TRADIUM
The key element in your business

The Touchables

Discover strategic raw materials as crisis-proof tangible assets

Dear Customers,

We are not surprised to find that, in recent years, private investors are increasingly approaching us: You have all discovered technology metals and rare earth elements to diversify your portfolios. Particularly in turbulent times on the stock exchange, they represent a crisis-proof and inflation-proof option. Although industrial customers make up our core business, we would like to make this tangible asset available to you too.

This brochure presents those metals which we consider the best tangible assets in the medium and long term. Because their history and areas of application are at times almost spine-tingling, we have placed them in the context of great classic movies.

We hope you enjoy reading about them.
Should you have any questions, or be intrigued by this opportunity, we would be delighted to take your call!

Your Matthias Rüth

Back to the Future

››› TECHNOLOGY METALS AND RARE EARTH ELEMENTS ARE NEEDED EVERYWHERE

No LEDs without gallium, no high-speed internet without germanium, no electric cars without dysprosium. Technology metals and rare earth elements are an essential component of the innovations of the late 20th and early 21st centuries and, as their core raw materials, are what makes progress in modern life possible in the first place.

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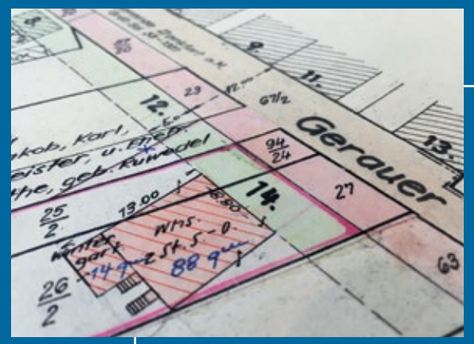
Traders of the Lost Ark:
TRADIUM GmbH

››› Anyone can do gold and silver. Technology metals, rare earth elements and their secure storage as a convenient and professional complete package can only be found in one place: on the platform of TRADIUM GmbH with its sister company METLOCK GmbH.

ABOUT OURSELVES

TRADIUM maintains longstanding, close contact with industrial customers. In addition, we are the exclusive representatives for several prestigious, international raw material producers. Many of our staff members have been keeping a close eye on the market for over 25 years and are therefore entirely familiar with market developments and customer requirements.

TRADIUM offers you not only a professional, synchronised team and therefore fast and faultless processes, but also experience and expertise with regard to tangible investments in strategic raw materials.



HISTORY

In 1999, Matthias Rüth founded TRADIUM GmbH and with the company motto *The key element in your business* formulated the firm's fundamental objective: to play a key role in the area of future technologies as an intermediary between producers and industry. In order to ensure the unwavering quality of the services, TRADIUM introduced a DIN EN ISO 9001 certified quality management system in 2003.

Today, TRADIUM is one of the best-known dealers for technology metals and rare earth elements in Europe. Since 2010, TRADIUM has also been offering private customers the option to purchase the essential raw materials of the 21st century.

Our Offer to Private Customers

››› TRADIUM is the only industry supplier to make the strategic metal investment category, which includes technology metals and rare earth elements, available to private customers. You therefore have the opportunity to become part of a market which, until recently, was open only to industrial clients.

We are not surprised to see interest growing in technology metals and rare earth elements: technology metals and rare earth elements – like precious metals in the past – are not threatened by inflation and, as sought-after raw materials for current technological developments, are a modern and far-sighted way of expanding the investment portfolio.

TRADIUM offers private investors competent, individual and cost-free customer service. Further benefits ensue from our cooperation with the company METLOCK GmbH. The core competence of METLOCK is optimum storage of technology metals, rare earth elements, precious metals and other valuable commodities to a bank-level security standard.

Our in-depth knowledge of the market with regard to the product range and packaging, quality and delivery form of the raw materials also enhances the liquidability of the investment. Together, TRADIUM and METLOCK therefore offer a convenient complete solution for material procurement, storage and resale.

Virtual investments are like a box of chocolates: You never know what you're gonna get.

››› Obscure share packages, sugar-coated investment funds, risky mining shares: classic investment products are often difficult to grasp. By contrast, the purchase of strategic metals expands every investment portfolio with the addition of a tangible asset – a crisis-proof and inflation-proof component.

Technology metals and rare earth elements are urgently required for almost all high-tech developments seen in recent years. Hardly surprising, therefore, that the interest of private investors in technology metals and rare earth elements is currently experiencing strong growth.

The Benefits to You

1 No gambling on the stock exchange possible

Technology metals and rare earth elements are not traded on the stock exchange. The price is driven by supply and demand alone. Market participants are exclusively the producers, specialised dealers like TRADIUM and the processing industry. This is where technology metals and rare earth elements differ from industry and investment metals, which are exchange-traded and do not physically belong to the investor. No high-risk gambling on the stock exchange can ensue for technology metals and rare earth elements; investments are, by and large, crisis-proof. This does away with the complex processes and terminology involved in exchange-traded metals or mining shares often so incomprehensible to outsiders.

2 Multiple tax benefits

As these are not financial products, investments in technology metals and rare earth elements offer considerable tax benefits. When they are sold, the profits attract neither withholding tax nor solidarity surcharge. Income tax is payable on the profits only if they are sold within one year of their purchase, for sales thereafter these taxes do not apply. All other taxes such as capital gains tax and wealth tax are also dispensed with. Even VAT has no role to play in an alternative investment through TRADIUM: The metals are stored in the bonded warehouse of METLOCK GmbH and delivered exclusively to industrial customers. Apart from a storage charge, a tangible investment therefore involves no further costs for investors*.

*Differing tax benefits possible, depending on the country.

3 Strong demand – Low availability

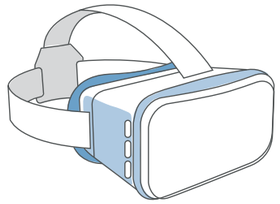
The current situation clearly favours the acquisition of technology metals and rare earth elements as permanent tangible assets: The increasing demand for high-tech products, digital technologies and renewable energies is making strategic raw materials ever more sought after. This development is further strengthened by the growing world population and the development of many emerging countries to prospering industrial nations. However, the raw material resources are finite. You don't need to be a mathematician to extrapolate fast-growing demand and a corresponding increase in value from the rapid transformation. And another very important factor for the development of strategic raw material prices: the majority of technology metals and rare earth elements originate in China. China is currently establishing strategic raw material reserves, thus further limiting the supply. No end to this policy is currently in sight.

4 High liquidability

Unlike gold, strategic raw materials are actually consumed. TRADIUM has been buying and selling technology metals and rare earth elements for over two decades. The range of raw materials TRADIUM customers can purchase is therefore constantly tailored to the current requirements of the market and the industrial consumer. Furthermore, the powders and metals remain in their original packaging at TRADIUM. This guarantees a high level of liquidability should investors wish to shed their investment. As technology metals and rare earth elements are required across innumerable branches of industry, the investment is crisis-proof.

The Success Formula for Your Tangible Asset

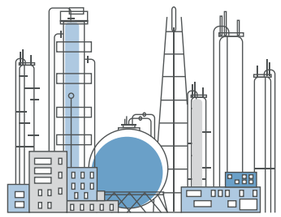
Rising demand
for high-tech products
and digital technologies



+ **growing demand**
for solar energy and
wind energy

+ **constantly growing**
global population

+ development of many
emerging countries to
prospering industrial countries



+ **low availability** of the
critical raw materials

= chances of an increase in value unusually good.

Technology Metals:

Situation

Many technology metals are on the EU list of critical raw materials[1]. Their relevance for the economy is considered particularly high; however, supply shortages are feared.
The reason, on the one hand, is the unequal distribution of raw materials: Up to 80 % of the technology metals originate in China alone. For numerous technology metals, recycling measures are already making a valuable contribution to ensuring an adequate supply to the European markets. On the other hand, the number of innovations for which technology metals are required continues to display steady growth. Exact details of the areas of application can be found alongside the respective products in our metal portraits.

