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TANTALUM-NIOBIUM INTERNATIONAL STUDY CENTER

PRESIDENT'S LETTER

Dear Friends,

All being well you should be receiving this Bulletin prior to the forthcoming T.I.C. meeting in Prague and after you have all made your reservations.

Details of the meeting will be covered later in this Bulletin.

The meeting comes at a time of particular significance to the host country and to Prague especially. It was thirty years ago that the embryonic democracy movement demonstrated itself in the 'Prague Uprising'. It is perhaps symbolic that as a country adapts and prospers our own industry faces numerous challenges of a truly global market. The meeting offers us all a great opportunity to meet and understand the changing demands of the market and the technical innovations taking place and those still awaited. This in conjunction with industry statistics, trend data and reports are the key contributions of the T.I.C. to its members.

I look forward to seeing you in Prague and feel sure that you will have a most enjoyable and interesting meeting.

Bill Millman
President

SUMMARY

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MEETING IN PRAGUE

Technical programme
Morning session. Chair: Mr William Millman

Market and trends for tantalum capacitors
Mr Glenn Louch, AVX Ltd.

The tantalum capacitor market continues to grow at a very healthy rate. The products available to the customer base continue to evolve to meet the needs of tomorrow's future applications. In this presentation AVX, one of the leaders in tantalum capacitors, provides data on the markets where the product is used and discusses the types of components needed to meet future needs.

Choosing capacitors for mobile phones
Mr Mark Jenkins, Director of Distribution for EMEA, Philips Consumer Communications

Use of tantalum capacitors at IBM
Ms Sylviane Bordas, IBM France, Bordeaux

Noise and non-linearity indicators for tantalum capacitors
Prof. J. Sikula, Department of Physics, Technical University, Brno

A new method of tantalum capacitor testing and reliability prediction is given. The aim of the work is to characterise the contacts and active region quality of tantalum capacitors by non-linearity and noise measurements. This method is based on evaluation of third (THI) and second (SHI) harmonic measurement and low frequency noise spectral density. The defects in active region, interfaces between different conducting layers and on contacts are responsible for non-ohmic characteristics. There exist two possible sources of non-linearity. A quadratic function of V-A characteristic can be extrapolated in intervals close to the zero voltage. Hence, in this case the second harmonic signal of testing AC voltage is measured. If a cubic or odd function of V-A characteristic decomposition is present then a third harmonic signal is given.

This is a fast, simple, non-destructive measuring method which will give information on quality and reliability of the components. In our case we are mainly focused on conducting layers, but non-linearity of the active region is indicated also.

The test procedure has been measured both with and without DC bias. The measurement was performed with modified Component Linearity Test Equipment of Radiometer a/s, Copenhagen NV, Denmark (CLT1). The basic measuring frequency was 10Hz of pure sinusoidal signal. The average values and dispersion of THI, SHI and noise spectral density are used to evaluate the quality and stability of different technologies.

Afternoon session. Chair: Dr George Korinek

Use of tantalum and niobium in chemical applications
Mr David Rowe, Special Metals Fabrication, Brentwood, England

Manufacturing of lithium niobate and lithium tantalate crystal wafers
Dr Peter Bordui, Crystal Technology, Palo Alto, California, U.S.A.

Lithium niobate and lithium tantalate are key single-crystal materials enabling important and growing component technologies in surface acoustics and bulk and guided-wave optics to develop. World production of the two materials exceeds 100 tons/year and continues to increase. Current methods for large-scale production of lithium niobate and lithium tantalate will be presented with emphasis on crystal growth and the associated process development.

SAW filters using lithium tantalate for mobile communication systems
Mr Masahiro Sugimoto, Fujitsu Ltd.

There is a huge increase in mobile communication systems which require compact/light and high frequency operations with newly developed digital system solutions. SAW filters have become key-components in these systems. Due to its excellent piezo-electric performance, such as temperature stability and a high coupling factor which gives low propagation loss, lithium tantalate is a suitable material for SAW filters.

Tantalum/niobium developments in the former Soviet Union
Mr David Henderson, Metallurg International Resources, New York, U.S.A.

The presentation will give a brief overview of the tantalum and niobium industries in the FSU, including commentary on their distinctly different historical development as compared to the West. The primary focus will be on the major chemical processors. The region's potential impact on the global supply/demand balance will also be examined.

