livingmetals
No. 14 | 2016
THE MAGAZINE OF THE PLANSEE GROUP
WWW.PLANSEE-GROUP.COM

Adding value: **Acquisitions and investments**

- Our DNA: A picture of tungsten and molybdenum
- Faster than ever: Always able to deliver

Our responsibility towards people, society and the environment

The sustainability magazine

For years, we have been reporting on compliance and the responsibility of the Plansee Group towards people, society and the environment in our Group magazine *livingmetals*. The figures in this publication are consolidated Plansee Group figures or average values for the associated production plants. Detailed information on the key figures published by the Plansee Group are available at www.verantwortung.plansee-group.com. There, you will find figures and detailed information on: raw materials, research and development, customer satisfaction, environment and energy, personnel, social commitment and corporate management. On our Website you will also find the Annual Report for the Plansee Group for the 2015/16 financial year, which ended on 29 February.

A word on the title

Only a tiny viewport gives some idea of what is going on inside this system: It is where solid carbide tools such as drills, milling cutters and reamers are coated. The coating makes the tool even more resistant to wear, increases its service life and reduces tooling costs for our customers.

Lots of new places on the map

» The Plansee Group's aim is to grow business with the high-technology materials tungsten and molybdenum across the globe.«

Dear reader,

800 million euros. That's a lot of money. And it is exactly the amount that the Plansee Group has spent on acquisitions and investments over the past ten years (page16).
The aim is to grow our business with the materials tungsten and molybdenum. Which means that recent years have seen many new places appearing on our map, whether it be in Chile and the USA or in Europe, India and Southeast Asia. True to our motto "tungsten and molybdenum, from powder right through to the final product", we have boosted our capabilities in the field of raw materials supply and the manufacture of carbide tools (page 19).
But why are we doing this? Quite simply because it is important to our customers that we guarantee the supply of raw materials, that we take absolute responsibility for the quality of the final product and that we are always in the position to cope with large-scale projects (page 50). And this has a welcome side-effect: Every acquisition opens up opportunities, both for our talents and for established managers (page 42). These are the people who are driving integration of new parts of the Group and making us stronger and more efficient.

Dénes Széchényi,
Head of Group Communications

livingmetals

No. 14 | 2016 THE MAGAZINE OF THE PLANSEE GROUP

Biggest tungsten mine in Europe

There were a number of crucial factors that allowed the Drakelands Mine to be opened in the heart of Southwest England in the fall of 2015: low operating costs, the high quality of the tungsten concentrate and good links to the transport infrastructure. Drakelands is currently larger than any other tungsten mine in Europe or America. Global Tungsten & Powders provided part of the start-up finance, thus ensuring the medium- and long-term supply of tungsten for its customers.

At our customers' doorstep

The backdrop to the new Plansee plant in South Korea is impressive: This is where a large number of electronics companies and research and development centers are headquartered. Highly qualified staff are readily available. In building this new plant, Plansee High Performance Materials is underscoring its long-term commitment as a supplier to the semiconductor and display industry in South Korea. It was only a short while ago that the red carpet was rolled out for the groundbreaking ceremony, and by the end of 2016 the building will be ready for its new occupants.


신축공사 기공식
PLANSEE
HPM Ground Breaking Ceremony
Thu. March 17th 2016

Plansee: Enabling high technology

With a great deal of patience and meticulous attention to detail, engineers and researchers at Plansee are developing materials and components for the high-tech industry of today, tomorrow and on into the future. Plansee's Japanese plant in Esashi prepares stencils for ion beam etching. Ion beam etching is used to structure electronic components such as microchips.

More products from India

Since the beginning of the year, Plansee has been manufacturing components and replacement parts for ion implantation (semiconductor manufacture) in Mysore/India. Austria's Minister for Foreign Affairs, Sebastian Kurz, visited the plant when it was opened.

They never give up

Around 70 percent of all used machines in the Plansee Group find a new home when they are no longer needed in their original production line. This is made possible by a used machine market on the intranet.

More innovations

When developing specialist tools or special components, Plansee and Ceratizit rely on close collaboration with external partners. In order to be able to get going on research and development contracts even more quickly, the Plansee Group and the German Fraunhofer Institute have signed a general agreement. The result: Less bureaucracy and more innovation.

Looking for contributions

Preparations for the 19th Plansee Seminar in Reutte/Austria have started. The world's leading conference for refractory and hard metals will be held from the 29th of May to the 2nd of June 2017. Some 500 participants from research centers and companies are expected to attend.

Always up to date

Regular news updates are always available on Facebook and LinkedIn as well as at www.plansee-group.com. And this is where you will also find the online edition of *livingmetals*, along with the opportunity of subscribing to *livingmetals*.

Niobium in two colors

It is now the 14th time that Plansee has provided the niobium for this collector's coin. The theme of this silver-niobium coin is a colorful trip through the world of time.

Still going strong

Since 2007, a fuel cell fitted with components from Plansee has been generating electricity in the Forschungszentrum Jülich. This means that the fuel cell has clocked up a total of 70,000 operating hours – a world record!

“Our investments have long-term development potentials thanks to their clear strategic positioning.”

Corporate development

"Vigorous support and clear guidelines"

Within a period of 10 years, the Plansee Group has acquired holdings with a transaction value of 800 million euros. Dr. Michael Schwarzkopf talks about the strategic aims.

livingmetals: One of the Plansee Group's aims is to grow profitably and do so faster than its competitors. What does that actually mean?

Dr. Michael Schwarzkopf: First of all we must ask ourselves the key question of what direction we want to take as a group. The answer to this question is quite clear: We want to be a leading supplier of the materials molybdenum and tungsten– throughout the whole value added chain. That means, from the processing of the ore concentrate and recycling through to the products that our customers can either install directly or transform for their own ends. The second question is: At what points in the value added chain can we improve or strengthen our position.
On the basis of this analysis, we first consider whether we can do this using our own resources, for example through investments in capacity or in the development of new products and solutions. If strategic measures seem to make more sense, we acquire other companies. No matter whether we are talking about investments, acquisitions or innovations – every project focuses on increasing the value and ensuring the long-term development of the Plansee Group.

When Plansee buys – who are we looking for?

Acquisitions make strategic sense for us when they allow us to extend our leading position in one of our current total of 16 business areas. Experience shows: Privately-owned companies whose ►

In September 2015, carbide specialist Ceratizit agrees the takeover of the Indian tool manufacturer Cobra Carbide.

► activities are closely related to our own core business can be particularly well integrated. In such cases, we attempt to acquire majority holdings in which we play the leading industrial role.

livingmetals: Why should a company that has previously been independent become a part of the Plansee Group?

Dr. Michael Schwarzkopf: We follow the best-owner principle. The businesses we acquire should feel that they are in good hands in the Plansee Group and have long-term development potentials thanks to their clear strategic positioning. Key criteria for our partners often include security regarding the continued management of the company, the transition from a locally restricted to a global market, or access to attractive input materials, products and technologies. Our holdings also benefit from the fact that they receive genuine support – with investments, in management decision-making, as well as with functioning HR, IT and compliance systems. However, there are also clear rules: one of the first steps during integration is usually to incorporate the company in our global IT network and our reporting structure.

livingmetals: What is the Plansee Group's image of itself?

Dr. Michael Schwarzkopf: We see ourselves as a source of strategic impetus, as a committed, long-term financial and development partner and as an advocate of transparency and responsible corporate leadership. What is more, for many of our employees – and in particular those from smaller businesses – we are a source of exciting career opportunities. And we consider our consistent policy of delegating responsibility to be a competitive advantage. This means that our holdings have the greatest possible freedom of action in their everyday operations. The better the numbers, the greater the freedom. ■

220

million euros was the level of investment made by the Plansee Group last year: The investment went into a new production site, extended production facilities, product and process innovations and acquisitions. All the expansions and acquisitions go to underpin the Plansee Group's strategy of taking a leading position in the field of the high-tech materials molybdenum and tungsten, from ore processing through to the production of customer-specific components.

Growth through acquisitions
Over the last ten years, the Plansee Group has acquired companies and holdings with a transaction value of 800 million euros. This has allowed the group to significantly expand its value added chain: The supply of the raw materials tungsten and molybdenum has been secured as part of the policy of backward integration. In addition, the manufacture of hardmetal products and solutions has been extended.

Here are a few examples:

Global Tungsten & Powders (GTP), Towanda/USA
Acquired: 2008
Logic: The Plansee Group's tungsten powder specialist. Purchases raw materials from mines based in the Western hemisphere. Manufactures tungsten powder and tungsten carbide for hard metal production from tungsten ore concentrate and secondary raw materials.

Tikomet, Jyväskylä/Finland
Acquired: 2015
Logic: Prepares high-quality tungsten secondary materials using the zinc process. Complements the chemical recycling process that has been used successfully at GTP for decades.

Molymet, Santiago/Chile
Acquisition: gradual since 2011 to the current 20 percent
Logic: The molybdenum powder specialist. Manufactures molybdenum trioxide for the Plansee Group and alloys for the steel industry from molybdenum ore concentrate.

CB Ceratizit, Taiwan/China
Holding: Joint venture with Ceratizit 2010
Logic: Uses attractively priced Chinese raw materials to manufacture carbide rods and wear parts for the Asian and American markets.

Günther Wirth, Balzheim/Germany
Promax Tools, Rancho Cordova/USA
Klenk, Balzheim/Germany
Cobra Carbide, Bangalore/India
Acquired: 2012 – 2015
Logic: Standard and special solid carbide tools for drilling, milling and abrasive applications throughout the manufacturing industry, as well as special solutions, for example for the aviation industry.

Wolfra Tech, Mysore/India, now Plansee India
Acquired: 2011
Logic: Competence center for molybdenum and tungsten fine wire. Competitive manufacturing of work-intensive products.

TCB, Seoul/Korea, now Plansee Korea
Acquired: 2012
Logic: Bonding as the final, locally performed production step before Plansee's coating materials are applied in its customers' coating plants.

A broad-based industrial group
In the Plansee Group, everything revolves around the materials molybdenum and tungsten – from the ore concentrate through to the finished product. When all the Plansee Group holdings are added together, the last reported total sales were 2.2 billion euros. The workforce worldwide numbers 11,900 employees. At the consolidated level, the Plansee Group achieved sales of 1.18 billion euros in the last fiscal year and employed 6,371 people.