Purchase of tangible assets

From the wide range of technology metals, TRADIUM provides customers with a specific selection of raw materials for purchase as a tangible investment. This selection is based on two decades of experience, an in-depth knowledge of the requirements of industry and our insights into the demand currently anticipated. At present, we offer the following technology metals as tangible assets:

GALLIUM

GERMANIUM

HAFNIUM

INDIUM

RHENIUM

TELLURIUM

The technology metals include 27 elements:

Antimony	Molybdenum
Beryllium	Niobium
Bismuth	Osmium
Cadmium	Rhenium
Chromium	Rhodium
Cobalt	Rubidium
Gallium	Selenium
Germanium	Silicon
Hafnium	Tantalum
Indium	Tellurium
Iridium	Tin
Magnesium	Titanium
Manganese	Zirconium
Mercury	

Technology metals owe their name to their relevance for technological applications.

The term originates in the general usage – chemical properties, common to all elements, do not exist.

Gallium: From Beijing with Love

››› By far the most important supplier of the new gold is China. It is therefore fortunate that, over a number of years, TRADIUM has established very good business relations with the country.

History

In 1875, after years of endeavour, the French chemist Paul Émile Lecoq de Boisbaudran made a groundbreaking discovery: Gallium. The element was named after Lecoq de Boisbaudran's home country, France, *Gallia* in Latin. However the chemist may also have immortalised his own surname in the element. Lecoq means *rooster* or in Latin *Gallus*. Over 140 years later, many technical innovations would have been unthinkable without this raw material.

PROPERTIES

Gallium is a shimmering silver metal conspicuous by its fascinating inconsistency: At just a little over room temperature (29.8 °C) it melts and contracts. However, boiling point for the raw material is extremely high: Only at 2,403 °C does gallium begin to boil.

AREAS OF APPLICATION

Gallium has a number of exciting areas of application. These include semiconductors, solar energy plants and electrical engineering as well as LED and AMOLED. Worldwide, LEDs are being used increasingly, the photovoltaic industry is growing and sales of mobile high-tech devices such as notebooks and smartphones are rising. What can only be described as a gallium boom is the consequence. In addition, the raw material is also used in the permanent magnets important for electric vehicles and wind power plants. Of much lower economic significance but far better known is its use in clinical thermometers where it replaces the toxic mercury.

GALLIUM AS A TANGIBLE ASSET

Gallium is a critical raw material and is, consequently, of great economic relevance but of limited availability. The global production capacity of the rare metal currently lies at around 720 tonnes per year and has reached its limit. Demand, however, is rising constantly: For foreseeable technical innovations up to 2035, the Fraunhofer Institute for Systems and Innovation Research anticipates one-and-a-half times the current demand[2]. Particularly for those looking for medium to long term investments, gallium is a wise addition to their portfolio.

Good to know: Since 2004, TRADIUM has been the representative for Beijing JiYa, one of China's largest gallium producers, whose products are characterised by the highest of quality. Liquidation to the best market price is therefore very likely.

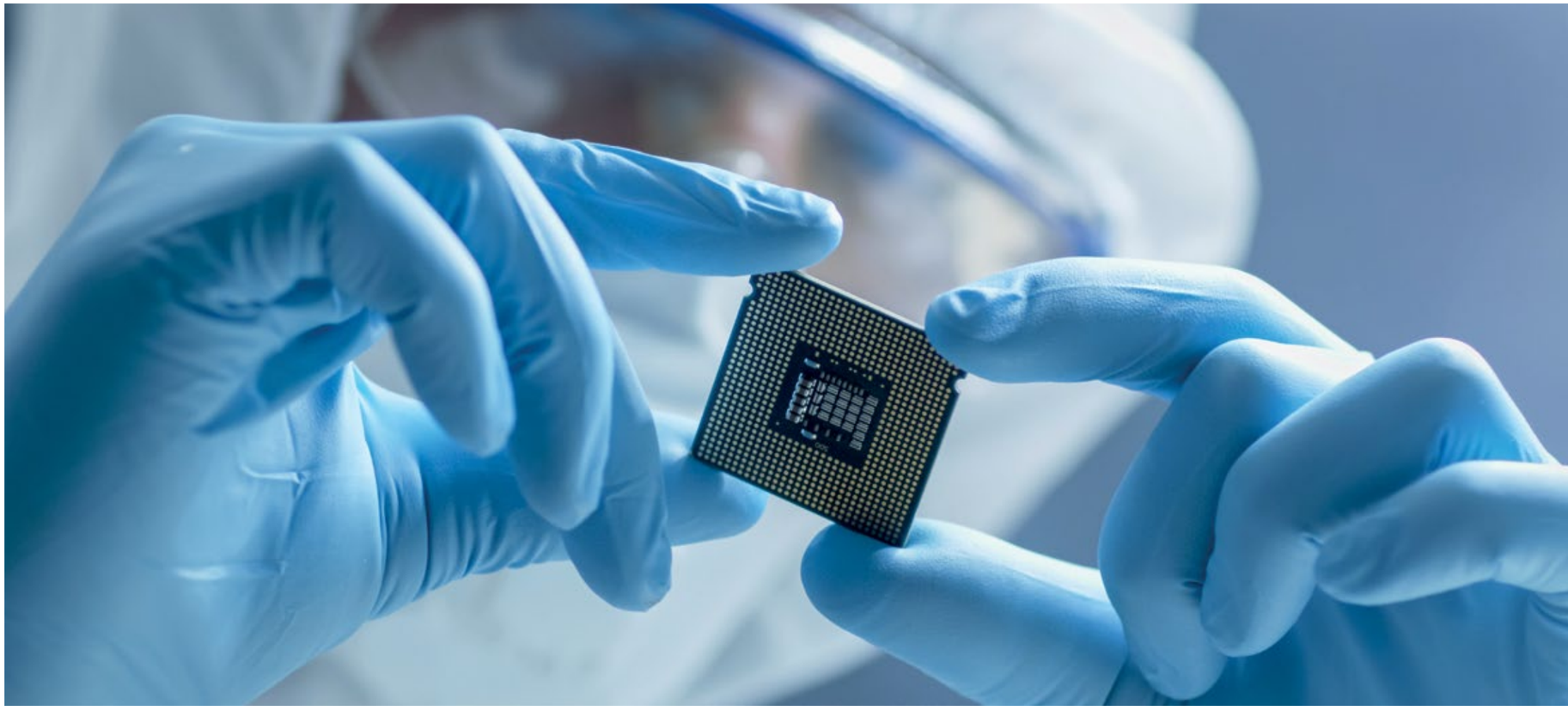
31
Ga

Facts:

Colour:	Silvery
Melting point:	29.8 °C
Boiling point:	2,403 °C
Specific weight:	5.91 g/cm³
Primary producers:	China

Use:

- LEDs and AMOLEDs
- Smartphones
- Computers
- Laser technology
- Photovoltaics (thin-layer solar cells)
- Alloying additions
- Liquid metal thermal pastes
- A substitute for mercury



The Force Awakens: Germanium

››› Many political leaders are promising nationwide high-speed internet. If this promise is to be met, it will require enormous quantities of fibre-optic cable, the most important component of which is germanium.

History

Although it may conjure up images of dark forests and primitive barbarians, it is actually an element: germanium. Germanium was discovered in 1886 by the German chemist Clemens Winkler when isolating the mineral argyrodite. He called the raw material after his home country, Germany, *Germania* in Latin. 1949 saw the beginning of the industrial career of the metal which is found primarily as a by-product in copper, lead and zinc ore. Today it is quite often extracted from the flue ash of germanium-containing coal.

PROPERTIES

Germanium is among the rarest metals on earth. The silvery element melts at just under 940 °C and boils at 2,820 °C. Like silicon, germanium is considered a semiconductor.
Its density anomaly is a constant conundrum for scientists: The density of germanium is lower in its solid form than as a liquid, the metal therefore weighs more in liquid form than as a solid. Deposits of the inert technology metal are widespread, but it always occurs in very low concentrations.