Technical and commercial development of the European Niobium Market
Dr Friedrich Heisterkamp, Niobium Products GmbH, Düsseldorf, Germany

The technical development of niobium containing products is to a great extent influenced and supported by the striving of the respective industries to maintain or even strengthen their positions in all fields of application against competing materials. The aircraft industry is increasingly using niobium containing nickel base alloys and is expected to continue in the long term its present high output of passenger planes. Eastern Europe and the CIS are slowly coming back to normal economic conditions and are already applying Western technology in their steel and metal industries. As a result the niobium market was very strong last year and it is very likely to remain so in the foreseeable future. The latest research and development in the field of niobium containing steels and alloys will be discussed.

Tantalum overview of the last year
Dr George J. Korinek, Technical Adviser, Tantalum-Niobium International Study Center

An overview of the developments in the tantalum industry since our last meeting in Xian, China, will be given. The main emphasis will be on the current supply and demand situation, and its future development.

FABRICATION INDUSTRY OF NIOBIUM AND ITS PRODUCTS IN CHINA

by Dr Yin Weihong, Mr Chen Qinyuan, Mr Fu Junyan and Prof. Chu Youyi, presented at the Thirty-eighth General Assembly meeting in Xian, China, in October 1997

ABSTRACT

The preparation of niobium products in China started in the 1950's. Fabrication production on a commercial scale began in the 1960's. Nowadays there are five main producers of niobium powder and blanks, and they produce ferro-niobium also. The common niobium in the form of blanks and ferro-niobium is used in the iron and steel industry, and this is the main consumption of niobium in China. Annual production capacity of common niobium reaches 300 tonnes. There are nine main producers of high quality niobium products, including research institutions. Their annual production capacity amounts to 160 tonnes, which currently meets domestic demand. Demand for niobium from high tech industries, and the development of the iron and steel industry with increasing quality and quantity, open up a broad prospect for the development of the niobium industry in the future.

INTRODUCTION

China has had more than 40 years' experience in niobium research, production and application, with a history of close integration of scientific research with production. The investigation of tantalum and niobium started in 1956 in Beijing General Research Institute for Nonferrous Metals (BGRINM). In the following year, the preparation of metallic niobium and sintered blanks by carbon-thermal reduction was successfully conducted. In the early 1960's, high purity ferro-niobium was prepared by alumino-thermic reduction of Nb_2O_5. In the mid 1960's, low grade ferro-niobium was produced from open hearth slags. Almost at the same time, niobium-bearing steels were develpoed by Tangshan Iron and Steel Company and Baotou Iron and Steel Company. In the mid and late 1960's, Ningxia Nonferrous Metals smelter was set up which, in co-operation with Zhuzhou Cemented Carbide Works which had been set up in the 1950's, provided the Chinese fabrication industry of niobium with the necessary starting materials. The first niobium wires were drawn in 1962, trial-rolled products were turned out in the following year, and then the research and preparation of NbTi superconducting alloys and Nb-75 alloys were launched. The establishment of Baoji Nonferrous Metals Works (BNMW) and the Northwest Institute for Nonferrous Metal Research (NIN) in the late 1960's and early 1970's brought China the possibility of producing niobium fabricated products on a commercial scale. Now a relatively well integrated industry system of niobium fabrication has been established in China through a great effort over the 1970's and further development during the 1980's.

PRODUCTION OF NIOBIUM POWDERS AND BLANKS

There are five main producers of niobium powders, blanks and ferro-niobium. They are Ningxia Nonferrous Metals Smelter (NNMS) in Ningxia Autonomous Region, Jiujiang Nonferrous Metals Smelter (JNMS) in Jiangxi Province, Zhuzhou Cemented Carbide Works (ZCCW) in Hunan Province, Conghua Smelter

(CHS) in Guangdong Province and Limu Tin Mine (LTM) in Guangxi Zhuang Autonomous Region: in terms of metallurgy, NNMS is the largest of these. The comprehensive annual production capacities of these plants in 1995 are listed in Table 1.

Product variety	Production capacity (t/y)
Nb powders, Nb blanks	160
High purity Nb oxides and Ta oxides	>20
Ferro-niobium	250~285

Table 1: Total production capacity of the five producers in China in 1995

All five producers operate processes beginning with ore digestion in the H_2SO_4-HF system. But the extractants used for the valuable metals and for separating tantalum and niobium from each other are different. NNMS uses MIBK (methyl isobutyl ketone), while the others use 2-octanol.

There are two processes for producing metallic niobium from Nb_2O_5, i.e. by alumino-thermic reduction and carbon reduction. Both are adopted in China nowadays, but carbon reduction is the more widely used for the moment. It is divided into direct reduction and indirect reduction: production flowsheets are shown schematically in Figures 1 and 2.