Similar culture is a great advantage

"I founded the company in 1981. 30 years later, we had 450 employees, mainly in Germany, France and India. Since we have been part of the Ceratizit Group, we have moved up to a considerably higher league, are able to offer new services and have extended our technical sales activities and our research and development capacity. New opportunities for exchanges and collaboration within the group allow our employees to develop at the personal and professional levels. The investments made by Ceratizit show the employees that we remain committed to our Balzheim site. The fact that Ceratizit is an owner-managed group and has a similar culture to our own is a great advantage during cooperation."

Günther Wirth, founder and former managing director

Excellent opportunities for expansion

"On the 1st of July 2015, Ceratizit took over the family-run company Klenk. We are glad that the takeover of the company and the subsequent continuation of operations has been successful, thanks to the professional way in which it was handled. The decision of the Klenk family to hand the company over to Ceratizit was the right one, and the staff are of the same opinion. The Klenk site in Balzheim and the jobs of the staff have been secured over the long term. It is impossible to miss the improvements that have already been put in place in the global sales network, focusing on the aerospace industry. Additional resources for research and development, coupled with the availability of high-quality carbides from Ceratizit's rod production, offer excellent opportunities to compete and expand in the market. The expansion of production capacity that is needed to achieve this is already well underway."

Horst Klenk,
former owner

Important impetus for optimization

"Plansee is a globally active group and has had a shareholding in Molymet since 2011. As such, the Plansee Group plays an active role in preparing, discussing and deciding on strategic projects and thus has a decisive influence on the further development of our company. The Plansee Group's comprehensive knowledge of the market and their longstanding experience with the standards of good corporate management have provided an important impetus for optimizing Molymet's management model. For us, it is immensely important not only that we have maintained a good business relationship with the Plansee Group for 25 years, but also that we share a corporate philosophy based on responsibility for our customers, our environment and local communities. These are key elements that allow us to pursue our business activities successfully and in a sustainable manner at all times."

John Graell Moore, Executive Chairman
Molibdenos y Metales S.A.

A major step to backward integration

"The acquisition of the tungsten processor Global Tungsten & Powders (GTP) in 2008 was a major step towards backward integration in the Plansee Group. A clear business focus on the manufacture of tungsten powders and constant investment in plant, capacity and recycling have made GTP one of the world's leading tungsten processors in today's market. GTP allows us to guarantee our customers a secure supply of tungsten over the long term. Long-term supply and purchase agreements give GTP preferential access to Western sources of raw materials. Our use of tungsten raw materials from ethically unimpeachable sources is certified by independent organizations. The shareholding in Molymet is allowing us to gradually implement a strategy of taking a leading position in the field of the high-tech materials molybdenum and tungsten, from ore processing through to the production of customer-specific components. Our current holding in Molymet is a little over 20 percent, and we are very interested in further increasing this stake."

Dr. Michael Schwarzkopf,
Chairman of the Executive Board,
Plansee Group

Shared fundamental understanding

"After many years of successful cooperation between Plansee and Wolfra-Tech, integration was the next logical step in our collaboration. The basis for this was a shared fundamental understanding of our values and of our commitment to outstanding performance in every area of our work. On this basis, we have created the conditions necessary for shared growth and success. To continue to be successful in the future, it is important that Plansee India maintains its own local culture while simultaneously contributing ever more as part of a globally active group of companies."

Anil Ramdasi, founder and managing director of Plansee India

Fully exploiting the sales network

"CB Carbide already enjoyed an excellent market position in Asia. When combined with Ceratizit 's outstanding technological expertise and global presence, this joint venture has brought about enormous benefits for our customers. Since the merger of CB Carbide and Ceratizit, our joint venture company has concentrated on achieving growth in the Asian markets and fully exploiting Ceratizit's sales network in the USA and Europe."

Wan Lung Liao, founder, shareholder and chair of the board of directors of CB Ceratizit

CB Ceratizit

Pole position in Asia

CB Carbide developed during Taiwan's period of rapid industrialization in the 1970s and is now a leading player on the Chinese carbides market.

CB Carbide was already up and running when Taiwan's tiger economy was getting ready to pounce. Since it was founded in 1973, it has been CB Carbide's aim to tailor its products and services to meet the growing demand for carbide products, first in Taiwan itself and then later in China and across Asia.

CB Carbide was launched in 1973 in Taiwan as a trading company that imported carbide blanks for molded parts and stamping tools. Founded by the Liao family, CB Carbide has remained a private enterprise that is totally committed to its responsibility toward its employees and to ensuring sustainable business development.

Huei Liao, daughter of the founding family and currently a board member at CB Ceratizit, has this to say: "We shall always cherish our modest beginnings as a small family business and remain faithful to our corporate culture of hard work and commitment, because together these form the basis for continuing growth."

In response to the promising market outlook for carbide products, CB Carbide opened its first plant in the Taiwanese city of Tamsui in 1978.

From sprinter to long-distance runner

Then something happened that many observers had thought impossible: The young tiger economy Taiwan did not just pounce, it turned into a long-distance athlete. During the period after 1980, demand for carbide products in Taiwan continued to grow, while customers' requirements in terms of delivery times, technical support and competitive pricing became ever more exacting. Working closely with Japanese carbide and tool manufacturers, CB Carbide grew throughout the decade to become Taiwan's leading carbide manufacturer.

Keenly aware of the future importance of the Chinese market, CB Carbide opened its first subsidiary in the southern Chinese city of Xiamen in 1999. Over the subsequent years, CB constantly strengthened its position on the Chinese market and opened four further plants in Shanghai, Tianjin, Zhangzhou and a second plant in Xiamen.

At the start of the new millennium, the focus shifted increasingly to establishing the company as a leading manufacturer

CB-CERATIZIT

The new exhibition hall in Xiamen was opened in 2015. It offers visitors an overview of the history of the company.

of carbide products in Asia and becoming a global player in the carbides market. This strategy resulted in the founding of the joint venture with Ceratizit in 2010. This proved to be a true success story – since 2011, the company has seen year-on-year sales growth above the market average. The next steps included the opening of a training center for both employees and customers in Tianjin in 2011 (see the article on the Tooling Academy in livingmetals 2015), the expansion of carbide rod production capabilities in Xiamen, and a consistent increase in powder production in Zhangzhou.

In his speech given to mark the fifth anniversary of the founding of the joint venture, Jacques Lanners, Co-Chairman of Ceratizit, explained: "So far we have achieved the goals we set for the joint venture and we will continue to extend our market position in the future." ■

In its various markets, CB Ceratizit numbers among the leading suppliers of carbide products in the following sectors: carbide rods and blanks, semifinished products and components for industrial manufacturing, components for wood machining and rock working and selected tools for the machining industry. CB Ceratizit manufactures at seven different sites and has twelve sales offices in Taiwan, China and Korea. From these, it covers the entire south-east Asian market.

55 %

Equity ratio: 1.1 billion euros equity capital and no net debt. This capital base means that the Plansee Group is in excellent shape for further growth, bold investments and even larger-scale acquisitions.

Sporting spirit

Manual dexterity and a sporting spirit were the order of the day when 30 of the Plansee Group's future skilled workers from Germany, Italy and Austria met to take part in the first trainee and apprentices tournament in Reutte.

"Tirolmobil"

160 staff from the Breitenwang/Reutte plant are taking part in the 2016 "Tirolmobil" cycling competition across the whole of Tirol. In the first six months, they have already cycled some 70,000 kilometers. Half this distance came from cycling to and from work, bringing health benefits and a bonus for the environment.

Pulmonary function test

All the staff at Ceratizit Italy go for regular health checks. The jobs that each of them do determine the types of examinations and how often they are carried out. Thus, for example, pulmonary function tests indicate whether respiratory protection equipment is being used properly.

Placement in China

Daniel Dreer (20) is studying industrial engineering and mechanical engineering at Kempten University in Germany and did his 3-month placement at the CB Ceratizit plants in Xiamen and Tianjin in China.

Strong Voices

What is going well? Where are the challenges? And how is leadership manifested and experienced? A worldwide employee survey across the Plansee Group revealed that the overall assessment was comparatively good, but that there is room for improvement in the areas of leadership and the dynamics of change. There were top marks for staff commitment, the recommendation rate and overall satisfaction.

Insurance coverage for dependents

Good employment conditions for staff at Ceratizit in India: Accident insurance will be taken out for all members of staff, and the health insurance even covers the entire family, including spouses, children and parents.

Apprentice training center equipped

Ceratizit India supports the training of well qualified skilled workers through the Bharatiya Skill Development Campus industry academy. Ceratizit has invested some 80,000 euros in equipping an apprentice training center with machines and provide the necessary tools. Training officers from Ceratizit share expert knowledge from the fields of metallurgy, sales and marketing.

135,000

euros – this is the financial support the Paul Schwarzkopf foundation has provided to pupils and students in Reutte during their education.

Good neighbors

Help and support that really make a difference: How staff at our production plants across the globe are getting involved with people and projects in their neighborhood.

Santa Claus in Calcutta

85 children from Calcutta were invited to spend the day at Ceratizit just before Christmas. The highlights included games in the garden in front of the production halls and a huge picnic with fruit and chocolate. In the afternoon there was a visit from Santa Claus, who brought gifts for all the children.

World Yoga Day

Indians across the globe celebrated World Yoga Day on the 21st of June. And the staff at Ceratizit India took part in a joint yoga session with expert trainers to draw attention to the valuable health benefits of yoga exercises.

Support for RCFC

Plansee India supports the aid organization RCFC, which provides orthopedic treatment for children without adequate insurance cover, and CINI, that offers children access to regular meals, basic hygiene, basic medical treatment and schooling.

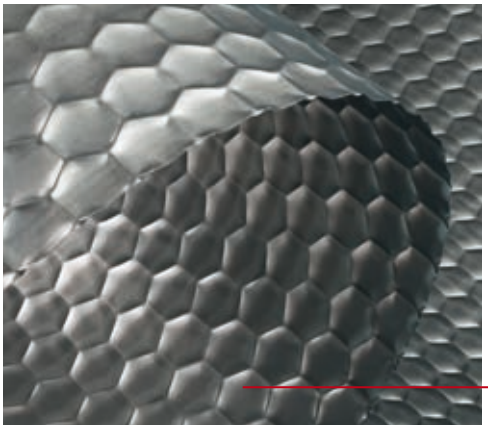
"Little stones"

Last year, Ceratizit Italy donated 2000 euros to the little stones organization. This organization gives young people access to a sound education.

Celebrating all things new

No matter whether they come in the form of tools, consumables or components, the innovative molybdenum and tungsten products from the Plansee Group are vital for our high-tech world, both now and in the future.