AREAS OF APPLICATION

For a long time, germanium was the leading material in electronics. Today it is used primarily in fibre optics and is an essential component of modern communication technology.

Furthermore, germanium can be used for the production of optics with infrared transmission. It is therefore indispensible for the production of night vision devices and infrared cameras, both crucial for self driving cars. The raw material is also used in semiconductors, recyclable PET bottles, high-performance processors, detectors for X-rays and in photovoltaics.

GERMANIUM AS A TANGIBLE ASSET

Supply shortages are also anticipated for germanium: The Fraunhofer Institute for Systems and Innovation Research expects a significant increase in demand due to new high-tech developments up to 2035. In the fibre optic cable application area, it is anticipated that the demand for germanium will quadruple. A significant increase in demand which should go hand in hand with a major price increase. Investors who now physically store germanium can benefit from this price increase.

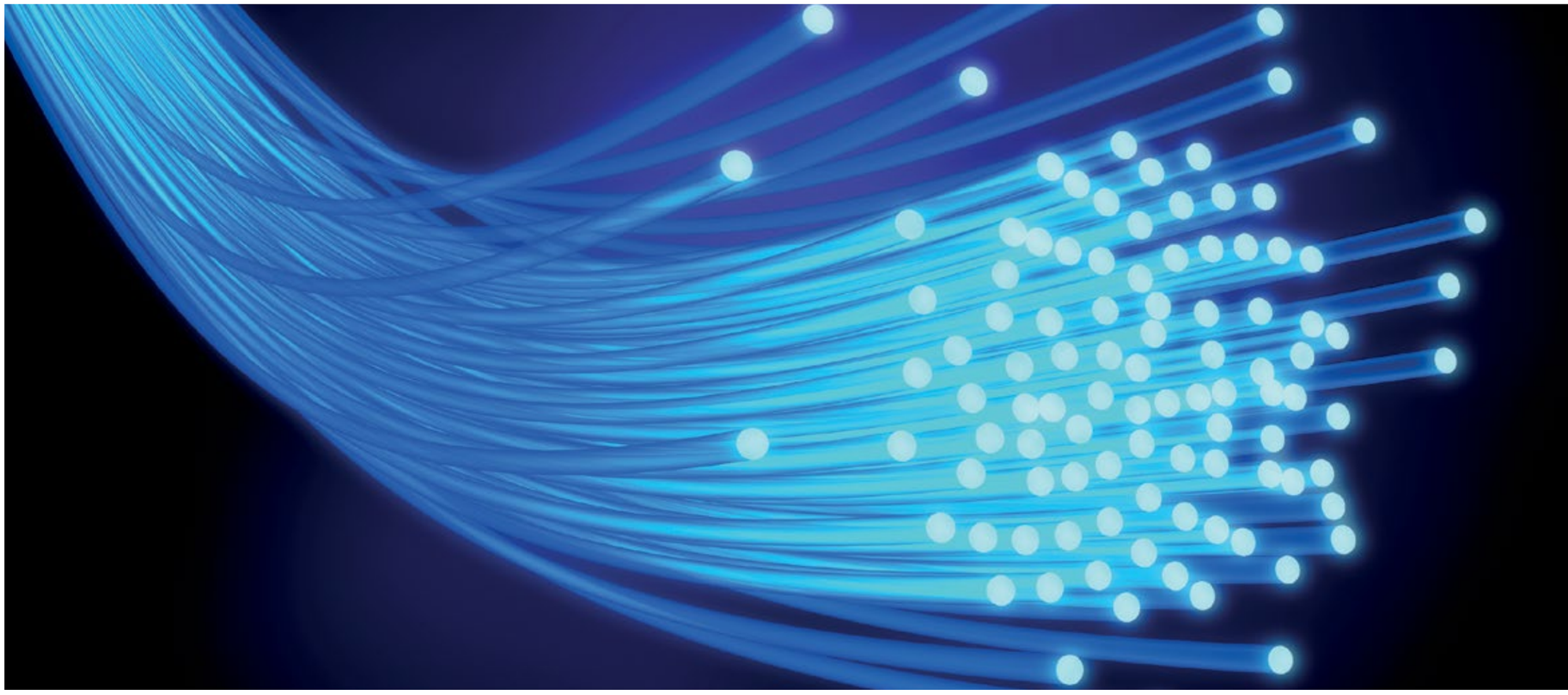
32
Ge

Facts:

Colour:	Silvery
Melting point:	937.4 °C
Boiling point:	2,820 °C
Specific weight:	5.32 g/cm³
Primary producer:	China

Use:

- Fibre optic cables
- Night vision devices
- High-frequency technology
- Detector technology
- Infrared lenses
- Catalysers for the production of PET bottles



Hafnium: Around the World in Two Days

››› While Phileas Fogg was not yet able to avail of the aeroplane for his travel wager, our holidays and working lives would be unthinkable without it today. As part of the superalloys in increasing powerful and environmentally friendly engines, hafnium makes a significant contribution to global interconnectedness.

History

In its properties, hafnium has an astonishing similarity to the metal zirconium. Only in 1923, in Copenhagen, did Dirk Coster and Georg von Hevesy succeed in proving the existence of hafnium as a separate metal. They identified the element in zirconium ore by means of its characteristic x-ray spectra. Hafnium is therefore the last element with stable isotopes to be discovered. In choosing a name, the two researchers took their inspiration from the city of Copenhagen: *Hafnia* in Latin.

PROPERTIES

Hafnium is a malleable, silvery metal. The temperatures at which it melts and boils are both very high. At very low temperatures, hafnium is superconducting. Hafnium is a relatively base metal which, in finely dissipated form, is highly reactive, with a strong resemblance to zirconium. When the metal is exposed to air, a thin oxide layer is formed, making it corrosion proof.

AREAS OF APPLICATION

Hafnium has many applications. It is used as a material for control rods in nuclear reactors and plays a role in laser technology. Computer chips would be significantly slower without hafnium. The main proportion of hafnium consumption is accounted for by superalloys for turbines and aircraft engineering. Approximately half the global extraction quantity is used for this purpose.

Even in terms of technology metals, the extraction of hafnium is very difficult, as there are no deposits of hafnium as such. Hafnium always occurs with a ratio of approx. 1:50 as an ore companion of zirconium. It has to be painstakingly separated from this very similar metal.

HAFNIUM AS A TANGIBLE ASSET

Purely because of the new, rapidly-developing semiconductor technology, the demand in the coming years is likely to rise steadily. A further contribution to this development is made by the significantly-growing hafnium demand for aeroplane turbines.

For those who physically own hafnium, this can result in a significant increase in value in the long term. Hafnium is therefore a very exciting technology metal for an asset purchase.