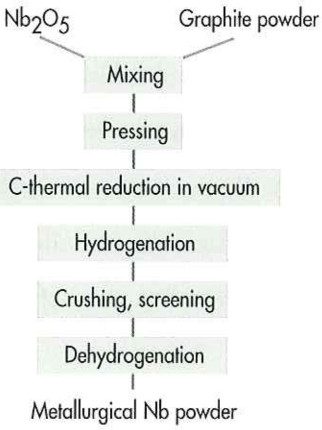

Figure 1: Production flowsheet for direct thermal reduction

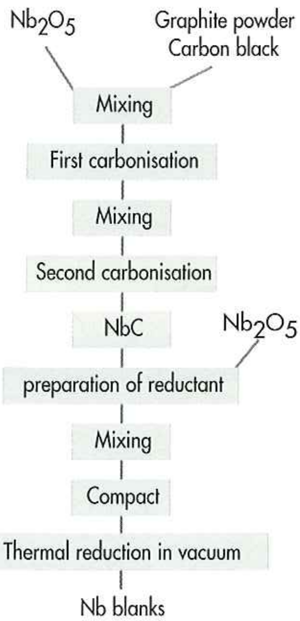

Figure 2: Production flowsheet for indirect thermal reduction

Major efforts are now being devoted by NNMS to producing niobium by alumino-thermic reduction. The first phase engineering project of the production line for producing niobium by alumino-thermic reduction and refining in horizontal crystallizers of an EB furnace will be put into production in the second half of 1998. The production capacity for pure niobium will reach 40 tons/year, and the production flowsheet is shown schematically in Figure 3.

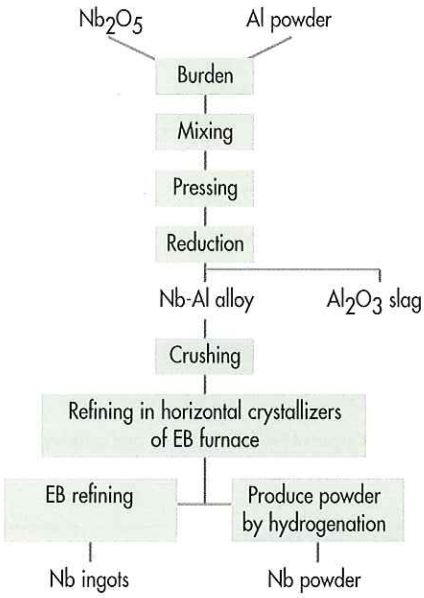

Figure 3: Production of niobium by aluminothermic reduction

FERRO-NIOBIUM

Because the addition of niobium to steels can increase their strength and improve properties of heat resistance and weldability remarkably, 80% of niobium concentrates in the world are used to produce ferro-niobium which is used in steels and superalloys. This is equally true in China. Most of the domestic producers of ferro-niobium (such as the five plants mentioned above) take commercial Nb_2O_5 as raw material and adopt the process of alumino-thermic reduction. Only a few plants, such as Henfong Mine, take niobium concentrates (containing about 50% Nb_2O_5) as raw material to produce ferro-niobium by alumino-thermic reduction directly after chemical treatment, by either the acid or the alkali process. The products of the former process are characterized by high purity and find a wide application not only in supply for production of high strength low alloy steels (HSLA), but also to meet the requirements of superalloys. The impurity content of the ferro-niobium produced by the latter process is much higher than that of the former, for example, the contents of phosphorus and sulphur reach 0.10%, and domestic applications have certain limitations nowadays. The production flowsheet of ferro-niobium by alumino-thermic reduction is shown schematically in Figure 4.

Niobium microalloyed steels in China have been developed rapidly in recent years, as shown in Table 2. The statistical data indicate that ferro-niobium consumption has increased significantly since 1990. Consumption in 1995 increased 1.4 times compared with that in 1990.

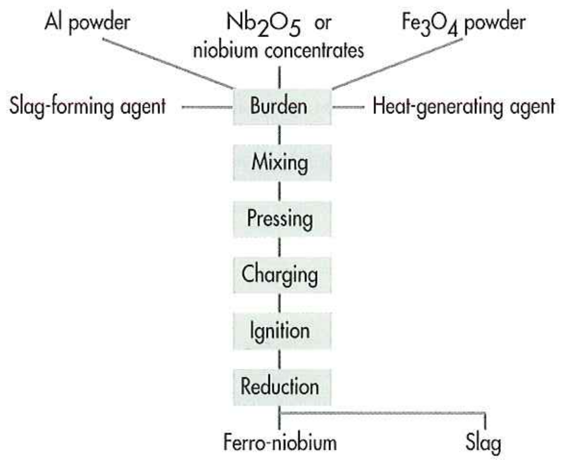

Figure 4: Production of ferro-niobium by aluminothermic reduction

Year	1980	1983	1985	1990	1994	1995
Output, t	5 000	49 386	18 129	179 200	314 477	526 218
FeNb/raw steel, g/t				1.13	1.84	2.69