Hot sheet



Their special structure makes molybdenum-lanthanum sheets from Plansee even stronger for furnace construction, where they provide ideal protection for the layers behind them. These sheets get their name from their appearance: Honeycomb sheets. They are installed as standard in Plansee's Enerzone hot zones.

Optimizing diesels

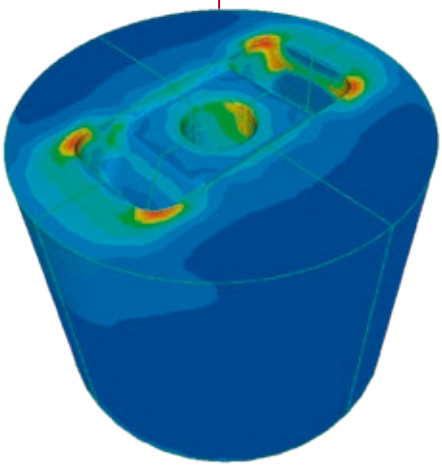
Up to 20 percent of the power available in a car is lost to friction. With a heat-resistant coating made from molybdenum nitride and molybdenum-copper, Plansee is making it possible to optimize combustion in diesel injection systems by increasing the operating temperature and thus reducing fuel consumption.

New shoulder milling cutter

Ceratizit has developed an entirely new carbide tool for shoulder milling. The new milling system allows precise 90-degree angles to be produced on components far more economically.

Innovative simulation

Ceratizit Italy has introduced the finite element method for simulating forming processes. This method makes it possible to simulate the entire process as well as each individual step in the forming process for a workpiece. Simulation of the forming process allows Ceratizit to provide scientific evidence of the performance of its forming tools.



37 %

of sales revenues in the Plansee Group last year were achieved with products that are less than five years old. This is a record! The long-term goal is a share of 33 percent for **new products**. The Plansee Group is investing heavily to achieve this: 60 million euros or five percent of revenues in 2015/16 alone.

Waste heat for heating

Heat at no cost: The new four-story building with workshops and offices houses the entire infrastructure and plant engineering department at Reutte. The low-energy building uses the waste heat from the neighboring production plants to feed a large-scale low-temperature heating system.

Environmental prize

Ceratizit has been awarded the Luxembourg's Industry Federation environmental prize for its recycling activities. The prize recognizes the achievements of companies in bringing the demands of productivity in harmony with the need to preserve natural resources.

Daylight + solar power

Energy-efficient from the word go: Plansee India's new building uses as much daylight as possible in the production facilities and offices. And when artificial light is needed, the site uses solar power that it generates itself.

Renovated facade

Renovation of the facade of one of the production halls in Reutte, which included the installation of new, energy-saving windows, has allowed Plansee to reduce the amount of power required for heating by 200,000 kilowatt hours per year. New LED lights that allow the brightness to be adjusted for each individual workplace have also brought huge energy savings.

Energy saved

In Reutte, Plansee and Ceratizit have saved 1.3 million kilowatt hours of energy in 2014 and 2015. This has met with statutory requirements and avoided additional energy costs (penalties). Evidence of compliance with the obligations to save energy that arise from the Austrian Energy Efficiency Act must be provided every year until 2020.

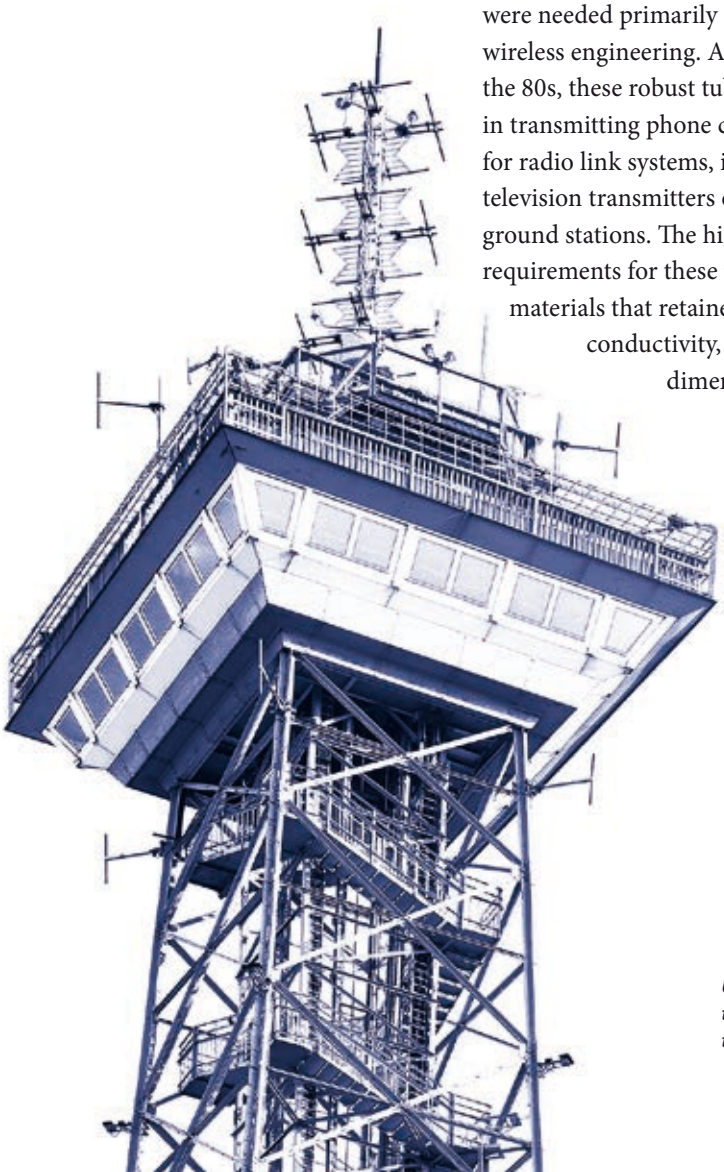
Faster annealing

A new annealing plant for molybdenum and tungsten products at Plansee in Reutte produces around 800 tonnes less CO_2 per year. The new plant replaces four old furnaces and is some 30 percent faster for each annealing run. The new furnace has a capacity of up to four tonnes of molybdenum and tungsten products.

Electronics industry

Robust materials are absolutely vital

Plansee has been supplying the electronics industry for more than 90 years. Over the course of time, the applications have shifted from the analog world to the digital world. But molybdenum and tungsten still remain absolutely vital materials.



In the 1920s, electron tubes were among the first applications in the nascent electronics industry for which Plansee supplied molybdenum and tungsten components. These tubes were needed primarily in radio and wireless engineering. And right up to the 80s, these robust tubes were crucial in transmitting phone conversations, for radio link systems, in UHF or television transmitters or in satellite ground stations. The high power output requirements for these tubes demanded materials that retained their electrical conductivity, strength and dimensional stability at the extremely high operating temperatures involved and which had a low coefficient of thermal expansion and a low vapor pressure.

From tubes to semiconductors

As of the 70s, molybdenum, tungsten and tantalum were in increasing demand in the form of thermal management components in power electronics and semiconductor fabrication. And to this day, material properties such as excellent thermal conductivity, a tailored coefficient of thermal expansion and a high degree of purity deliver a long service life in electrical equipment, where such materials are used in semiconductor base plates, heat sinks or heat spreaders.

Up to the 80s, robust tubes with molybdenum and tungsten components were vital for radio link and television transmissions.

The products from the display industry are destined for consumer electronics equipment, and the industry is now one of the largest markets for molybdenum and tungsten coating materials.

At first glance, the fact that electrical components generate heat would not seem to be anything to worry about. But because the transfer of heat can also be expressed as heat flux per surface area (heat flux density), the heat flux density in many components is actually extremely high, sometimes reaching values comparable to those of a rocket engine at around 2800 °C.
The coefficient of thermal expansion is another critical factor for all semiconductors. If the semiconductor and the underlying material expand at different rates when exposed to changes in temperature then mechanical stresses arise. These may damage the semiconductor or impair the connection between the chip and the heat spreader. Plansee's materials have the optimum coefficient of thermal expansion for joining semiconductors and ceramics. Plansee's semiconductor base plates can nowadays be found in wind turbines, trains and large-scale production plant. Or in semiconductor power modules for inverters (thyristors) and power diodes, for example. As the substrate for the sensitive silicon semiconductor, they ensure a module service life of over 30 years. Various coatings also protect Plansee's materials against corrosion and improve the solder connection to the semiconductor.

From tube TVs to flatscreens

In the 80s and 90s, as the technology behind CRT color TVs had fully matured, Japan began to see the development of the upcoming flatscreen industry. And from the word go, Plansee was an important supplier, engaging in the development, manufacture and ongoing optimization of sputtering targets. Sputtering targets are coating materials made from molybdenum, tungsten and other alloys, and still provide vital functional layers in thin-film transistors in TFT-LCD screens. These provide instantaneous control of the individual image dots (pixels) and consequently ensure sharp image quality. Plansee has established complex supply chains for the production of these sputtering targets, and has a complete mastery of all the steps involved in the process: Every sputtering target is manufactured in its entirety by Plansee. The tungsten and molybdenum producers GTP and Molymet ensure supplies of these coating materials over the long term. The coatings experts at Plansee are in constant and close contact with universities and research establishments and use their knowledge of products and applications to support the development of customer applications in Asia and across the globe. ■

Components from Plansee (left) lie at the heart of high-performance CT scanners – and make it possible to capture sharp images of a beating heart, for example (right).

X-ray technology

Sharp images of a beating heart

In the field of high-tech medicine, diagnostic imaging needs extremely high-performance CT scanners, which in turn need tailored components from Plansee.