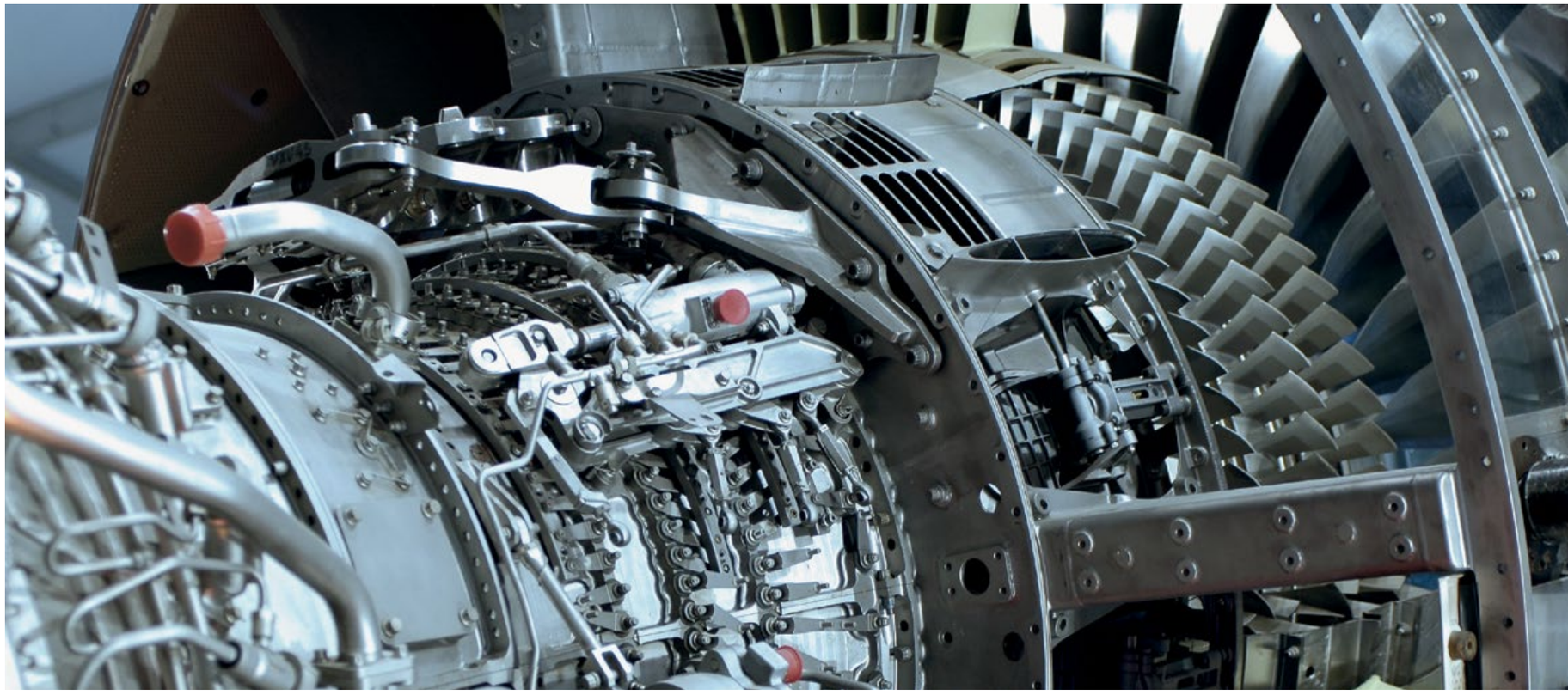
72
Hf

Facts:

Colour:	Silvery
Melting point:	2,150 °C
Boiling point:	4,603 °C
Specific weight:	13.31 g/cm³
Primary producers:	Australia, South Africa, China, Brazil, Russia, Ukraine

Use:

- Superalloys for aeroplane turbines
- Nuclear industry
- Highly-efficient flashlight technology
- New semiconductor technology
- Computer chips
- Laser technology



Indium: Lord of the Displays

››› Smartphones, touch screens, solar cells: All technical developments and products without which the lives we live today would be barely imaginable. They all require indium.

History

Germany in 1863: The telephone had not yet been invented when the two chemists Ferdinand Reich and Theodor Richter in Freiberg made a discovery which, over 140 years later, is to be found in many technical revolutions such as the smartphone: indium. This element owes its name to its indigo blue spectral line. Indium was first presented at the International Exposition in 1867. It is said that up to 1924 only a single gramme of this raw material had been isolated. Today, the annual quantity is many hundreds of tonnes.

PROPERTIES

The silvery indium occurs during zinc smelting. In its pure form, indium is extremely soft. It can be cut with a knife and it is even possible to nick it with a fingernail. But if you try to bend it, you hear a cracking sound and the crystals break. Indium melts at just 156 °C and turns to gas at 2,080 °C.

AREAS OF APPLICATION

Indium surrounds us in almost all items of daily life; in the computer monitor at the workplace, in the smartphone when we make a call, in the flat screens in our living rooms. It is used most frequently for LCD displays. In photovoltaic and nano technologies too, indium compounds play a significant role, as they do in the quantum dots for screen brilliance.

INDIUM AS A TANGIBLE ASSET

Indium appears on the list of critical technology metals for which the EU Commission anticipates shortages. The Fraunhofer Institute for Systems and Innovation Research expects a significant rise in the demand for indium by 2035. At the moment, the production capacity for indium is stable at 1,000 tonnes per year, but demand is rising.

With indium in your portfolio, you benefit from this growing demand. Therefore indium is ideal as an alternative investment.

49
In

Facts:

Colour:	Silvery
Melting point:	156.6 °C
Boiling point:	2,080 °C
Specific weight:	7.31 g/cm³
Primary producer:	China

Verwendung:

- Displays
- Touch screens
- Mobile phones
- Motor bearings
- Solar technology
- Medical technology
- LEDs

Rhenium: Some Like it Hot

››› Something which we say of ourselves in a tongue-in-cheek way is a simple fact for rhenium: rhenium is extremely heat-resistant and withstands a multitude of high-temperature applications.

History

The collaborative couple, chemists Ida and Walter Noddack discovered rhenium in 1925. They called their discovery after their home region, the Rhineland (*Rhenus* is Latin for Rhine). Due to the high costs, the production of larger quantities only commenced in 1950, when rising demand occurred for the newly-developed wolfram-rhenium and molybdenum-rhenium alloys. Today, the silver-grey metal is extracted in the smelting of molybdenum or copper.

PROPERTIES

Rhenium is a heavy metal and extremely resilient. After wolfram it has the second-highest melting temperature of all metals. The technology metal offers numerous superlatives: It has an above-average degree of hardness, high density and is superconductive at low temperatures. Rhenium is the rarest of the stable elements (those which do not decay radioactively) – even gold and platinum occur more frequently. It never occurs naturally alone but is always a component of other minerals.

AREAS OF APPLICATION

Rhenium is the metal of choice for high-temperature applications and plays a significant role in catalysers for oil refining and the production of rockets and aircraft turbines. Due to the high melting temperature, the metal is the ideal choice for the production of thermo-elements and filaments in lamps and X-ray tubes.

RHENIUM AS A TANGIBLE ASSET

A study by the Institute for Future Studies and Technology Assessment (IZT) allocates rhenium to the highest criticality zone (very high level of uncertainty of supply, very high level of vulnerability)[3]. The raw material is significantly rarer than the most important precious metals, but in relation, not much more expensive. The demand from industry is rising steadily; to date no substitution options in terms of other metals are in sight. In their prognoses, the aircraft makers Boeing and Airbus anticipate a doubling of the global number of aircraft by the year 2030.

It is hardly surprising that experts foresee that, of all metals, the highest increase in value will apply to rhenium. As a physical purchase rhenium is therefore of great interest for private investors, particularly when they are pursuing long-term goals.

75
Re

Facts:

Colour:	Silvery grey
Melting point:	3,186 °C
Boiling point:	5,596 °C
Specific weight:	21.02 g/cm³
Primary producers:	Chile, USA, Kasachstan, Polen

Use:

- Aeroplane turbines
- Catalysers for the petrochemical industry
- Gas turbines
- Thermo-elements

Tellurium: The 52nd Element

››› Ever-larger solar plants produce the environmentally-sustainable power so urgently needed by the growing global population. This makes tellurium so sought after, as an indispensible component of the modern thin-layer solar cells.

History

In 1782, Austrian chemist Baron Franz Joseph Müller von Reichenstein suspected the existence of an unknown raw material in gold ore. As the type of raw materials remained a mystery to him, he gave it the telling name *metallum problematicum*.
The pharmacist Martin Heinrich Klaproth succeeded in isolating the mysterious raw material in 1798. Klaproth declared Müller von Reichenstein to be the discoverer of the new element, but retained the privilege of naming it. He chose the name tellurium after the earth (Greek *tellus*).