Table 2: Output of Nb-bearing steels and consumption level of FeNb in China in recent years

NIOBIUM FABRICATION

Nowadays there are nine main units engaged in the production of niobium fabricated products in China, as listed in Table 3. Among them Baoji Nonferrous Metals Works is the largest on the fabrication scale. The output of fabricated products can meet domestic demand. Production during the past ten years is shown in Figure 5, from which it is clear that the annual output of fabricated products is basically stable, with the exception of 1989.

IMRAS Institute of Metal Research Academia Sinica
CISRI Central Iron and Steel Research Institute for Ministry of Metallurgical Industry
SRINM Shanghai Research Institute for Nonferrous Metals
SNMW Shenyan Nonferrous Metals Works

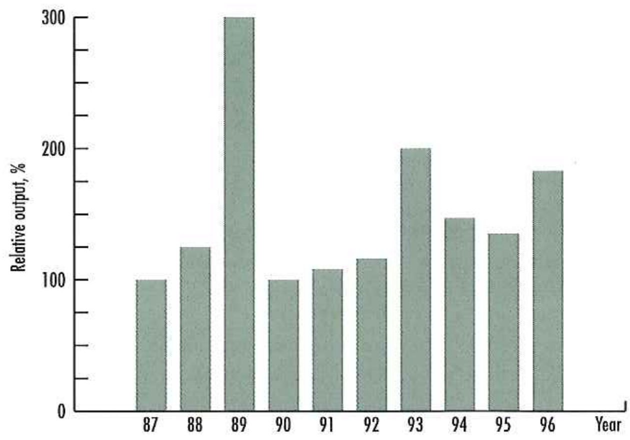

Figure 5: Relative production of niobium fabricated products in the last ten years

The production capacity of niobium fabricated products depends on that of ingots and blanks. At the present time, domestic production capacity of melted ingots is 100t/y, and that of sintered blanks is 50t/y, which exceed actual demands by a large margin. The ingots are usually melted twice in EB furnaces or in consumable arc furnaces. The common sizes for the ingots are 60~120mm in diameter. The maximum diameter can be 400mm. The chemical compositions of niobium and its alloy ingots are listed in Table 4. Some of the sintered blanks are used for producing rods and plates of small sizes.

Unit	EB ingot	tube	plate/sheet	strip	foil	rod	wire	forging	high purity niobium	single crystal	$LiNbO_3$
BNMW	+	+	+	+	+	+	+	+			
NIN	+	+	+	+	+	+	+	+	+	+	
NNMS	+	+	+	+		+	+				+
ZCCW	+		+	+		+					
BGRINM	+		+		+						
IMRAS	+	+									
CISRI	+		+							+	
SRINM		+	+								
SNMW	+		+			+					

Table 3: Main fabrication units of metallic niobium in China, and their products

Designation	O	C	N	H	Fe	Ni	Cr	Ti	Ta	Cu	W	Mo	Mn	Si	Al	Zr	Nb
ND-S	0.02	0.003	0.005	0.002	0.001	0.001	0.001	0.001	0.01	0.001	0.001	0.001	0.001	0.001	0.001	0.001	Balance
ND-1	0.01	0.005	0.002	0.002	0.002	0.001	0.001	0.001	0.015	0.001	0.003	0.003	0.003	0.001	0.001	0.002	Balance
ND-2	0.015	0.01	0.01	0.002	0.005	0.005	0.005	0.005	0.2	0.005	0.01	0.01	0.005	0.005	0.005	0.005	Balance
NZ-1	0.015	0.01	0.01	0.002	0.005	0.005	0.005	0.005	0.2	0.005	0.01	0.01	0.005	0.005	0.005	0.82*	Balance

Note: The contents of all elements have to be lower than the given data except Zr content * in NZ-1

Table 4: Chemical compositions of Nb and its alloy ingots (by melting process)

The fabrication flowsheet of niobium is shown in Figure 6. Various kinds of fabricated products are available, including plates, sheets, strips, wires, rods, tubes, rings, spinnings, die-forgings, etc., of which the main specifications are listed in Table 5. There are 15 designations of the fabricated products, including those of pure niobium, niobium alloys, high purity niobium and single crystals. In terms of product structure, tubes are dominant, followed by plates. The proportion of niobium alloy products exceeds 50% of all niobium products.

