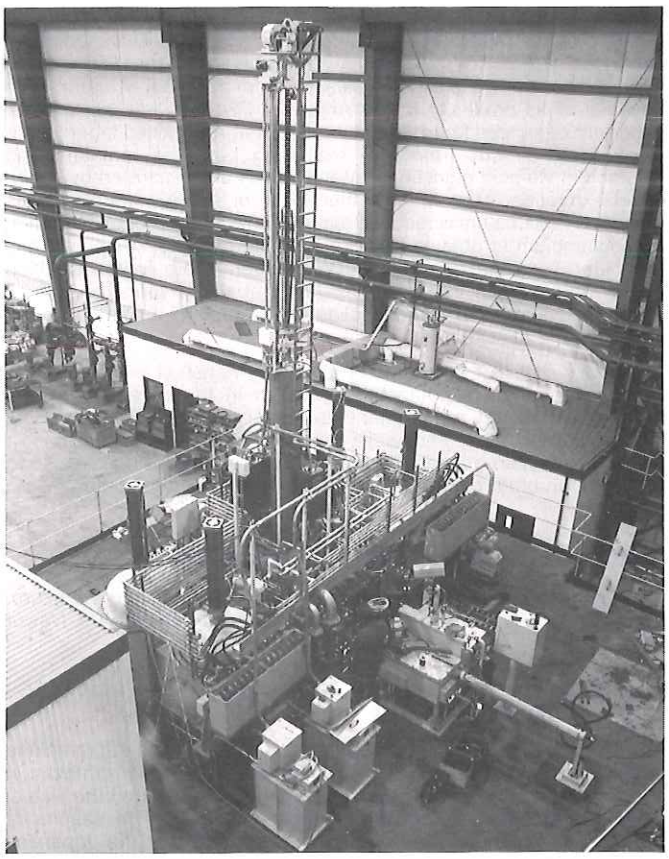
Fansteel/Metals has completed installation of a six million dollar melting facility for refractory metals at its Muskogee, Oklahoma, plant, and is now starting up this facility. The addition includes not only the new electron beam melting furnace, built by Leybold AG and utilizing state-of-the-art technology, but also a retrofitted, computer-controlled vacuum arc remelt furnace.

The melting facility represents the largest single capital equipment investment made at the Muskogee plant since its opening in 1957. Fansteel is an integrated producer of the refractory metals tantalum and columbium (niobium), and fabricates precision metal products for use in the electronic, aircraft and aerospace, defense, chemical and energy-producing industries. The company is recognized as a world leader in manufacture of tantalum capacitor products, including powder, wire, and foil. In addition to Muskogee, other plants for production of these products are located in North Chicago, Illinois, and in Mito, Ibaraki Prefecture, Japan, where Fansteel has set up V Tech-Fansteel (VFI), a joint venture with the trading company V Tech; this plant began operations in late 1986 and today offers a full line of high charge capacitor powders under the VFI label.

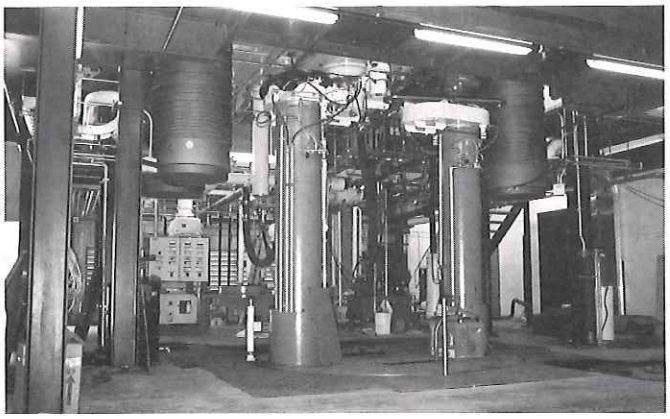
The new EB furnace will provide both improved efficiency and quality for melting tantalum, columbium, and their alloys. Fansteel sees burgeoning market opportunities for columbium alloys in both superconducting and high temperature alloy applications. It has been estimated that the Superconducting Super Collider, for example, to be located in Texas, will employ $ 270 million of superconducting cable, which will require about 1,800,000 pounds of columbium-titanium alloy billets. Fansteel intends to supply alloy rod to superconducting cable and magnet manufacturers. Other applications for superconducting columbium also exist with the Continuous Electron Beam Accelerator Facility (CEBAF) being constructed by Southern University Research Association in Newport News, Virginia (USA), and at CERN in Geneva, Switzerland, for both the large electron-positron collider (LEP) and the planned large hadron collider (LHC). The technology for manufacturing high-field, superconducting magnets has been demonstrated with the Fermilab (Batavia, Illinois) Tevatron II collider, as well as commercially in numerous body cavity magnetic resonance imaging systems now in use in medical centers.