PROPERTIES

Crystalline tellurium is a silvery-white, shiny metallic semimetal. It occurs as an ore companion of sulphur in sulphides and is brittle under pressure. This makes it perfect for pulverisation. It is similar in appearance to tin and antimony. In chemical terms it is closely related to selenium.

AREAS OF APPLICATION

Tellurium is multitalented: As a component in metal alloys, it makes them less susceptible to corrosion; as cadmium telluride it is used in photovoltaics. Tellurium is also found in the coating for offshore cables, in optical storage discs and in special-purpose glass for fibre optic cables. In addition, tellurium is used in the vulcanisation of rubber.

TELLURIUM AS A TANGIBLE ASSET

The numerous areas of application make tellurium indispensible for many branches of industry. In addition, with its relevance in photovoltaics, tellurium is an important raw material in the energy turnaround. Due to these future-proof applications, private investors should consider buying tellurium to diversify their portfolio.

52
Te

Facts:

Colour:	Silvery-white shiny
Melting point:	449.51 °C
Boiling point:	988 °C
Specific weight:	6.25 g/cm³
Primary producers:	Canada, Japan, Peru, Sweden, China

Use:

- Semiconductors
- Photovoltaics
- Special-purpose glass in fibre optic cables
- Re-writable CDs, DVDs,
- Blu-ray discs
- Vulcanisation of rubber

Rare Earth Elements and Where to Find Them

The Basics

Rare earth elements always occur in a composite with other rare earth elements. The separation process is painstaking and complicated. Furthermore they are subject to strict environmental regulations, for example, because the ore always contains low concentrations of radioactive thorium.

A differentiation is always made between light and heavy rare earth elements. On average, over 95% of the deposits of rare earth elements are accounted for by the four light rare earth elements cerium, lanthanum, neodymium and praseodymium. Consequently, the proportion made up by the 13 heavy rare earth elements amounts to less than 5%.

Situation

At the beginning of the 21st century, China focussed, among other things, on strategic raw materials. Within just a few years, it achieved worldwide market dominance. In the mining of rare earth elements, China occupies what is almost a monopoly position. At present, the Australian mining company Lynas provides a certain counterbalance with a market share of around 15%. At the same time, since 2015, China has been taking action against illegal mining of rare earth elements in its own country, this further shortens supply.

Worldwide demand for rare earth elements is being driven primarily by what are known as magnetic metals. These are required for the rapidly-growing future technologies wind energy and electro mobility.

Tangible Asset

The rare earth elements in oxide form are most suitable as a tangible asset, oxides being capable of almost unlimited storage. In addition, every industrial use is based on oxides. The oxide form therefore increases the liquidability of the raw material. From the wide range of rare earth elements, TRADIUM makes a specific selection available as tangible assets for its customers.

This selection is based on two decades of experience, an in-depth knowledge of the industry and our insights into future anticipated demand. At present, the following rare earth elements lend themselves to tangible purchase:

DYSPROSIUM

NEODYMIUM

PRASEODYMIUM

TERBIUM

The 17 metals of the rare earth elements are

- Cerium
- Dysprosium
- Erbium
- Europium
- Gadolinium
- Holmium
- Lanthanum
- Lutetium
- Neodymium
- Praseodymium
- Promethium
- Samarium
- Scandium
- Terbium
- Thulium
- Ytterbium
- Yttrium.

As it used to be believed that the metals of this group were very rare, they were called rare earth elements. However, some of them are by no means rare. Cerium, for example, occurs just as frequently as copper or nickel.

The term *earth* goes back to the early days of extraction of these raw materials which could only be extracted as oxides from certain minerals. *Earth* is a former term for oxide.

Dysprosium: No Prince but Precious Pauper

››› This raw material is not at all noble. And that is exactly what makes it so fascinating, because in the world of chemistry, base also means highly reactive.

History

Having discovered gallium in 1875, Lecoq de Boisbaudran pulled off another coup in 1886: Up to then it had been assumed that holmium was a homogenous substance. By means of spectral analysis, he was now able to determine the presence of a further substance. Following enormous effort, he finally isolated dysprosium oxide in a sample of holmium oxide. The name originates from Greek and aptly means *inaccessible*.

PROPERTIES

The silvery-grey heavy metal is elastic and flexible. It is very much a base element and therefore highly reactive: it oxidises when exposed to air, is affected by water, and dissolves in diluted acid. In its usual commercial form, it is a beige powder.

AREAS OF APPLICATION

Like neodymium, dysprosium has strongly magnetic properties. Dysprosium is therefore a component in permanent magnets which still have to function at high temperatures. It serves as a shielding agent for nuclear reactors and is used in the production of laser materials, glass and halogen lamps.

DYSPROSIUM AS A TANGIBLE ASSET

Although, for years now, industry has been endeavouring to reduce the proportion in alloys for high-performance magnets, dysprosium is still considered irreplaceable in many areas of application. As the annual extraction quantity lies at just 500 tonnes, the prospect of long-term supply shortages is real.

At the present time, an acquisition of dysprosium can be very lucrative. Particularly from a long-term perspective, this tangible asset is well worth considering as an investment option.

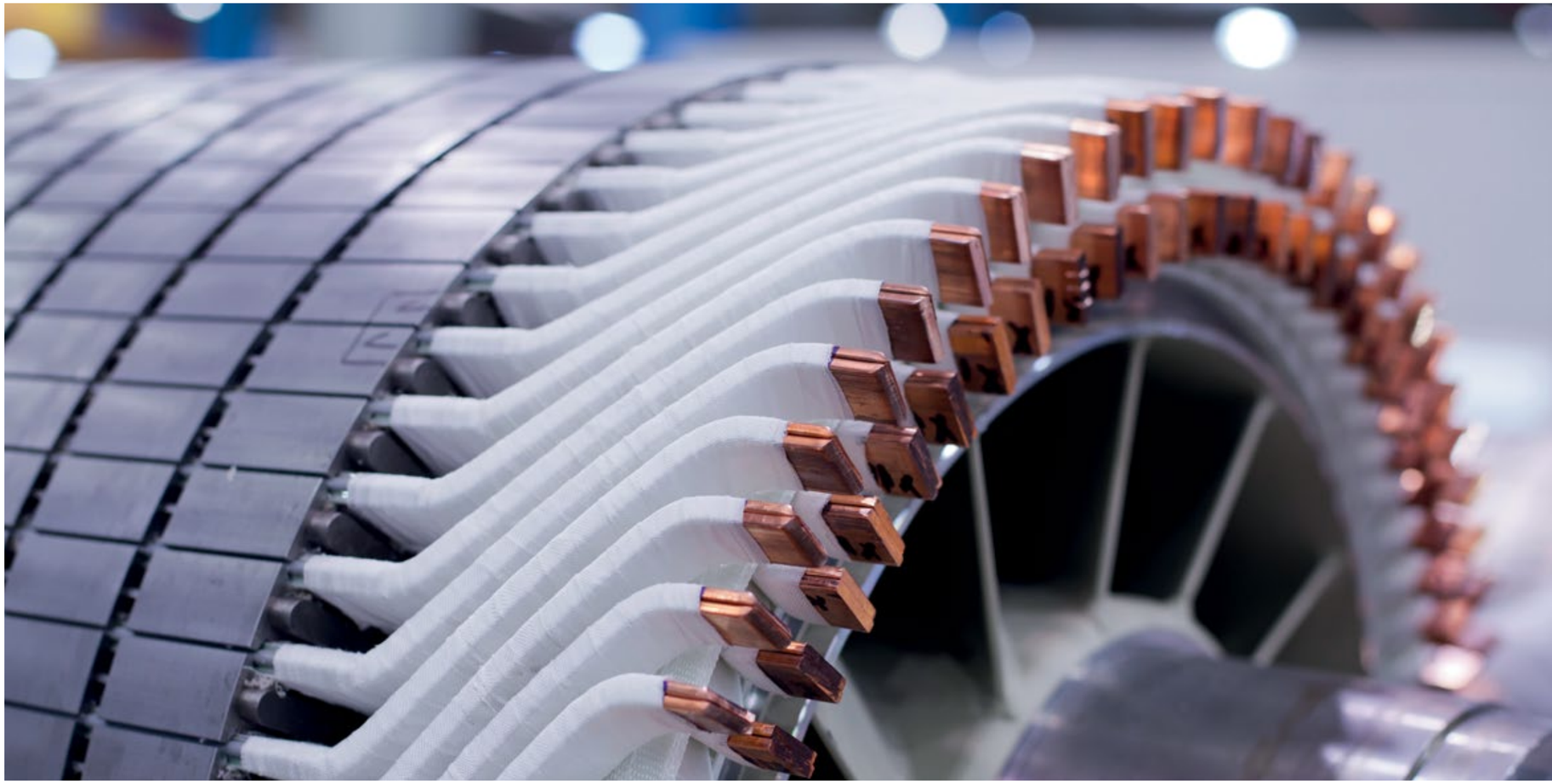
66
Dy

Facts:

Colour:	White (in oxide form)
Melting point:	1,407 °C
Specific weight:	8.55 g/cm³

Use:

- Permanent magnets
- Nuclear industry
- Glass production
- Halogen lamps



Metal Attraction: Neodymium

››› Lifting a sack of cement requires quite some effort. But lifting 1,300 times your own weight is beyond the capabilities of even the strongest weightlifter. But not of neodymium, as it is extremely magnetic.

History

A whole series of scientists were involved in the discovery of neodymium. In 1841, Carl Gustav Mosander extracted the rare earth didymium from lanthanum oxide. In 1874, Per Teodor Cleve noticed that didymium was, in fact two elements.
In 1885, von Welsbach succeeded in separating didymium into praseodymium and neodymium. In the Golden Twenties, it finally became possible to produce pure metallic neodymium on a commercial scale for the first time.

NEODYMIUM AS A TANGIBLE ASSET

The significance of neodymium for many future technologies is immense and is growing constantly. For example, neodymium magnets are in use in the lifts of the One World Trade Center in New York. Experts anticipate that the worldwide demand for neodymium will continue to grow steadily.

Neodymium is perfectly suited as a basis for an alternative investment in rare earth elements. Raw material holders with medium to long term perspectives benefit particularly from the growing demand from industry.

60
Nd

Facts:

Colour:	Purple-blue (in oxide form)
Melting point:	1,024 °C
Specific weight:	6.8 g/cm³

Use:

- Neodymium-iron-borum magnets
- Wind turbines
- Electric motors
- Smartphones

PROPERTIES

Neodymium is, unlike other rare earth metals, more corrosion proof. Its pink-coloured oxide layer peels off easily. An unusual feature: as a metal, it is inflammable and irritating. Its outstanding properties also define its main application: It is strongly magnetic. In its oxide form it is blue-violet.

AREAS OF APPLICATION

Neodymium is used primarily for the production of extremely-powerful neodymium-iron-boron magnets. Throughout the high-tech branch, they are used wherever strong magnets with small volume are required: in wind turbines with high-efficiency electric motors, in microphones or in loudspeakers for smartphones.

Magnets made using neodymium provide significantly higher performance than conventional magnets, for example in the generators in wind power plants. As the weight of the drives plays a considerable role in wind turbines, the demand for neodymium is by far highest here.

Praseodymium: It Takes Two

››› This twin to neodymium increases the capabilities of the substances with which it is bonded and can therefore certainly be described as legal doping.

History
The discovery of neodymium also marked the birth of praseodymium: After Carl Gustav Mosander succeeded in extracting the rare earth element didymium from lanthanium oxide in 1841, Per Teodor Cleve realized, a good 30 years later, that didymium was two elements. Von Welsbach succeeded in 1885 in separating didymium into praseodymium and neodymium.

PRASEODYMIUM AS A TANGIBLE ASSET

The steady growth in magnet production should drive demand for praseodymium upwards in the long term. Experts anticipate that China will not be able to meet the increased demand on its own in the future. Even potential new producers will be unlikely to be able to satisfy the market.

In the medium to long term, an increase in value for a tangible purchase of praseodymium can be anticipated. Investors will be able to benefit from this growing demand.

59
Pr

Facts:

Colour:	Dark brown (in oxide form)
Melting point:	3,212 °C
Specific weight:	6.48 g/cm³

Use:
- Permanent magnets
- Aircraft turbines
- Protective eyewear
- Glass colourations
- Ceramic industry

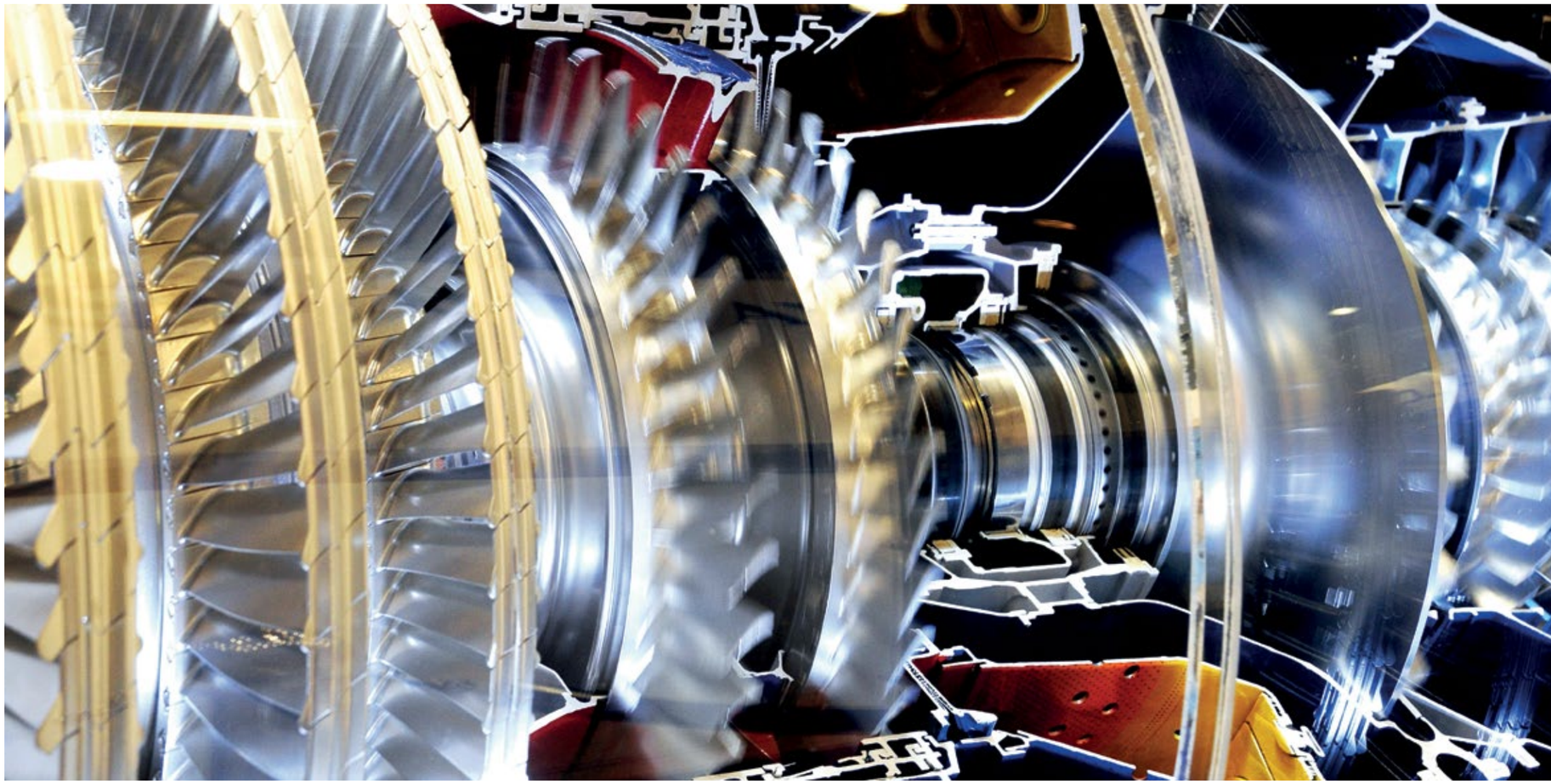
PROPERTIES

In its oxide form, the silvery-white paramagnetic metal is a dark brown to black powder. When exposed to air, it is somewhat more corrosion resistant than neodymium, but quickly develops a green oxide layer which peels off in the air. Like neodymium it is inflammable.