Most of the fabricated products have been standardized. There are two national standards and six enterprise standards worked out with reference to international standards, and in accordance with domestic experience. There is no doubt that the standardization has played an important role in improving and stabilizing product quality.

China has modern equipment essential for niobium fabrication. EB furnaces, consumable arc furnaces, zone melting furnaces, etc. are used for ingot production. Cold and hot isostatic presses, heavy self-resistance heating furnaces and induction furnaces as well as superhigh temperature vacuum furnaces are used for pressing and sintering. There are various series of rolling mills (2-high, 4-high, 20-high), tube-rolling mills, precision forging machines, die-forging machines and fast forging machines. The necessary auxiliaries for different fabrication procedures have been provided and a relatively complete system of chemical analysis and property-testing and measuring has been set up.

NIOBIUM R & D

The development of the Chinese niobium industry is a history of integrating research with production. A complete system for the niobium industry should consist of both research institutions and plants. Nowadays there are five main institutions dealing with niobium research and development. They are Northwest Institute for Nonferrous Metal Research, Beijing General Research Institute for Nonferrous Metals, Central Iron and Steel Research Institute for Ministry of Metallurgical Industry (CISRI), Institute of Metal Research Academia Sinica (IMRAS) and Shanghai Research Institute for Nonferrous Metals (SRINM). These institutes conduct research and development, and also transform their achievements into production, thus forming an appropriate scale of production capacity for niobium products. Various kinds of products produced by them, as shown in Tables 3 and 5, occupy a large portion of the niobium market at home.

Many types of important equipment were first researched and designed in the institutes, such as presses with cold cylinders 1000mm in diameter and hot cylinders 800mm in diameter, EB furnaces and other heavy-type forming and melting equipment, then put into production. The technologies of capsule extrusion, superplastic forming, explosive bonding for niobium and its alloys have been already commercialized. A great deal of experience in welding, auxiliary machining and surface protective coating has been accumulated. NIN is one of the most important institutes dealing with niobium fabrication in China. It not only produces fabricated products, but also researches and develops high purity products and single crystals of niobium as well as improving fabrication. The Institute integrates the technologies of fabrication, welding, coating and non-destructive testing, which have proven successful in the production of niobium alloy rocket nozzle extensions used in aerospace. The rocket nozzles and skirts produced are shown in Figure 7.

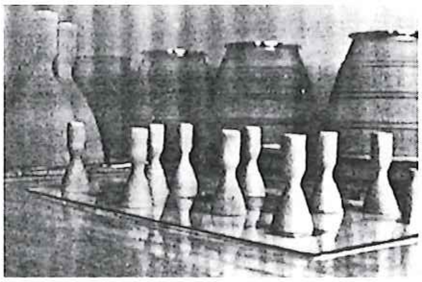

Figure 7: Rocket nozzles and skirt made of Nb alloy

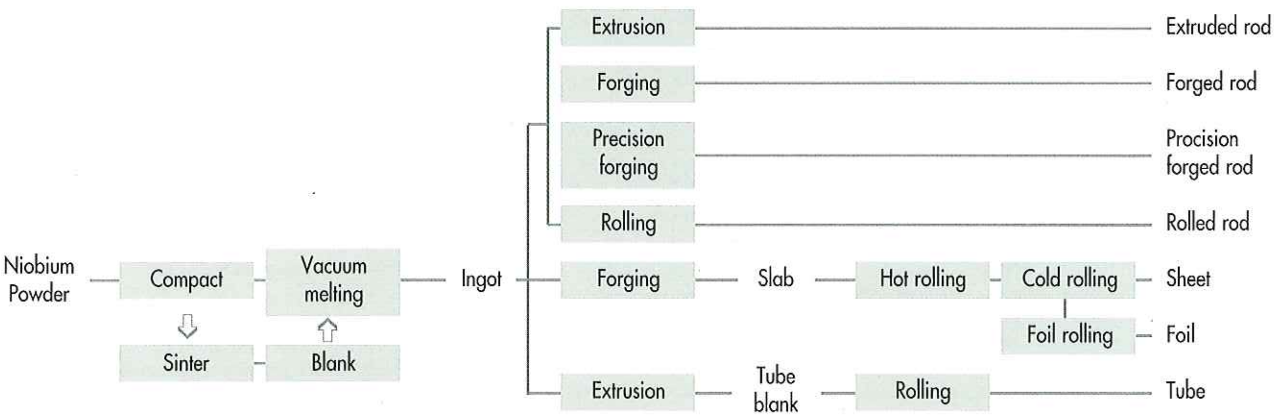

Figure 6: Flowsheet of niobium fabrication

Variety	Specification (mm)
foil	0.03 ~ 0.09 (thickness) x 30 ~ 300 (width)
sheet	0.1 ~ 6.0 (thickness) x 50 ~ 420 (width)
wire	D0.05 ~ 3.00
tube	OD3.00 ~ 50.00 wall thickness 0.15 ~ 3.50
rings	OD225 ~ 380 wall thickness 25 ~ 50
rods	D3.0 ~ 70.0