The expansion of the melting facility at the Muskogee plant consisted of four phases : (a) modernization of the power substation from a maximum capacity of 6,600 to 10,600 KVA, (b) construction of the melt shop building, which has dimensions of 180 ft. long by 80 ft. wide with 52 ft. height at the eaves, (c) upgrading and retrofitting of the vacuum arc furnace, and (d) installation of the new electron beam furnace.

The VAR furnace upgrade consisted of increasing power by 15 % to 1000 KW, adding state-of-the-art control and instrumentation systems with automatic read-out at the operator console, and improved systems for materials handling and cooling water recirculation. The maximum ingot diameter will be 12 inches for tantalum, and up to 18 inches for lower melting columbium alloys. The VAR furnace improvements were completed in December, 1988, and the equipment has been in production since that time.



Top view of EB furnace platform. Bar loader is located next to operator. Note cooling water pumps at upper left of picture, cooling tower is located outside building



EB furnace underneath platform at ground level, showing ingot crucible on carousel, diffusion pump and controls

The new electron beam furnace has two 600 KW/40KV electron beam guns. These double-pumped Leybold electron beam guns will also maintain operation even if there are pressure fluctuations in the vacuum chamber caused by feed material gassing. The vacuum system design permits pump-down to less than 0.5 microns (5 x 10-4 millibar) in less than twenty minutes. The ultimate pressure for the continuously pumped system is 0.01 microns (1.3 x 10-5 millibar). Although the bottom of the furnace extends about twenty feet below ground level and forty-one feet above, all components requiring routine maintenance are easily accessible. A vacuum lock and horizontal feed bar loader permit the furnace to be fed continuously. A carousel-design crucible station permits one ingot to be melted while a second is cooling without vacuum interruption. The control room and operators' console have capability for automatic data acquisition, fault-finding, and a maintenance management system. The furnace has capability of melting tantalum ingots up to 12 inches diameter by 105 inches long and columbium ingots up to 14 inches diameter by 105 inches long. The furnace capacity is approximately 250 000 lb/yr of triple-melted columbium (14-inch diameter) or 510 000 lb of double-melted tantalum ingot (12-inch diameter). The building contains adequate space for material handling, staging and expansion, when required.

Fansteel's Muskogee plant was built in 1957 when the company, the first to produce refractory metals commercially in the U.S., identified expanded needs for columbium to be used in the U.S. space effort. The Muskogee site was selected from a number of alternatives because of its proximity to the Arkansas River as well as to other important resources for transportation, power, and skilled labor. The plant starts directly from ore, extracting both the tantalum and columbium via acid digestion. Metal values are separated by liquid-liquid extraction, after which either oxide or fluoride double salt is produced. Tantalum is reduced to metal powder by sodium reduction and columbium is obtained by the thermite process. Fansteel has two older Temescal-design 450 KW electron beam furnaces which began operation in 1964. Plans are that these furnaces will be maintained and used for consolidation of first melt ingots, added capacity, and special-purpose melts.

The addition of this new melting facility by Fansteel will enable the company to retain a competitive position in the refractory metals field. With industry requirements for capacity and quality becoming ever more demanding, Fansteel's expanded melt capability positions it not only to remain a leader in refractory metal processing but also to capitalize on other opportunities in high temperature metallurgy.

The tantalum market in Japan

This article is based on a report prepared by Mr Yoichiro Takekuro, Chairman of the Tantalum Group at the Japan Society of Newer Metals.

THE CONSUMPTION OF TANTALUM IN 1988 AND A FORECAST FOR 1989

As can be seen from Table 1, the Japanese tantalum market remained in buoyant condition in 1988. However, the demand for tantalum in 1989 is expected to be less than in the previous year, and the size of the decrease will differ from one product to another. The reasons for the drop in distribution are, firstly, it is forecast that the Japanese economy will not be as strong in 1989 as it was last year and, in addition, the total amount of tantalum distributed in 1988 was far more than the amount actually used in the Japanese industry in that year and consequently it must be assumed that some of this tantalum is stored somewhere in the country.

Table 1 : Demand for tantalum in Japan 1985 to 1988 and a forecast for 1989 (Unit : kilogram tantalum contained)

	1985	1986	1987	1988	1989 estimate
REFINED					
Powder	95 854	85 120	109 125	158 652	135 000
Imports	19 200	19 150	22 448	35 438	31 500
Import share	20 %	22 %	21 %	22 %	23 %
Compounds	52 900	50 320	48 320	55 340	51 000
Imports	12 300	14 300	14 500	17 000	15 500
Import share	23 %	28 %	30 %	31 %	30 %
Total	148 844	135 440	157 445	213 992	186 000
Imports	31 500	31 450	36 948	52 438	47 000
PROCESSED					
Processed goods	34 532	34 554	42 034	78 732	52 490
Imports	12 740	14 748	20 890	46 007	25 150
Import share	37 %	43 %	50 %	58 %	48 %

Tantalum powder sold in 1988 amounted to approximately 158 tonnes, marking a record 45 % increase over 1987 sales. In January 1989, we estimated that the amount of tantalum powder actually used in Japan during 1988 was 120 tonnes, or 130 tonnes at most. For tantalum capacitors the consumption of tantalum per unit continues to decrease, due to the great efforts at improvement made by the manufacturers of powder (even though their efforts are not, unfortunately, reflected in the price of powder). Also, although 3.5 billion tantalum capacitors were produced in 1988, a 27 % increase over 1987, this percentage did not match the 45 % growth in powder sales. These factors form the basis of our conclusion that part of the tantalum sold last year is stored in Japanese users' warehouses.