AREAS OF APPLICATION

Similar to neodymium, praseodymium is now used mainly to produce permanent magnets. It is very similar to neodymium which is why it is often used in magnets together with neodymium. In addition, it is used in alloys with magnesium to produce high-tensile metal for aircraft turbines.

As praseodymium improves UV absorption, it is also used for protective eyewear (such as welding goggles). Compounds with praseodymium content are used for green colouration of crystal glass and for ceramic materials with high electrical conductivity.



Terbium: Big Discoveries in Little Ytterby

››› Called after the first place it was found, Ytterby in Sweden, terbium is of great significance for the production of smallest magnets.

History
In Ytterby, the Finnish chemist Johan Gadolin succeeded in 1794 in isolating a previously-unknown compound which he called *Yttererde*. In 1843, the Swedish surgeon, chemist and mineralogist Mosander isolated a total of three elements from Yttererde in one go: yttrium, erbium and terbium. Pure terbium, however, was first produced with the emergence of ion-exchange techniques subsequent to 1945.

PROPERTIES

In its oxide form, the heavy metal is a blackish-brown powder. In metal form, terbium is so soft that it can be cut with a knife. It is very much a base metal, but relatively stable when exposed to air. Terbium mainly occurs in compound with other lanthanides.

AREAS OF APPLICATION

Terbium is used in the production of semiconductors and serves as an activator for fluorescent lighting. The artificial crystal terbium-gallium-garnet is used as an optic isolater in laser technology. In addition, terbium, together with zirconium oxide stabilises the structure of high-temperature fuel cells.

Due to its ferromagnetic *talents,* terbium is suitable for the production of magnetic components:
In the particularly high-performance neodymium-iron-borum magnets it increases resistance to demagnetisation.

TERBIUM AS A TANGIBLE ASSET

The future prospects for terbium are similar to those for dysprosium and neodymium. For the medium and long term, the Fraunhofer Institute for Systems and Innovation Research anticipates an enormous supply shortage for terbium, like that for dysprosium[2].

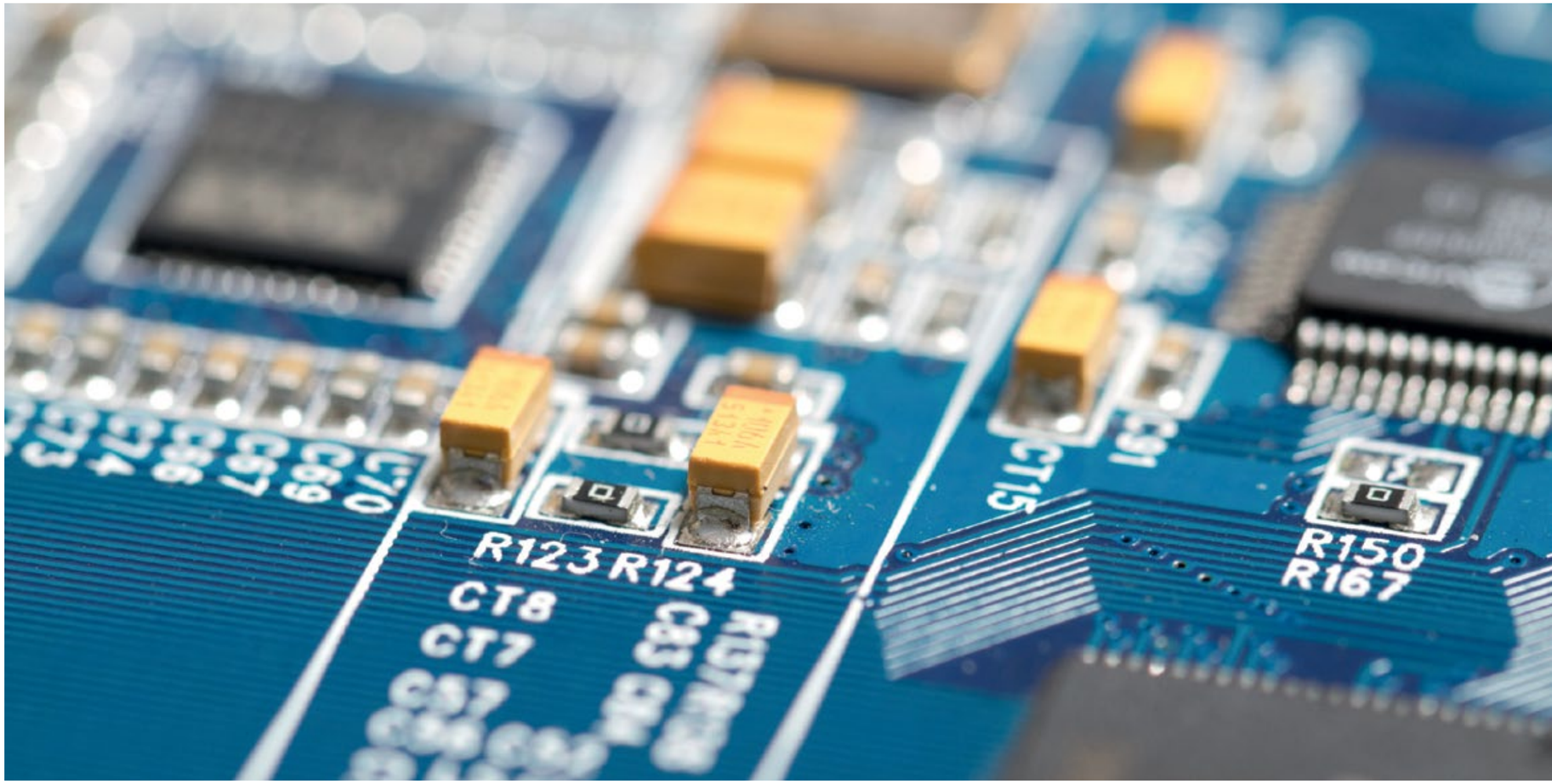
Terbium is outstandingly suitable as a component in a balanced portfolio of strategic raw materials. Buyers can therefore benefit from the long-term opportunities presented by this rare earth element.

65
Tb

Facts:

Colour:	Brown (in oxide form)
Melting point:	1,356 °C
Specific weight:	8.25 g/cm³

Use:
- Semiconductors
- High-temperature fuel cells
- Neodymium-iron-borum magnets



How Does a Tangible Asset Actually Work?

TRADIUM GmbH offers you the unique opportunity to buy technology metals and rare earth elements as tangible assets directly from the wholesaler. In the long term, this allows you to build up a balanced portfolio of precious metals, rare earth elements and technology metals.

With 30 years experience in the branch, Managing Director Matthias Rüth stands for security, transparency and excellent conditions. Annual inventory in the presence of an auditor, clearly-communicated costs and the best market information give customers the security they need. All this makes your tangible investment fast and uncomplicated.

CONSULTATION

Your interest has been awakened, or you already have an initial concept of what your portfolio should look like? We would be pleased to supply you with all the necessary information and explain the further steps. What technology metals and rare earth elements are likely to be most in demand and how does a tangible investment actually proceed?