Table 5: Specifications of Nb and its alloy fabricated products

It is expected that niobium capacitors will attract more and more attention because the performance of Nb capacitors is as good as that of Ta capacitors, especially in low voltage service. Owing to cheap prices, low specific density and abundant resources, niobium capacitors have good prospects for use in this area, which tantalum capacitors have not yet entered at the present time, and to create competition with ceramic capacitors. A research project for niobium powders is now being conducted in NNMS, aiming to produce 25V, 50 000uFV/g grade Nb powder. Procedures for carbon-reduction of Nb_2O_5 - EB melting - hydrogenizing powder preparation - heat treatment - crushing and screening - blending are used to lower the harmful contents of C and N as impurities.

Superconducting materials of NbTi and Nb_3Sn have been put into practical applications, and become an important part of consumption of high quality niobium. NIN is one of the main institutes dealing with researching and producing superconducting materials in China. Production with an annual capacity of 10 tonnes of NbTi and Nb_3Sn superconducting materials has been set up and multifilament wires, tapes, flat cables, woven cables, twisted cables, hollow conductors and NbTi tapes with a high proportion of copper have been produced by the institute. The critical current densities Jc of the composite wires are obtained steadily in the range 2.5~3.5x10-5 A/cm2 (5T,4.2K), standing at advanced level of the same sort of products in the world.

NIOBIUM APPLICATION

The market for applications of niobium can be divided generally into the common niobium market and the high quality niobium market. The main applications are in the fields of iron and steel, electronics, electric lighting, atomic energy, chemical engineering, machinery, aerospace, aviation, superconducting techniques, etc. Niobium applications in China are summarized in Table 6. Recent domestic annual consumption of niobium is in the range of 100~110 tonnes, of which 75~80% of niobium in the form of ferro-niobium is consumed in the iron and steel industry.

Application area	Application form	Niobium function	Applications
Metallurgical industry	Fe-Nb	Additives in HSLA steel to refine grain and increase strength	Petroleum, oil, gas pipelines, pressure vessels, ships, bridges, etc.
	Fe-Nb	Additives in heat resistant steels for precipitation hardening and increasing strength	Blades of vapour turbines
	Nb, Ni-Nb, Cr-Nb	Additives in superalloys for precipitation hardening and increasing strength	High temperature materials for aeroplane engine, heating furnace components, etc. and reactor materials
Chemical industry	Fabricated Nb products	Corrosion resistance	Heaters of electrical plating, protective tubes of thermometers, heat exchangers
	Nb sheet	Corrosion resistance	Nylon spinning jet
Machinery industry	NbC, NbN	Increasing hardness of hard metals	Cutting tools
	Nb powder or Fe-Nb	Refine grain of weld area	Welding rods of stainless steel
Electrical industry	Nb powder	Good oxide film stability, only slightly worse than that of Ta	Nb electrolytic capacitors
	Lithium niobate	Good voltage properties	Surface wave filters
	Thin film of Nb oxide	Good dielectric properties	Resistance-capacitance components for integrated current
	Crystals of NbO or NbO_2	Strong dielectricity and thermosensitivity	New type thermosensitive materials and strong dielectric materials
	Nb		Permanent magnets, magnetic heads
Superconductive technique	Pure Nb, Nb-50Ti, Nb_3Sn, NbN thin film	Superconductivity	Superconductive magnets, microwave resonators, cables, generators, energy storage, research for fusion reaction, magnetic suspension vehicles, MRI, etc.
Optical industry	Nb-1%Zr or Nb rods, tubes	Corrosion resistance, weldability with aluminium oxides	Discharge tube ends of high voltage sodium lamps
	High purity Nb oxides	High refractive index, low dispersivity	Optical lens, microcrystal glass, optical fibres
	$LiNbO_3$ crystal, doped $LiNbO_3$ crystal	Laser SHG (second harmonic generation), filtering, etc	Laser communication system, optical storage system, optical storage system of hologram, computers
Atomic industry	Pure Nb, Nb-1%Zr	Small thermal neutron capture cross-section, corrosion resistance to liquid metal	Components of fast neutron reactor
Aviation and aerospace industry	Nb-based alloys	High temperature strength	Materials for rocket nozzles, satellite antennae