The Japan Electronic Machinery Association has forecast that the production of solid capacitors is expected to be 7.9 % higher in 1989 than in 1988. In the past, the annual growth rate for tantalum capacitors was higher than the rates for aluminium and ceramic capacitors, but in recent years production figures show that growth rates for the latter two types have increased considerably while that for tantalum has remained static. The growth rates for aluminium, ceramic and tantalum capacitors were minus 0.3 %, plus 15 % and plus 26 %, respectively, in 1987, while in 1988 production of the three types increased by 17 %, 29 % and 27 %, respectively.

Figures for the month of December 1988 when compared with data for the same month in 1987 show that there is almost no difference in the growth rates of the three types. The age when the growth of tantalum capacitor manufacture outstripped that of other types appears to be history, and therefore we project that the amount of tantalum powder to be consumed in 1989 will be 15 % less than last year, at 135 tonnes. This effect will be accentuated by the additional factor that the more tantalum costs as a raw material, the greater will be the decrease in the volume marketed.

The amount of processed goods, such as wire, sold in 1988 was 78.7 tonnes, an increase of 87 % over 1987 sales. The market environment for these products is the same as that for tantalum powder, and in 1988 there was here also a large difference between the amount sold and the quantity consumed. It is therefore predicted that sales of these tantalum products in 1989 may drop by as much as 33 %.

DEMAND STRUCTURE

Table 2 shows the structure of the Japanese market in terms of the percentage taken up by each type of use. It can be readily seen that the electronic industry, that is, for capacitors, has by far the largest share — 70 % of the total for 1987.

Table 2 : Industry structure : demand, by type of use (Unit : percent)

JAPAN

	1986	1987	1988	1989 estimate
Electronic industry	66	70	68	68
Cemented carbide	22	17	13	16
Ceramics	8	7	6	6
Others	4	6	13	10
Total	100	100	100	100

T.I.C. DATA (1987)

Powder	42 %	Ceramics	5 %
Cemented carbide	25 %	Others	12 %
Rolled products	16 %		

A comparison of the structure of the Japanese industry with the world industry in general, as represented by the T.I.C.'s collected data for the year 1987 as an example, may be attempted. The figure for the electronic industry in Japan includes not only use of tantalum in powder but also that in wire for capacitors : the figure for wire could therefore be deducted to make the comparison more accurate. Even when this is done, it is clear that the proportion of the total consumed by the electronic industry is much greater for Japan than for the world as a whole. ('Others' in Table 2 stands for processed products used in industries other than the electronic industry.)

Another major difference between the world market and the Japanese market is that there is a considerable demand for tantalum for aerospace use in the rest of the world, whereas in Japan this kind of use is rare. Also, in our opinion, a relatively large amount of tantalum was consumed for ceramic use in Japan, including the addition of tantalum to glass used for lenses. However, the table shows very similar percentages for ceramic use in both Japan and the world market. This is probably because use of tantalum in this segment of the Japanese industry has not yet recovered from a rapid drop when the price rose abruptly, a factor which should not be forgotten.

IMPORTS

Government statistics show that tantalum to the value of 5700 million yen ($ US 44.61 million) was imported into Japan in 1988 in the following forms : ore ($ US 1.96 M), intermediary products ($ US 19.41 M), powder ($ US 9.00 M), processed products ($ US 11.36 M) and other products ($ US 2.88 M). But these figures do not include the imports of tantalum compounds, which accounted for about 30 % of the market over the past four years (see Table 1), and therefore the real value of all tantalum-containing imports into Japan was considerably higher than these statistics suggest.

The value of imports, as given by these statistics, increased from $ US 20 M in 1987 to almost $ US 45 M in 1988, but a similar increase cannot be expected in 1989, for the economic reasons outlined above. Also it must be appreciated that the industry's sound development would be hindered by soaring prices which would lead to a loss in the tantalum market, and also that unfair dumping would weaken the industry.

Looking back at Table 1, it is evident that the Japanese tantalum industry provides a market which is not exclusively for Japanese companies. Japan is an open market, importing from overseas 20 % of its powder requirements, 30 % of compounds and as much as 50 % of processed products, and the market share of imports has been increasing steadily. Japanese manufacturers rely on the availability of imported materials ranging from ores and intermediary products to scrap, and for the healthy development of their industry they look forward to further co-operation with overseas companies in the years to come.

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