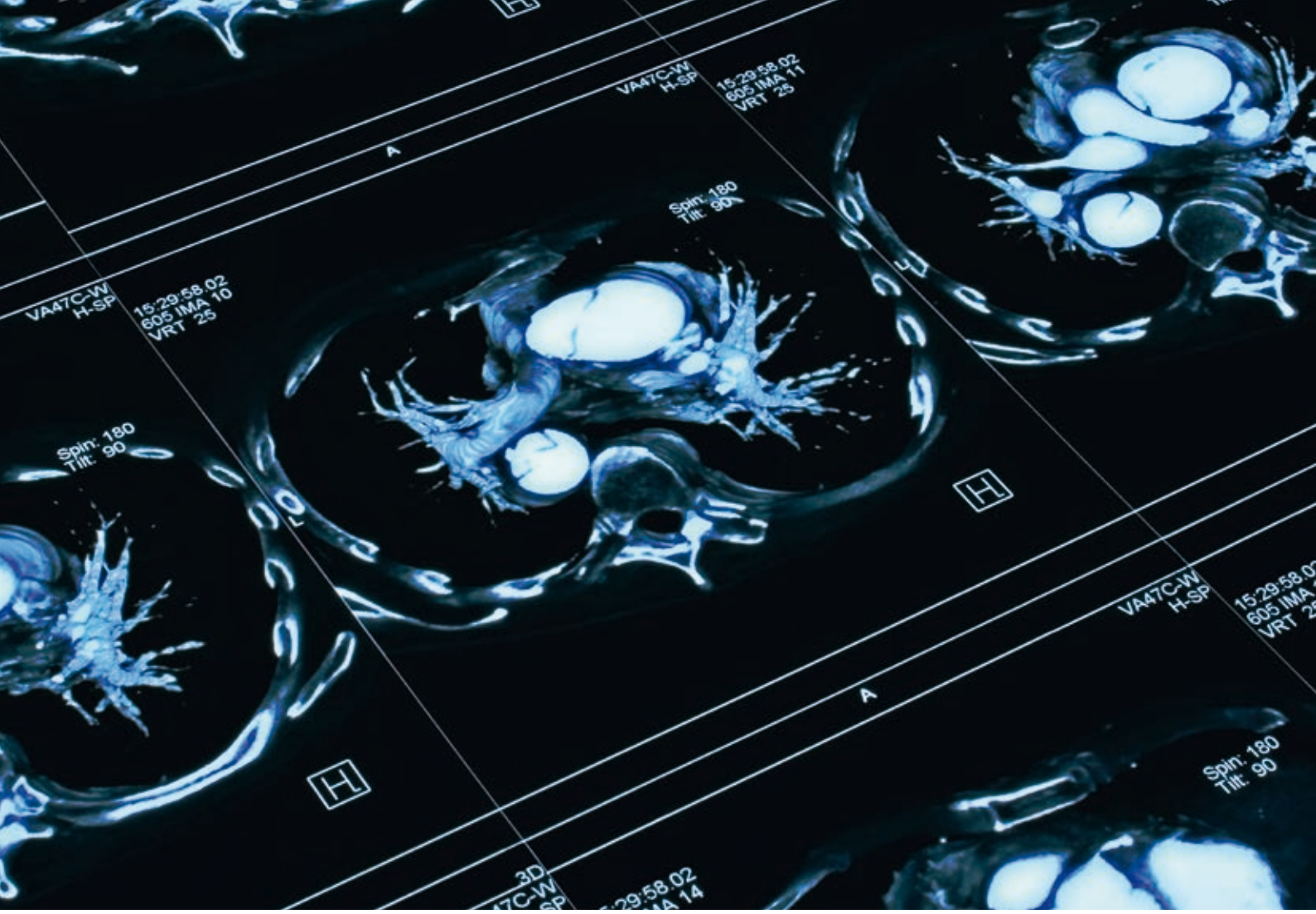
X-ray machines can do far more than just reveal fractured bones. Scanning the entire body in a matter of seconds, creating a sharp image of a beating heart or identifying the chemical composition of a kidney stone from the X-ray image – these are just a few of the astonishing fields of application for modern CT scanners.

But not every machine is suited to every specialist medical discipline. Each area of application presents a different technical challenge for the X-ray machine, and hence for the products Plansee manufactures for them. These include components such as shield packs, collimators, flat emitters, stationary anodes and, above all, X-ray targets for generating the X-ray radiation. The X-ray target lies at the core of every machine: The design of the X-ray target determines the technical performance of the entire machine as well as factors such as the radiation intensity, the rotation speed and the diameter of the X-ray tube.

Plansee's products are used across the entire range of X-ray machines from leading manufacturers. Innovative technology, design and materials have a great deal to do with this success. A few examples:

Stable connections: The key issue for many customers is the stability of components under conditions of greatly fluctuating thermomechanical stress. Top-of-the-range CT scanners achieve gantry speeds of up to four revolutions of the tube per second. This generates huge forces that also act on the components in the X-ray tube and the detector. Here, for instance, bonding technologies are of crucial importance. And so Plansee has developed soldering processes that allow various metals and graphite to be permanently bonded. This applies to high-performance graphite anodes, for example.

A long life: Alongside reliability and stability, the service life of the focal path of the X-ray target and a high dose yield across the entire service life are important issues for many customers. And the key factor in meeting these requirements is the surface quality of the X-ray target: This is where the accelerated electrons collide with the target, giving rise to X-ray radiation and a considerable amount of thermal energy. To meet these requirements, Plansee has developed tungsten alloys that are applied to the basic component using pressing,



sintering, forging or even vacuum plasma spraying techniques in order to form a focal path.

The ideal weight: And even for "weightwatchers", Plansee is the right place to go for advice. After all, the weight of the components is a factor in many X-ray machines. To put it simply: the lighter the component, the longer the service life. When developing lightweight component solutions, Plansee turns to their in-house team of experts, who make use of sophisticated simulation techniques to calculate with absolute precision the behavior of newly designed components in live operation.

In good shape: Another field in which Plansee provides innovative products for the latest X-ray machines is that of shield packs and collimators. An extrusion process makes it possible to manufacture particularly thin and workable tungsten heavy alloy sheet. And Plansee is also a world leader in the manufacture of molybdenum and tungsten components using "additive processes". These are better known as "3D printing processes". This manufacturing path opens up new dimensions in terms of shaping and makes it possible to produce extremely intricate structures. New designs make it possible to reduce or absorb scattered radiation. Ultimately, this leads to higher quality images.

"These examples show how wide-ranging our developments are, and our teams are constantly working on tailored products and solutions that meet or exceed our customers' requirements. Our ambition is to provide a tailored innovation for every type of system!" explains Dr. Wolfgang Glatz, who is responsible for the X-ray technology business at Plansee.
Over the course of many years, Plansee has made a name for itself as a reliable, neutral development partner for refractory metals in the field of medical engineering. Glatz: "Our developers in the fields of simulation, materials science and bonding technology have always recognized the value of close collaboration with leading universities and research institutes. Our expertise and our extensive technological facilities mean that we are able to manufacture any component, from the most intricate and delicate up to the most complex. From prototype to series and from powder to end product, all the various stages of development and processing are handled in-house." ▪

Reliable tungsten producer

GTP has responded to the massive drop in the price of tungsten with a root-and-branch modernization and automation of its production operations. With new products for key markets and a global sales push, the company believes that it is in good shape to face the future.

Dr. Andreas Lackner, President/CEO of GTP.

livingmetals: How has the raw materials price changed over the past years?

Dr. Andreas Lackner: In common with the prices for many other raw materials, tungsten prices have dropped significantly over the past years. And tungsten was among the hardest hit by falling prices. Since 2014, the price of tungsten has fallen by more than 60 percent – from 420 dollars per metric tonne for the intermediate product APT (ammonium paratungstate) to 160 dollars*. We are currently seeing prices recover slightly.

livingmetals: What is causing this trend?

Dr. Andreas Lackner: The falling price is the result of a global surplus of tungsten ore concentrate and chemical processing capacity. There are a number of different factors at play: On the one hand, there is the general weakness in the global economy. And then there is the dramatic fall in the oil price, which has hit investment in the oil and gas industry, particularly in the USA, and this is an important market for tungsten-based carbide tools. And thirdly, there is the fact that China dominates the tungsten market. It is there that some 80 percent of the world's tungsten reserves are to be found, and production quantities are "partially state-controlled". Despite a huge drop in demand, far too much is still being produced there. We estimate that China's overcapacity is double the annual global production volume.

livingmetals: Surely low raw material costs are what the processing industries dream of?

Dr. Andreas Lackner: For producers, it is, of course, an ideal scenario. The problem is that all the world's tungsten mines are currently selling at prices that lie below the production costs. Even Chinese mines can barely show a profit at a price below 220 US dollars per metric tonne. As a consequence, many mines, particularly those in the West, have already cut back or shut down operations.

livingmetals: What steps is GTP taking to remain competitive?

Dr. Andreas Lackner: We are cutting costs, investing in automated processes and expanding our recycling capacities in order to become less dependent on primary raw materials. With new products for key markets and a global sales push, we should be in good shape as soon as raw materials prices begin to pick up again.

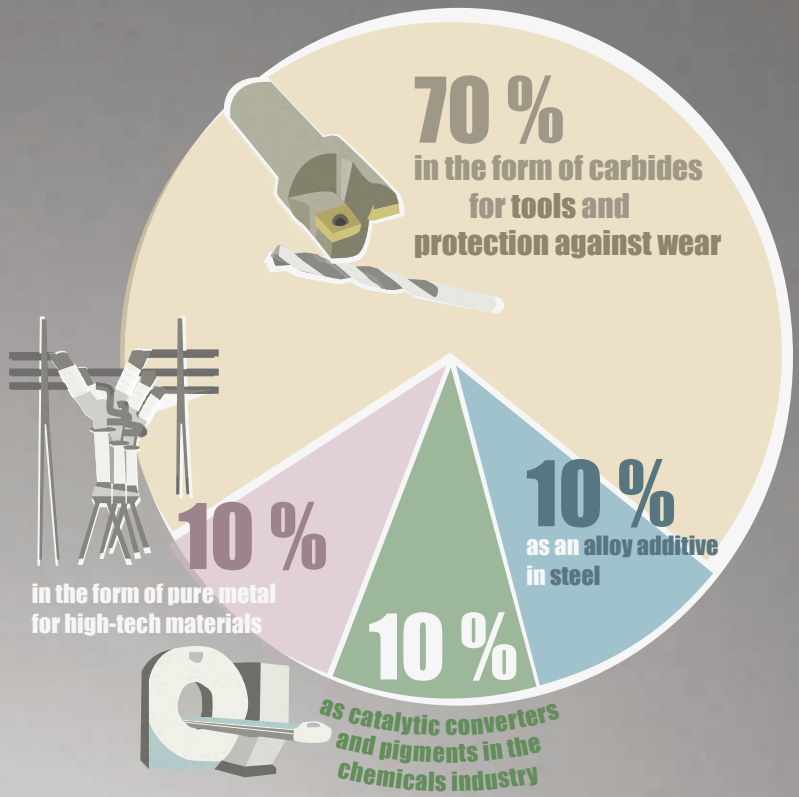
livingmetals: And how do customers benefit from this?

Dr. Andreas Lackner: I am convinced that the reliability of tungsten supplies will again become an issue in the medium term. The price of raw materials rises and falls on a five to ten year cycle. GTP has put everything in place to ensure that it will continue to remain an independent and reliable tungsten producer with a secure supply of tungsten.

livingmetals: What is the significance of tungsten for industry?

