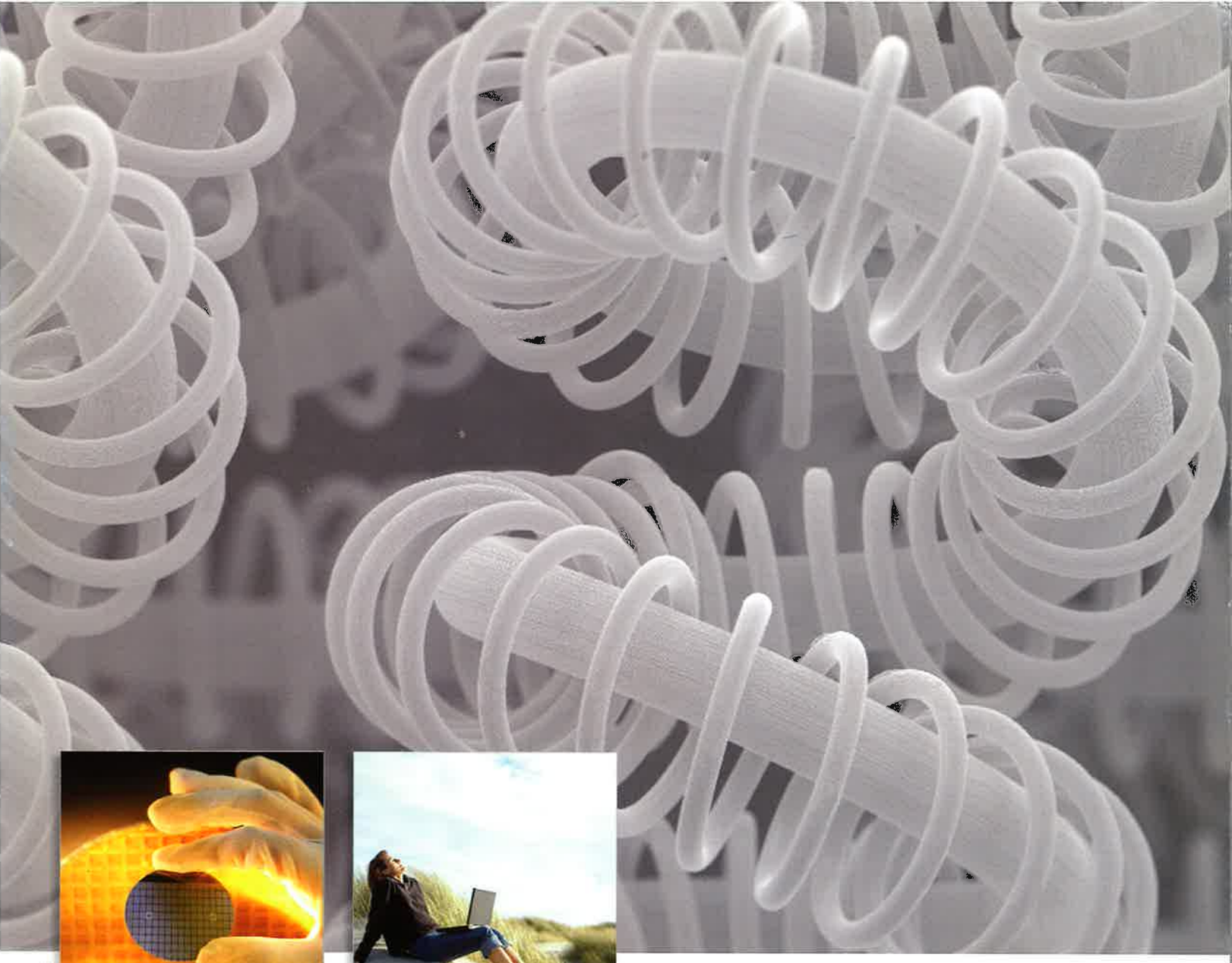


Go beyond

Innovation, total cost and sustainability
Philips Advanced Metal Solutions

PHILIPS

An ambition to go beyond

We have an honest ambition that underpins our capabilities in advanced and refractory metals. We want to deliver a solution for you that breaks new ground; that achieves and exceeds your aims through your products' lifecycle; and that uses technology to its known limits while minimizing our impact on the environment. We want to excel as your preferred partner for developing and manufacturing metal components, and to give you a competitive edge. Whatever you expect, we want to go beyond.

This brochure will illustrate how Philips Advanced Metal Solutions can energize and support your forward-looking technologies by focusing our efforts on innovation, total cost and sustainability.