Table 6: Summary of niobium applications in China

In the iron and steel industry, the consumption of niobium has increased rapidly during recent years. The output of Nb-bearing steels, mainly HSLA, reached 526 000 tonnes in 1995, with annual consumption of standard grade ferro-niobium about 220 tonnes. The output of Nb-bearing steels in 1996 was 650 000 tonnes, with consumption of 250 tonnes of ferro-niobium required. Recently, the domestic production capacity of ferro-niobium has reached 250~285t/y, but there is lack of competitive ability owing to high production cost, thus the imported quantity of ferro-niobium is still much more than that of domestic supply, as shown in Table 7. More than 90% of imported ferro-niobium came from CBMM, Brazil.

In the electric lighting industry, Nb-1%Zr alloy is widely used as seal cap material for high voltage sodium lamps owing to its excellent property of corrosion resistance to sodium vapour. The lighting colour of high voltage sodium lamps is much better than that of high voltage mercury lamps, and electricity can be saved by 50%, so the lighting industry is the stable consumption sector of high quality niobium.

In aviation and aerospace industries, rocket nozzle extensions made of Nb alloys have been put into production. In the mid 1980's, soon after they were successfully applied in the carrier rockets of meteorological satellites, the extensions became an important consumption part of high quality niobium. Niobium alloys were also selected as the nozzle materials of attitude control engines in space.

Superconducting materials of NbTi have been used in fusion reaction devices, superconducting generators and superconducting magnets for experimental devices for high energy physics. In the mid 1970's, the first superconducting generator in China using NbTi/Cu wires was set up in Shanghai and connected to the electricity network for testing. In the mid 1980's, more than 30 superconducting magnets in small sizes were turned out, among them there were 20 NbTi magnets, used for measurement of electrical and physical properties of superconducting materials.

FUTURE PROSPECTS

In spite of the fact that the application of niobium in China is limited at the present time, the niobium industry sees bright prospects for development and an enormous potential market in the long run.

Common niobium will remain the main consumption. The application of microalloying elements, such as Nb, V and Ti, in steels is unambiguously important to the development of the iron and steel industry. As shown in Table 2, the levels of consumption of FeNb in China were 1.84 and 2.69g FeNb per tonne of total production of raw steels in 1994 and 1995, respectively, which is only about 1/20 of that in USA, Japan and Germany. In order to develop high quality steels, a national project in China has been worked out to target the annual growth rate of Nb-bearing steels at 30% on average during 1996~2000, and at 25% during the period 2001~2010. By that time, the consumption level of FeNb will be up to 10 and 30g/t respectively, therefore, the demands on niobium will be increased sharply. It is estimated that the output of Nb-treated steels will be over 2 870 000t/y, and that of Nb-bearing steels over 1 700 000t/y. The total demand on FeNb will reach 2 000t/y approximately in 2000. The application of Nb-bearing steels will be increased remarkably in the sectors of petroleum, oil gas, automobile and construction, etc.

The development of superconducting materials will further expand the market for high quality niobium. Usually 0.5~1.5 tonnes of NbTi superconducting materials are needed for each Magnetic Resonance Imaging machine. Nowadays there are thousands of NbTi magnets and hundreds of Nb_3Sn magnets applied in nuclear laboratories all over the world. Investigations into the application of NbTi superconducting materials in magnetic suspension vehicles have met with preliminary success. MRI equipment is becoming increasingly popular and will be used widely in the future. All of these will bring great challenges and opportunities to the development of the niobium industry in China.

Year	1990	1991	1992	1993	1994	1995
Domestic output	45.10	64.20	70.00	65.00	66.90	60.00
Total imported quantity	80.00	80.00	85.00	169.00	96.00	255.00
Total supplied quantity	125.10	144.20	155.00	234.00	162.90	315.00
Total consumption *	75.00	85.00	95.00	100.00	170.00	220.00

*estimated data consumed in iron and steel industry

Table 7: Recent Nb supply and consumption in China (t/y)

MEMBER COMPANY NEWS

Metallurg

Metallurg announces acquisition by Safeguard International Fund, L.P.