Dr. Andreas Lackner: Tungsten is an integral part of the refractory metals industry, even if the difficulties of processing tungsten and the high costs involved mean that people regularly try to replace it in this or that application. But in its primary application, tungsten is virtually impossible to replace: Tungsten carbide is the material used to manufacture the majority of tools in the machining industry and extremely wear-resistant semi-finished products in the world of industrial manufacturing. ▪

* a metric tonne corresponds to 10 kilograms, and hence a price of 16 dollars per kilo of tungsten oxide



Use of tungsten

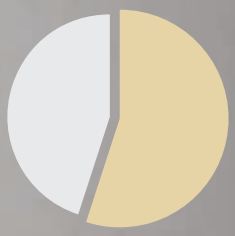
quantity processed annually: 95,000 tonnes worldwide

Wear-resistant

Despite the relatively high cost of tungsten, it is worth using it in tools in order to benefit from a massive increase in service life and its high resistance to wear.

Tungsten recycling

25 % of all the tungsten used globally (95,000 tonnes) has been recycled



55 % of all tungsten used in the Plansee Group has been recycled

Carbide tools as a lever for the economy

Each year, goods to the value of 400 billion euros are manufactured with carbide tools.

The global market for carbide tools is worth 8 billion euros.

Carbide tools account for 3 percent of manufacturing costs in the mechanical engineering sector (alongside service, maintenance, setup times and so on).

Minimizing cost risk

In order to cushion the effects of the volatile price of molybdenum, Chilean molybdenum producer Molymet has adopted a strategy of close cooperation with its customers, coupled with tailored product solutions.

John Graell Moore, Executive Chairman of Molymet.

livingmetals: How has the raw material price for molybdenum changed over the past years?

John Graell Moore: In 2015, the molybdenum price fell sharply. In 2014 we were looking at a price of 11.3 US dollars per pound*, but last year it fell to 6.65 US dollars per pound, a fall of a good 42 percent. Despite this fall, Molymet is able to minimize the risks associated with this price volatility thanks to an appropriate financial and commercial framework.

livingmetals: What is causing this trend?

John Graell Moore: Over the past years, the drop in the price of molybdenum has been greater than for other raw materials. Above all, this has to do with the fact that the molybdenum price is strongly linked to the steel industry. And the steel industry is suffering from extreme overcapacity, particularly in China. As the largest producer and consumer of molybdenum, China's economy is showing clear signs of slowing down. The underlying outlook for the global demand for molybdenum is not positive. There are two main reasons for this: On the one hand there is the slowdown in economic growth in China, the largest consumer of molybdenum in the world. On the other hand, demand has fallen for molybdenum alloy steel pipes, which are used in the oil and gas industry. We nevertheless expect the molybdenum price to recover slightly this year, primarily as a result of a number of port and railway investment projects in China which require heavy-duty steels.

livingmetals: Surely low raw material costs are what the processing industries dream of?

John Graell Moore: History teaches us that raw materials prices are subject to certain economic cycles. Because fluctuations are determined by a large number of different factors, it is extremely difficult to predict how prices will change. These factors include supply levels, global demand for the products concerned, developments in technology, different end uses and new materials that replace the old ones. Experience leads us to believe that a period of high prices such as we had a few years ago will be followed by a period of low prices. But I am essentially optimistic that the molybdenum price will stabilize again.

livingmetals: What steps are you taking to remain competitive?

John Graell Moore: To start with, we are aiming to negotiate long-term supply contracts with our customers in order to mitigate the risk of volatile product prices and to stabilize our business. Beyond that, we are looking to expand our business portfolio to include molybdenum metal products, to offer a wider range of refractory metals and to develop recycling technologies to recover these metals and use them as raw materials. Furthermore, we shall redouble our efforts to take account of the needs of our customers and develop solutions that allow them to boost their earnings and provide a more comprehensive service for their end customers.

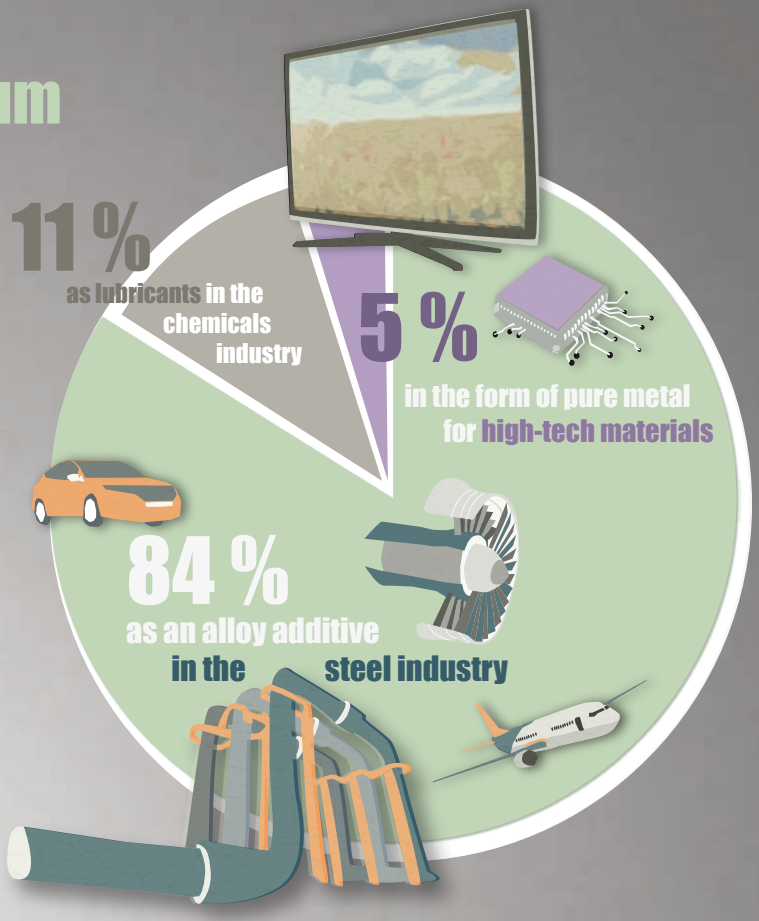
livingmetals: And how do customers benefit from this?

John Graell Moore: For many years it has been part of our corporate philosophy to regard our customers as partners, in the sense that we are constantly working at understanding their key requirements and building long-term customer relations. Over the years, the closeness

* Molybdenum approx. 14.8 US dollars per kilo, Tungsten 40 US dollars per kilo

Use of molybdenum

quantity processed annually: 235,000 tonnes worldwide



Essential material

A large proportion of all molybdenum is used in the steel industry. Smaller quantities are needed in the chemicals industry and in the form of pure metal for high-tech materials. Good news: The vast majority of all molybdenum remains in the raw materials loop permanently.

Molybdenum in the commercial cycle

- **Share of recovered molybdenum waste such as grinding sludge, scrap and offcuts, as a percentage:** 100
- **Average proportion of molybdenum as an alloy additive in steel production, as a percentage:** 0.2
- **Proportion of steel globally that is recycled, including the molybdenum it contains, as a percentage:** 80

of this cooperation has allowed us to establish a successful bond with each customer, to know the exact scope of their requirements and in this way to support them in growing their business.

livingmetals: Why is molybdenum important for industry?

John Graell Moore: A large proportion of the molybdenum produced worldwide is needed in the steel industry, where it is used as an alloy additive for stainless high-performance steel. As an additive, it improves certain properties of the steel, such as its hardness, high-temperature strength and corrosion resistance. It also increases the service life and efficiency of machines and plant equipment. Molybdenum is also used in pigments, catalytic converters, lubricants and many other applications. ▪

Jan Klepuszewski, managing director of QSGS Technology (right) and Jean-Marie Greiveldinger from Ceratizit receiving the "Gold Medal Award".

Woodworking industry

Cutting it fine

Carbide-tipped ribbon saws are becoming ever more popular in the woodworking industry. Carbide-tipped ribbon saws have the advantage that the service life is many times that of conventional ribbon saws without carbide tips. Not only that, because the cut is thinner, the amount of wood wasted is far less than with circular saws.

Ribbon saw with carbide tips.

The new ribbon saw, which is marketed under the name "Armoth Professional CTE", is the result of a development partnership between the tool manufacturer QSGS Technology and carbide specialist Ceratizit. The ribbon saw with carbide tips has been specially developed for the woodworking industry. The individual tips can be brazed to the ribbon saw in different geometrical arrangements, sharpened and simply replaced if they break as a result of incorrect handling.

The saw lasts five times as long

"Thanks to the innovative solution that we developed in conjunction with Ceratizit, we have been able to increase the average service life of the saw fivefold," says Jan Klepuszewski, managing director of QSGS Technology.

The carbide that Ceratizit chose for the job was the chrome alloy, fine-grain grade KCR10. "It offers an ideal balance between hardness, corrosion-resistance and bending strength, giving the best possible performance for working wood, coupled with process reliability," explains Michael Magin, head of development at Ceratizit.

The successful collaboration between QSGS Technology and Ceratizit earned them the "Gold Medal Award" at the DREMA 2015 in Poznań. This makes the ribbon saw one of the twelve most innovative products on show at the international trade show for machines and tools in the wood and furniture industries. ■


TOOLMAKER SOLUTIONS BY
CERATIZIT
PATENT

The dovetail grooves on each turbine shaft ensure that the guide vanes are positioned correctly. The milling cutters are a joint development by Weingärtner Maschinenbau and carbide specialist Ceratizit.

Massive machining center

Creativity and the art of engineering

A 60-tonne turbine shaft is fully machined in a single operation for a third of what it used to cost.

The job was a serious challenge: A large turbine shaft with a new geometry for use in gas-fired power stations was to be machined in a single operation. The solution demanded a great deal of creativity and all the art of engineering, not only when constructing the machine, but also when designing the machine tool. And to achieve this, two Austrian companies worked hand in hand. Mechanical engineers Weingärtner built the huge machining center. And carbide expert Ceratizit supplied the machining concept including all the key tools.

The close collaboration between the two companies was extremely fruitful. Although the project team had originally set themselves the target of halving the previous machining costs, it became possible to reduce them to a third during the course of the project.

Weingärtner was awarded the contract because they managed to considerably enlarge the existing machining center, which represented a clear competitive advantage. "Up to that point, the maximum weight of the workpiece between headstock and tailstock had been restricted to 30 tonnes. We doubled this to give 60 tonnes, at the same time permitting larger turning diameters of up to two meters," says Werner Pommer, responsible for technology and sales at Weingärtner.