OFFER

If you have decided on a tangible asset from TRADIUM, we would be pleased to compile an individual offer for you, made up of technology metals and rare earth elements. (By the way, you can also buy precious metals from TRADIUM.) If our offer meets with your approval, the raw materials physically pass into your ownership – once the bill has been paid.

STORAGE

For the safe-keeping of your raw material portfolio, we recommend the high-security bunker of our sister company, METLOCK GmbH. Here your metals and powders will be ideally stored and protected to bank security standards. Furthermore, thanks to the professional storage, we can ensure fast and safe liquidation.

METLOCK:
No Chance for Goldfinger

››› Unlike virtual investments such as shares or investment funds, tangible assets such as technology metals and rare earth elements have to be stored. This takes two things: A lot of space and a high level of security. TRADIUM's sister company, METLOCK GmbH, offers both.

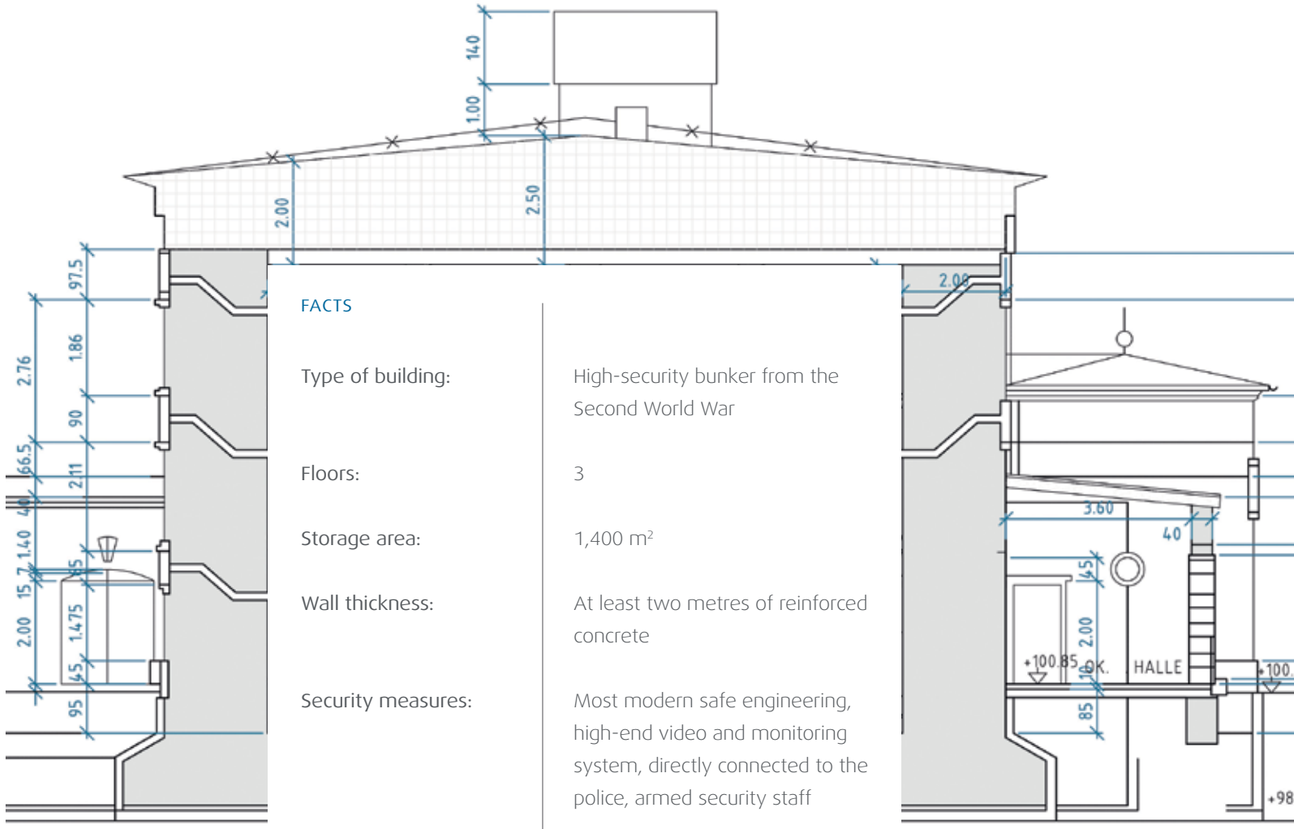
METAL + LOCK = METLOCK

The very name reveals what METLOCK is all about: Keeping metals behind bars. The core competence of METLOCK is the optimum storage of highly-valuable raw materials and other tangible assets to bank-level security standards. In order to achieve this, METLOCK works with a security concept best described in superlatives.

CONCEPT

Both the building and the concept set new standards: the reinforced concrete walls and ceilings of the bunker are at least two meters thick; the armoured door has numerous security systems of the latest generation. Further protection is offered by leading-edge sensor, monitoring and alarm technology.

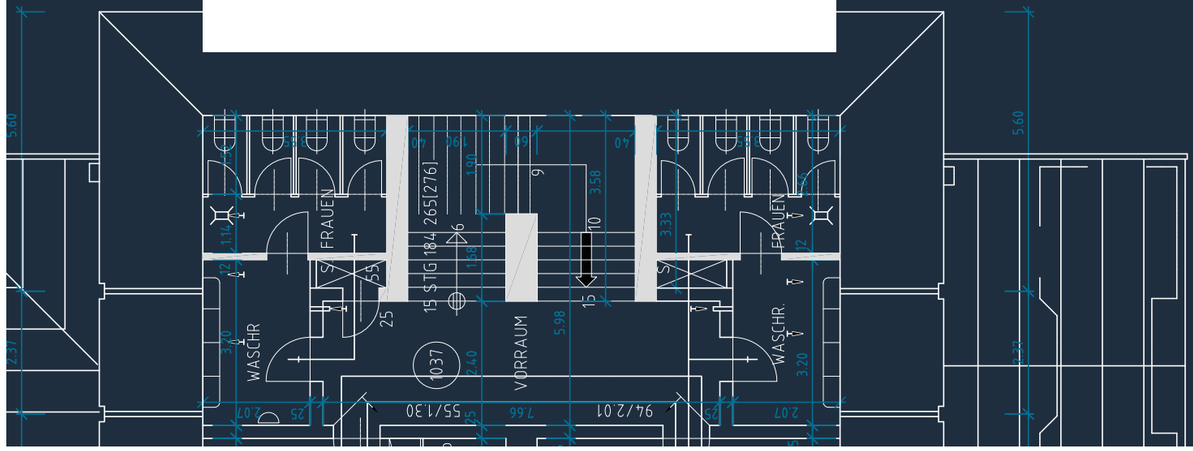
The alarm systems are directly connected to both a security service and the police. METLOCK goes that extra mile with armed security staff. The protection is supplied to a total safe area of 1,400 m². Nobody else takes this level of security precautions. Except, perhaps, Fort Knox.



FACTS

Type of building:	High-security bunker from the Second World War
Floors:	3
Storage area:	1,400 m²
Wall thickness:	At least two metres of reinforced concrete
Security measures:	Most modern safe engineering, high-end video and monitoring system, directly connected to the police, armed security staff
Special feature:	Bonded warehouse (permits storage without tariff burden and VAT)
Security level:	Extremely high (10 CD EX), comprehensive safeguarding of the assets, surpassing the risk requirements of the insurers
Further details:	On request

Further information, Images and plans can be found under metlock.com



An offer you shouldn’t refuse

››› With TRADIUM you can profit from the major opportunities presented by technology metals and rare earth elements as tangible asset.

The benefits to you:

- Inflation-protection and security in times of crisis
- Security through tangible purchase, no risk of non-payment
- Fast liquidation possible
- No management charge, no issue surcharge
- No withholding tax when held for longer than one year
- Secure storage through our sister company METLOCK
- No VAT due to storage in a bonded warehouse
- Only 2 % per year administrative costs
- Competent and individual customer service

We would be pleased to hear from you.

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The key element in your business

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