Metallurg, Inc. announced that it was being acquired for $30.00 per share in cash by a group of institutional co-investors led by Safeguard International Fund, L.P. Metallurg signed a definitive merger agreement pursuant to which Safeguard International would acquire all of Metallurg's outstanding common stock including the assumption of Metallurg's outstanding indebtedness. The transaction is valued at approximately $300 million.

The Board of Directors of Metallurg has unanimously approved the proposed merger. The transaction is subject to a number of customary conditions including the receipt of required third-party approvals and approval by Metallurg's stockholders. The merger is expected to be completed in July 1998.

Metallurg, founded in 1911, is an international producer and seller of high quality metal alloys and specialty metals used by manufacturers of steel, aluminum, superalloys and titanium and other metal consuming products.

Dr Heinz C. Schimmelbusch, Managing Director of Safeguard International Fund, L.P., has been elected Chairman of Metallurg's Board of Directors. Mr Michael A. Standen, the company's former President and Chief Executive Officer, was named Vice Chairman of the Board and Senior Adviser to the company. Mr Nils A. Kindwall, former Vice Chairman of Freeport-McMoRan, joined Mr Arthur R. Spector, also a Managing Director of Safeguard International, Dr Schimmelbusch and Mr Standen on the Board of Directors. Mr Alan D. Ewart, former head of London & Scandinavian Metallurgical Co. Ltd., the company's United Kingdom subsidiary, was elected Metallurg's new President and Chief Executive Officer.

Gwalia

Following the merger between Sons of Gwalia and Gwalia Consolidated, Sons of Gwalia announced a record consolidated net operating profit for the 1997/1998 financial year. Tantalite sales by the Minerals Division were at a record level, and all material was sold under long term contracts with the company's two major customers.

During the year, the company Sons of Gwalia consolidated its assets and liabilities with those of its associated company Gwalia Consolidated Ltd. as a consequence of the Scheme of Arrangement between Gwalia Consolidated Ltd and its ordinary shareholders. Although the company's new Minerals Division was only consolidated for two months, its performance was excellent in terms of production, sales and profitability.

The budget for 1998/1999 included approximately $2 million for exploration to be undertaken at both the Greenbushes and Wodgina Mines to increase existing tantalite reserves and resources. Operating budgets for the tantalum mines are based on production required to meet existing sales contracts. The existing milling facilities at the Wodgina Mine are being upgraded, which should allow an increase in production to take place in 1999/2000.

Alfred H. Knight

Mr David Cross has been nominated as the delegate for Alfred H. Knight International, succeeding Mr Alan Katz.

Mamore

Mr Luis Antonio Lacombe has become the delegate of Mamore Mineracao e Metalurgia Ltda., as Mr Carlos Rangel is no longer with Mamore. The address for correspondence is now
Estrada dos Romeiros km 49,
Pirapora do Bom Jesus - SP,
Brazil, CEP 06550-000.

Sogem USA

Sogem-Afrimet has been renamed Sogem USA Inc., and its address is now:
3120 Highwoods Blvd., Suite 110,
Raleigh, NC 27604, U.S.A.
Tel.: +1 919 274 7171, fax +1 919 274 7195.

Cambior

In its report for the second quarter of 1998, Cambior reported record gold production and an improved financial performance. The company also produces zinc and copper, as well as the niobium extracted at the Niobec Mine.

Siemens-Matsushita

Siemens has recently made good progress in product development in many types of chip capacitors. The company announced that the 1998 business year saw a substantial increase in turnover, and noted among the especially successful components its tantalum chip capacitors. This boost was credited to an upward turn in industrial electronics plus steady growth in mobile radio and automotive electronics, markets in which the division's innovative products are firmly entrenched. Increased investment should continue to strengthen the division's competitive standing.

Kemet

Kemet Corporation reported lower sales and earnings for the fiscal quarter to June 30th 1998 compared with the same quarter last year. Mr David Maguire said that major customers were experiencing slower sales growth, particularly in Asia, which in combination with channel inventory corrections had depressed shipments. But he was confident that the long-term outlook for the industry remains very positive and stressed that Kemet is committed to increasing revenues and earnings.

In June 1998, Kemet announced that it had finalised plans to build a major new manufacturing facility for tantalum capacitors in Ciudad Victoria, Mexico. This location was chosen because of its plentiful supply of high-quality labour, reliable and low-cost utilities, good technical schools, and proximity to existing Kemet facilities, explained Mr Charles Culbertson II. The new facility will initially house electrochemical processing operations for tantalum leaded capacitors, thus allowing expansion of similar processing operations for tantalum surface-mount capacitors in existing facilities in Mauldin and Greenwood, South Carolina. Construction was expected to take about twelve months.

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