Ceratizit developed the milling concept for machining the high-strength alloy steel blank. "Our objectives included a high level of shaping precision, process reliability, a long service life and high productivity," explains Peter Uttenthaler from Ceratizit's sales team. Another important criterion that influenced the selection of the tool supplier was that availability of all the tools is guaranteed at all times. To achieve this, Ceratizit developed a logistics concept based on three aspects: A rolling forecast of the customer's tool requirements. Requirements planning for the necessary tools at Ceratizit's logistics center in Kempten and in Ceratizit's US subsidiary. And, last but not least, a sharpening service provided by Californian subsidiary Promax Tools. ■

Facts and figures

The workpiece:
A turbine shaft with a weight of 60 tonnes

The machining center: Complete machining of the turbine shaft with a turning diameter of two meters at one third of the previous cost.

The tools:
- High-feed milling cutter
- Solid carbide multi-tooth form milling cutter
- Indexable cutting insert drills
- Grooving system for large widths and depths

Implementation timeframe:
20 months from contract to operational deployment

Peter Uttenthaler and Werner Pommer in front of the "giant" among the machining centers: It handles workpieces of up to two meters in diameter and up to 60 tonnes in weight.

Adapt to the unknown

Acquisitions, joint ventures and newbuild factories: The dynamic growth of the Plansee Group offers staff the opportunity to become expatriates and work at a different location.

And they jump at the chance of experiencing new things. They make their own way off the beaten career track. And they rise to challenges, even though they sometimes have no idea what shape these challenges will take. In short, wherever they happen to be working, that's where they give of their best. We are talking about people like Wolfgang Frick, who is working as an integration manager in California. Or about Analeigh Yu, who is building up logistics expertise in Austria. And Lukas Schlatter, who is making preparations for a SAP deployment in China.

livingmetals: How did you get your current job?

Wolfgang Frick: After the acquisition of Promax Tools in California in 2014, it was necessary to integrate the company in the Ceratizit group and to organize the transfer of technology. After I had worked in application technology at

Lukas Schlatter is coordinating the deployment of SAP at CB Ceratizit in Xiamen. He studied at the University of Applied Sciences in Kufstein, Austria and also studied international business & management in Japan for a year, followed by three years in China studying Chinese and applied economics, concentrating on China.

Lukas Schlatter:

"I see myself as an intermediary between the various locations."

Ceratizit in Austria for three years, I went to university and wrote my master's thesis. As part of this master's thesis, I conducted interviews with senior managers in the Ceratizit Group. As a result of these contacts, I had the prospect of going to California as an integration manager after I had finished my studies and completed a period of familiarization at a number of different Ceratizit locations in Europe.

Analeigh Yu: As a project assistant, I was involved in the construction of the new Plansee plant in Shanghai from the very start. Among other things, I was responsible for the procurement of machines, plant equipment and tools and took charge of the formalities with the authorities. Now that the plant is operational, the challenge is to integrate it into the production network of the Plansee HPM Group and to optimize the logistics workflow. I went to the Plansee headquarters in Reutte for two years in order to get to know the Plansee logistics concept from bottom to top so that I could later implement it in Shanghai.

Lukas Schlatter: I had studied for four years in Japan and China and in the fall of 2013 I was looking for a job at a careers fair in Innsbruck in Austria. At the Plansee/Ceratizit booth, I made contact with someone, and things gradually took their course until I had a concrete job offer. I was to have the task of coordinating the deployment of SAP at CB Ceratizit in China. In preparation for this, I spent several months getting to know the European locations of the Ceratizit Group and was involved in the deployment of SAP in India.

livingmetals: What do you see as the greatest challenges in your job?

Lukas Schlatter: Deployment of SAP needs to be well prepared. After all, colleagues from Europe and China have to understand the same thing when they think of a "pick list" or a "delivery note". I think that one of my most important tasks is to bring all the ►

670

talents: The Plansee Group wants to identify talent early and get them excited about the world of the high-technology materials molybdenum and tungsten. Students gain an insight into day-to-day professional life and obtain some initial experience during their hands-on thesis work. Postgraduate students open up new areas of development and productive work, and in the process secure their future jobs. 162 interns, 499 bachelors, masterands and graduate students as well as 9 post-graduate students were working for the Plansee Group worldwide in 2015.

Wolfgang Frick:
"The thing that drives me is that every week brings something new for which I have to find a solution."

► terms and concepts together coherently. And in this respect, I see myself very much as an intermediary between the various locations.

Analeigh Yu: And the same goes for me. Understanding the logistics processes that have become established and proven themselves in Reutte, sometimes over many years, and then introducing them at our new plant in Shanghai is not a job that can be done within the scope of a Skype conference. This needs someone who has built up an understanding of the processes and who can then transfer this knowledge to the new location. The next challenge will be to team up with my colleagues in Shanghai to work out what we can sensibly implement and how.

Wolfgang Frick: I also see myself as a communication interface. With technology transfer in particular, it is vital to overcome language barriers. And to this end, I have compiled a

Analeigh Yu analyzes and develops logistics workflows for the Plansee High Performance Materials production network. She studied international business in Shanghai and was involved in the construction of the new Plansee plant in Shanghai for three years as a project assistant and purchaser.

Analeigh Yu:

"I had to learn that I have to find my own way of doing the work I have been given."

glossary of all the technical terms that are of importance when manufacturing carbide drills. This forms the foundation that allows engineers from Germany and California to communicate constructively about concrete technical details. Beyond that, an integration project like this means that you have to deal with a lot of different aspects simultaneously: Preparing the deployment of SAP, developing the future production concept or coordinating how Sales is to be set up in future.

livingmetals: What is it like to work at a location in a different country?

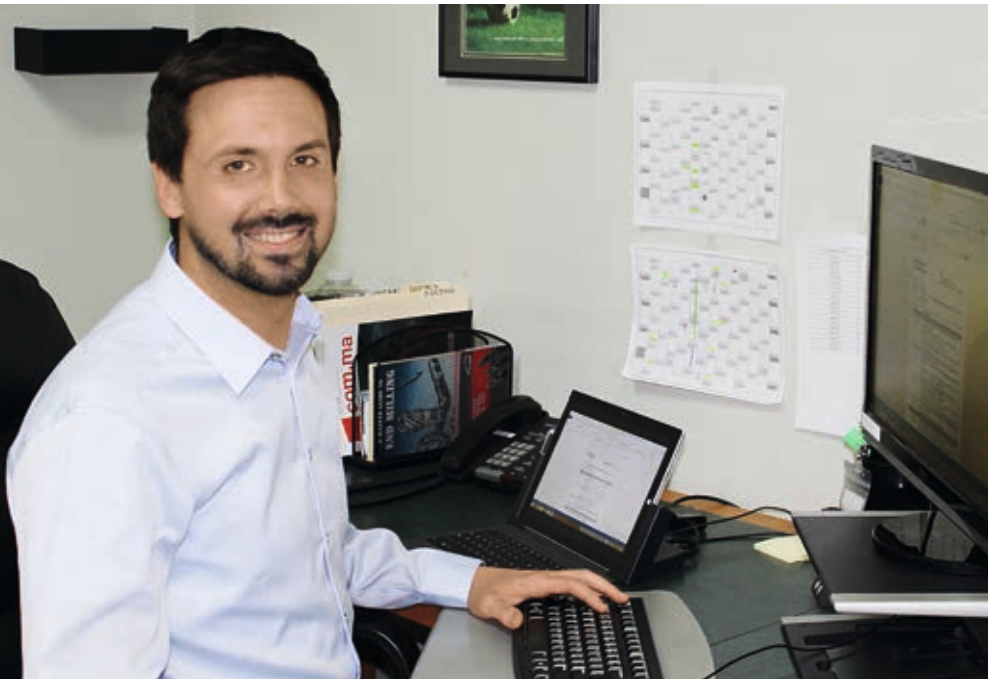
Analeigh Yu: In China, it is absolutely normal to be given clear instructions that have to be followed to the letter. And this is also very much part of our upbringing. In Austria, I first had to learn that my boss delegates the various tasks, and that I have to find my own way of doing the work I have been given. This means that, as a member of staff, you have a greater responsibility to seek support from your colleagues.

Wolfgang Frick: The big time difference makes it all but impossible to reach colleagues in Europe during normal working hours. So I very quickly started to get onto Skype and make important calls late in the evening at least once or twice a week. The great advantage is that I already know many colleagues and am able to approach them directly.

Lukas Schlatter: Even though I studied in Asia for four years, my knowledge of Chinese could still be improved for me to have detailed discussions about carbides and process workflows. Because the subway in Xiamen is under construction and the traffic is chaotic in the rush-hour, my wife and I have decided to take a company apartment on the company premises. Another benefit of this is that we often work on Saturday, which takes a little getting used to after the regular 7.7-hour day in Austria. ▸

80 %

Internal recruitment. It is the Plansee Group's aim to fill eight out of every ten management posts from internal applicants. Last year, this goal was achieved with 80 percent in middle management. Among top management, 74 percent of all posts were filled by staff who had built their careers in the Plansee Group.



Wolfgang Frick, integration manager at Promax Tools in California. He is coordinating the deployment of SAP, the development of the future production and sales concept and technology transfer. He graduated from the Higher Technical Institute in Innsbruck, Austria, spent three years in Reutte as an application engineer and product manager, and then studied business economics/strategic management and wrote his master's thesis on "Business Model Innovation with Industry 4.0".

Questions to Udo Fichtner, head of group HR:

Why is mobility important?

"Of course, it is up to each member of staff to recognize the opportunities that present themselves when they work at a different location for a period of time. As a company, we encourage mobility on the part of our staff, as this promotes cooperation and the transfer of knowledge across different countries and cultures, which in turn supports the long-term development of the Plansee Group. Not only that, we increasingly need to translate customer requirements into staff behavior, and this brings with it the need for staff who have wide-ranging experience, understand customers and markets in the broadest possible context and are able to derive the correct behavior from this knowledge."

► ***livingmetals:*** What have you gained personally from this stay overseas?

Analeigh Yu: As far as professional project management is concerned, I want to better understand what my colleagues here think of in advance when they plan complex projects. And, of course, it is also very important for me to learn German. To relax, I take the opportunity of enjoying the wonderful countryside in Reutte with colleagues and spend a lot of time hiking and rock-climbing.

Wolfgang Frick: In California there are so many different people with such different roots. And these roots make it easy to talk with people and get to know them. I was also impressed by the very warm welcome I received from my colleagues. The thing that drives and motivates me in my job is that every week brings something new for which I have to find a solution, and the same applies in my private life. It makes for an exciting life.

Lukas Schlatter: If you get an offer like this, it is a huge opportunity that you cannot afford to pass up. It takes you out of your established way of thinking and your familiar environment and you get to know something different. I would do it again without hesitation. And, personally, I now have a far better understanding of why Chinese companies are putting Europe under so much pressure. They are simply immensely fast and flexible and keep their eye on the costs. They are doing plenty of things right, and we in Austria have to get out of our comfort zone and do something about it. ■

43

members of staff at the Plansee Group were deployed far from home over the past year. 7 women and 36 men. Most of these were working in the USA (9) and China and Luxembourg (8 each). The figures cover all members of staff who were working at a different location within the Group, provided that this location is at least 100 kilometers from the "home location" and the member of staff has the option to return home.

Export control

Software relieves the burden on Sales

In order to comply with export control regulations, the Plansee Group relies on powerful software and regular staff training.

Every business transaction is checked before the products are delivered.

Patricia Roth from the sales team meticulously records the customer's order in the system. Because it is a new customer, she first creates the master data. The system saves the record without problems. Then, Patricia Roth records the product that has been ordered. Because the export control software is updated daily to incorporate the latest changes in the international sanction lists, it permits efficient, ongoing checking of all business partners in the background. This means that the system is in the position to occasionally flag up a transaction so that it can be subjected to closer inspection to ensure that all export control regulations have been complied with in respect of sanction lists, embargoed countries and end use (e.g. dual use).

Dual use

The term "dual use" refers to products that can be used for two different purposes. It is primarily used in the context of export controls, where it refers to the potential use of a commercial product for both civil and military purposes. This applies whether the product is a machine, a piece of software, a technology or, as in the case of Plansee, a product made from the high-technology materials molybdenum or tungsten.

Speeding up the workflow

The Plansee Group is aware of its obligations in respect of export controls geared towards international security and has explicitly stated this in its Code of Conduct. Ultimately, any failure to comply with export control regulations can not only damage the image of a company, but can also lead to civil or criminal proceedings.
The sales staff in the Plansee Group perform detailed checks on the recipient, the end user, the product and the intended use. In the scenario we have described, it turns out that the product ordered, in the dimensions and quality ordered, could actually fall into a dual use category. However, the customer can provide a coherent explanation of the application and guarantee that this is the case in an end-user certificate.
The system deployed in the Plansee Group relieves sales staff like Patricia Roth of a considerable amount of work. Every time an order is recorded it completely unobtrusively checks numerous criteria: Is the customer or an affiliated company on a sanction list? Is the product to be delivered to an embargoed country? The various criteria can be combined in many different ways, and the difficulties are exacerbated by the fact that the sanction lists and the lists of embargoed countries are constantly changing. "It is impossible for a member of the sales staff to remember all this at once," says Sandra Horninger, head of trade affairs and export compliance at the Plansee Group. "The software does not just relieve the burden on our sales staff. It also allows us to protect ourselves and our customers and speed up our workflows." But the Plansee Group does not wish to rely solely on systems to ensure compliance with export controls. Training courses sensitize staff from Sales and other departments to situations where caution needs to be exercised with a contract: If, for example, the products that have been requested do not fit in with the customer's other activities. Or if the customer insists on an unusual transport route. Or they refuse to reveal any information about the use of the product. One thing is clear to Sandra Horninger: "It is extremely important to sensitize staff at the Plansee Group if we, as a globally active company, are to guarantee effective export control." ■

Standardized production

Always able to deliver

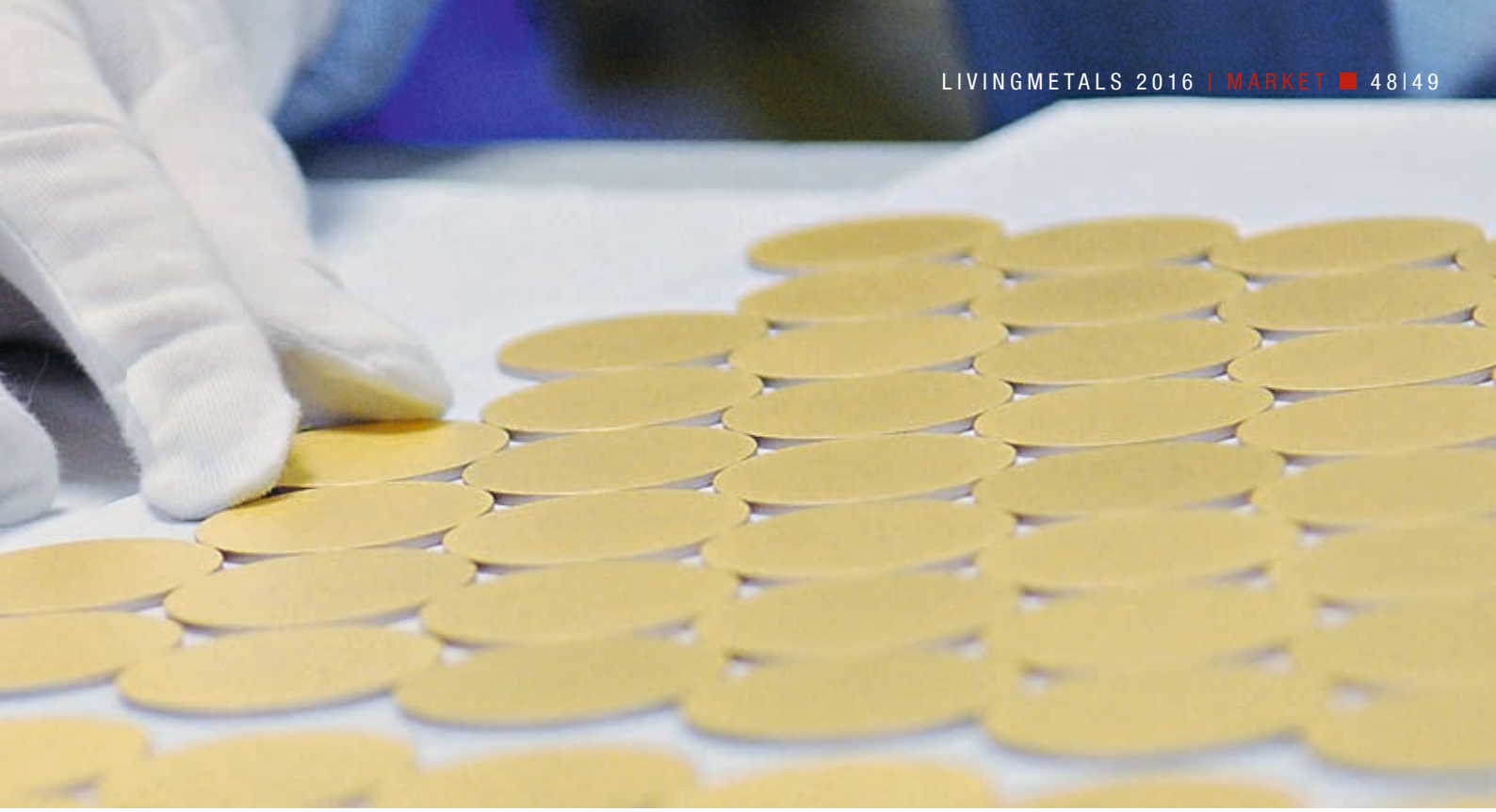
Plansee sees a decisive market advantage in the rapid availability of its standard molybdenum and tungsten products.

The online shops of our modern world are a constant reminder to all consumers of how fast that world is becoming: A smartphone that cannot be delivered within a matter of days has no hope of ending up in anyone's shopping basket. After all, there is usually an alternative vendor or a comparable product that can be delivered quicker.

And consumers are notoriously fickle. Today they will buy Smartphone X and tomorrow it will be Model Y. The days when manufacturers planned their production quantities across the entire sales cycle are long gone. They only produce what the customer needs. Of course, sales volume forecasts will be made when a product is launched. And the entire manufacturing chain is then adjusted radically in the light of sales trends over the first few days and weeks. Which means that all suppliers have to adjust production accordingly, either upwards or downwards.

Always able to deliver

And Plansee's response to this trend is a radical rethinking of its production philosophy. A few years ago, the aim was still to try to plan predicted customer demand as accurately as possible. After all, molybdenum and tungsten are extremely expensive materials to purchase and demand complex processing. In other words, every kilogram in products that cannot be sold represents a tangible financial loss. But Plansee has completely abandoned this practice. Long-term, highly volatile production forecasts are being eliminated from the systems one by one, as stock replenishment is done on the basis of stock levels, irrespective of the forecasts. Now,



What do carrier plates for semiconductors and rolled sheet have in common? The first answer is that they are both made from molybdenum. And the second answer is that they are both produced from the same hot-rolled input material. Only when a customer order is received are prefabricated interim products taken to manufacture the thin round molybdenum blanks for the semiconductor industry (top) or the cold-rolled sheet (bottom).

the watchword is: "We must always be able to deliver". Plansee sees a decisive market advantage in the rapid and reliable availability of the materials molybdenum and tungsten.

Custom manufacturing

The new production philosophy applies to all products that are repeatedly manufactured with standardized processes. This affects a large proportion of the Plansee product range.
Special products will continue to be manufactured to order. The big difference in delivery times becomes clear when we make a direct comparison: Whereas the majority of all products can be delivered within two weeks, delivery times for special products can be between eight and twelve weeks. This is a timeframe that really is not all that long for materials such as molybdenum and tungsten, which are manufactured using powder-metallurgy processes. After all, during this time, the materials have to be pressed, sintered, formed and further processed to customer requirements.

Standardization

Faced with the constraints imposed by the materials themselves, the production department grappled with the difficult question of how to reduce delivery times to two weeks. The solution was to standardize semifinished products that are always in stock, irrespective of customer orders, thus massively reducing the delivery time. When an order is received, the molybdenum and tungsten sheets, strips, wires or rods that have already been produced can be further processed to meet the customer's exact requirements and then delivered in a very short space of time.

Replenishing stock

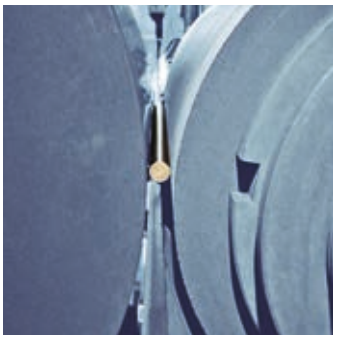
Production is geared entirely towards the actual quantities delivered. When products are taken from stock, replacements are produced and stock is replenished to the defined levels. Virtually all business areas benefit from this development at Plansee: the coatings business for the display industry as much as the business in components for X-ray machines; tungsten components for high-intensity discharge lamps, molybdenum base plates for the semiconductor industry or melting electrodes for the glass industry. ■

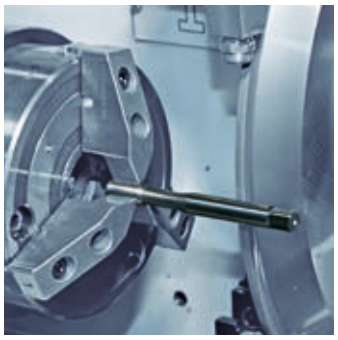
8.2

Awarding a rating of 8.2 out of 10 points, Plansee HPM **customers** remain just as **satisfied** as in previous years. Product quality and clear quotations are rated very highly. Alongside quality, speed is an important factor for our customers. And they have let us know that there is room for improvement in this respect. We are working at it!

From one-off to short run

Speed is what matters here





Perfectly harmonized processes, from sintering to grinding.

No matter whether we are talking about a new development, a short run or a batch size of one, there is only one thing that counts for Ceratizit when manufacturing blanks for carbide tools: the customer's wishes.

A world of unlimited options – consumers are already familiar with this: A configurator allows them to customize their trainers, at the cost of a small surcharge. And muesli-lovers have a free choice as well and can mix their product however they choose, in endless variants. And this trend is increasingly taking hold in industry. A B2B customer puts their product together with a few clicks, and the supplier delivers. "The whole point is to give the customer a tailored and efficient service," says Peter Fink, managing director of Ceratizit Austria GmbH. The aim: To be able to manufacture short runs and even batch sizes of one automatically. In this way, Ceratizit is offering its customers far more than just a choice between two extremes, namely inexpensive mass-produced goods or expensive custom-made products.

The technical prerequisite for being able to offer an ever wider selection and produce small batches efficiently is Ceratizit's modular production structure for carbide blanks, which are then further processed in a whole range of different tools. "No matter whether it is a milling cutter, a drill or a reamer, no matter whether it is long or short, thick or thin, or with or without a cooling duct, the input product is always a carbide rod blank," says Peter Fink.

The preformed carbide blanks, whose complexity demands that they are manufactured precisely according to the customer's drawings, are needed as blanks or semifinished products for solid-carbide tools, replaceable head systems and tool shafts: Preformed carbide blanks reduce to a minimum the effort involved in grinding and erosion on the part of the customer.

When the Ceratizit service center receives an inquiry during working hours, the customer can usually expect to have an offer on their desk within a few hours.

The more information the customer provides, the quicker the response will be: What grade of carbide is to be used? Where are grinding allowances to be provided? Is there a digital drawing?

If the customer accepts the offer, the electronic drawing is sent directly to the machining center. Logistics and work preparation ensure that the appropriate tool is provided and that the correct input material is used. Ceratizit's many years of experience in processing unsintered carbides (green compacts) and state-of-the-art manufacturing systems make it possible to produce even the most complex geometries in

In no more than 15 days, Ceratizit delivers preformed blanks on the basis of customer drawings, either as one-offs or as short runs.

near-net shape with the shortest possible delivery times. For the customer, this means that the preformed blank will be delivered punctually within 15 days, no matter whether it is a one-off part or a short run.

Rods: From standard …

The product range for standard carbide rods is huge, covering three product lines, many different lengths and diameters and other features. This becomes clear in the world's largest warehouse for carbide rods in Kempten, Germany. There, many tonnes of carbide rods are waiting to be ordered by customers, either through the carbide Webshop "E-Techstore" or via the internal sales team. All standard products, from order quantities of 1 upwards, are shipped from there to destinations throughout the world within one day. In many parts of Europe, the product will reach the customer the next morning. Within three days, the carbide rods from Ceratizit reach all corners of the globe.

In order to guarantee high levels of product availability from stock, attractive prices and fast delivery times, Ceratizit has fully aligned its production with its customers' ordering behavior. An intelligent production system constantly ensures that the right product is always in stock at the right time and that production capacity is utilized as evenly as possible. Ceratizit's objective in using this production system is to ensure short reorder lead times through very short runs that can be produced extremely quickly.

… to development project

Alongside its range of standard products, Ceratizit has invested heavily in developing custom carbide rods over the past years, establishing a development team made up of materials researchers, chemists, mechanical engineers, design engineers, production engineers and environmental and process engineers. The job of the development team is to develop new carbides, products and technologies in close collaboration with customers, project partners and universities. The team provides support throughout all phases of a project, including modeling, basic research, metallurgical development and efficient manufacturing techniques for high-quality products. In particular for premium products that are used for high-performance drilling and milling tools in all sectors. Which takes us full circle: From an automatically manufactured milling cutter with a batch size of one up to custom-developed drills for a customer, Ceratizit has fully aligned its workflows and service offering with the needs of its customers. ■

Project business

Making things happen – more and more often

Increasingly, Plansee products are needed for manufacturing modern mass products such as LEDs, smartphones and displays. And molybdenum and tungsten parts, either in the form of components used directly in our customers' products or in the form of tools for manufacturing those products, need to be available in large quantities in very short timeframes.

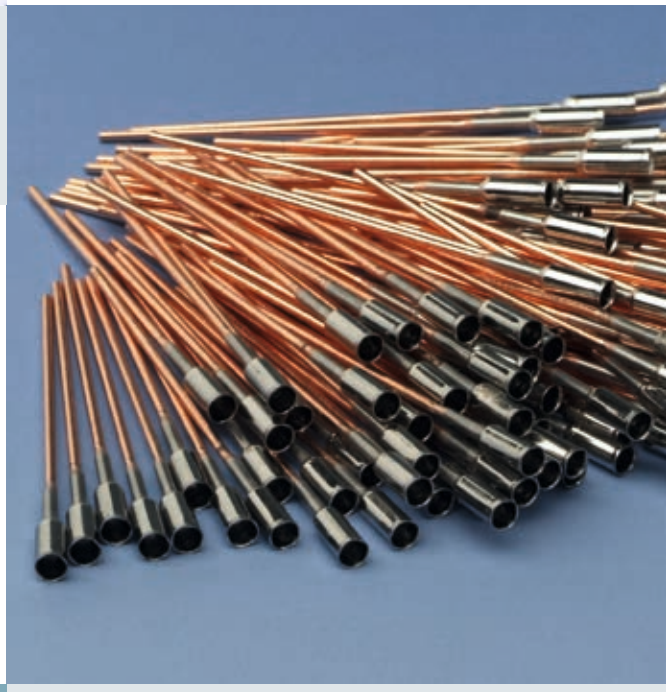
There is an unmistakable trend for products in the semiconductor and consumer electronics industries to be launched onto the market with major functional improvements in ever shorter cycles. In this context, the major manufacturers are targeting global markets, which they are supplying with huge quantities of products simultaneously. Nowadays it is commonplace for a well-equipped smartphone or tablet to contain components made from anything up to 60 different elements of the periodic table. Among the indispensable materials in the consumer electronics industry are molybdenum and tungsten. Plansee's ambition is to be able to custom-develop, manufacture and deliver molybdenum and tungsten products to meet any quality requirements in the shortest possible time, whatever quantity is required.

Expectations are growing. The many years of experience that Plansee has to offer in the development, manufacture and reliable supply of the materials molybdenum and tungsten represent one of the key requirements of customers from the electronics industry, who have extremely high expectations. The new challenges are to be found in becoming part of an extremely complex, global value-added chain and producing and delivering the product at the specified time, in the correct quantity and quality and in a specific country. And that's not all: It is not rare for the order to be placed while the engineers are still specifying and elaborating the design details and the precise properties of the materials. "In such circumstances, an extremely rapid response and concurrent working are needed in order to adapt the manufacturing techniques and make the necessary production capacity available," says Damir Blazevic, head of the Electronics market unit at Plansee High Performance Materials.

In spite of all Plansee's experience and the fact that its capacity for manufacturing molybdenum and tungsten products is the largest in the world, every project presents obstacles that need to be overcome. There could be issues related to the quantity or specification of the raw material required. Or in developing suitable tools that take account of the properties of the material while at the same time meeting the stringent quality requirements. Or in procuring special machines. Or in logistics, if the available air freight capacity is limited, which has already happened, due to the high weight of molybdenum and tungsten. "At first sight, many of these projects seemed simply impossible. But our ambition is to make it happen – thanks to our extremely tightly networked organization," says Damir Blazevic.

The organization adapts to the situation. There are only a few months between confirmation of the order and the start of production, and these are hectic weeks. In a very short space of time, Plansee puts together a project team made up of specialists from all the required disciplines. One crucial issue is where the product will be manufactured. This is where Plansee makes good use of its worldwide production network of highly specialized plants in Europe, the USA and Asia. And then things start moving very quickly. Process engineers develop a suitable production process, and this is increasingly done using sophisticated computer simulations. The machines and systems that will be needed are specified and ordered. Production staff are taken from other units or hired and given training in the new processes and quality standards. Damir Blazevic: "Whenever our customers need large quantities of tungsten and molybdenum products as quickly as possible, we are the right people to come to. There's no such word as 'can't'." ▪

Components for manufacturing sapphire: Plansee supplies crucibles and shield packs made from molybdenum and tungsten, sometimes compounded with graphite. At peak times, several thousands of these have been needed to cover requirements for LED manufacturing and the consumer electronics industry.



Molybdenum cathodes for backlights in LCD screens: Mass production of LCD TVs originally started out with CCFL lamps as backlights. Plansee developed and supplied tiny deep-drawn molybdenum parts as electrodes for these lamps.

Plenty of weight in a small space! It is always used when plenty of weight is needed in a small space: Heavy metal from Plansee, a material made from tungsten and other alloy elements. This was another project where the high precision of the small, heavy-metal parts was crucial.

Preparing the way

The Gotthard Base Tunnel

Since the 1st of June 2016, passenger and goods trains have been hurtling through the longest railway tunnel in the world at speeds of up to 250 kilometers per hour. The 57-kilometer tunnel is in an operational test phase until December. The stretch between Zurich and Milan is almost flat. The Alps tower up to 2300 meters over the heads of the passengers. To build the tunnel, gigantic tunnel boring machines carved their way through the rock formations to create the tunnels with their circular cross-sections with a diameter of 9.20 meters. The most important part of a tunnel boring machine is the cutter head, fitted with carbide disk cutters. This tool is made by carbide manufacturers such as CB Ceratizit.

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