Delivering advanced metal solutions

Philips Advanced Metal Solutions is the specialist in designing and manufacturing refractory metal components. Our services are stimulating and enabling a wide range of applications and industries. We're a global center of competence for our customers. Our R&D and manufacturing facilities complement companies that demand value-driven support, application specific solutions and zero-defect production. Our creative and knowledgeable development engineers are equipped with state-of-the art facilities, and we invest a significant percentage of our sales into R&D. From specific manipulation of metal properties through to mass production, you will find the solution here. Our components and R&D contribute to many industries, from lighting to health and automotive; opening opportunities for the energy market, aerospace, microelectronics, IT and other industries.

The extra mile

Nowhere is reliability more necessary than on the road. Our tungsten products play a vital role in the automotive industry where durability and quality must go beyond the norm. Our components can be found in streetlights, all types of lights installed in the car, as well as in heated windscreens.

Large cover photo

Fluorescent lamp triple coil, magnified 200 times.

Going beyond in innovation

Innovation is vital to your continued success, as well as our own. We have innovated and improved our metal components every day since our formation. Every day. We never stop looking to do things better, and to put exciting new ideas into practice.

That's because our primary focus is you – the innovator in industry. If we can set the pace in advanced and refractory metals, you can set the pace in your sector. And our innovation goes much further than you might imagine.

The key is working alongside you in partnership, to understand your needs, limitations, budgets and projections – and to help you exploit your potential.

When you have a problem, we can develop the solution through research and understanding of what's possible. We combine our in-house expertise with strong relationships with research labs and universities.

To make this possible we have built Philips Advanced Metal Solutions around your needs for service and product delivery. You'll find our regional and key account managers in strategic locations across the world, ensuring you benefit from a global presence backed up by knowledge on the ground.

Going beyond in cost control

We understand that any product has stages in its lifecycle. That's why we've established a dynamic, layered approach to service and production. We give you the production support you need, when you need it.

Our customer-driven approach is focused on adding value to your processes at every level and every stage of your product lifecycle, wherever we sit in the supply network.

Our zero defect manufacturing approach plays a crucial part in this. High process control and precision engineering even at high volume minimizes waste and errors while aligning your product with the most compelling demands for quality.

We support the fast industrializing of new products and technologies. Our facilities in Central and Western Europe, as well as networks in China and India enable us to keep our production processes for mature products lean and mean to keep you total cost competitive.

Cost control

Our consideration of your needs at every stage of a product's life – from invention to mass production – enables you to drive value through your production process, minimizing total cost of production while maximizing quality and performance.

Green switch

We significantly reduce the environmental impact of our products and processes by consideration of energy consumption, waste production and emissions to the air and water.

Going beyond for sustainability

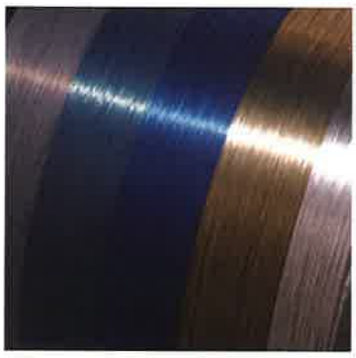
We look upon sustainability as the link between our social, economic and environmental values. We cannot view profit as the ultimate aim of our business. Ours is an industry involving the planet's raw materials, and we must respect the efficiency of their use, their wastage and the impact on the world.

The policy that we pursue upholds these values, and ensures we are compliant with even the strictest environmental regulations.

This attitude ensures the stability and longevity of our business as a whole, creating harmony between the needs of our staff, stakeholders, customers and wider world. It's a policy that we encourage our partners to follow. It is also why Philips has led the 'green switch' initiative to encourage governments, industries and consumers to move from incandescent to energy saving lamps.

Competencies

It has taken Philips Advanced Metal Solutions decades of tireless work to build the understanding of refractory metals in order to exploit them to their full potential. It's reassuring to know that we have developed the knowledge, tools and abilities to be competent in every sphere of their use. And that means being effective for you.



Zero defect control

We take production control seriously and can apply a zero defect approach to the manufacturing process. It is founded on a regime of quality assurance, process control and six sigma methodology in manufacturing which ensures utmost safety, lifetime excellence and continuously improved performance. Our certifications include ISO 9001, ISO 14000 and OHSAS 18001.

Lean and mean production

We can partner with you from the embryo stage of a product to its mass production. Our facilities are in place to ensure we make production lean and mean, providing:

- a rapid response and reaction to your and the market's needs
- worldwide logistics support
- lead time performance
- maximum value and return on investment.

Material properties design

Refractory metals have many specific properties, and our role is to influence these properties to suit almost any practical use. We apply various techniques to change these properties.

Doping and alloying

We can influence the properties of tungsten and molybdenum by intentionally adding other materials to the pure metal.

Doping allows us to significantly influence:

- mechanical properties: such as creep, strength, rigidity, plasticity, elongation, ductility and weldability
- chemical properties: such as resistance against oxidation, corrosion and catalytic activity
- electrical properties: such as conductivity, resistance and work function
- physical properties: such as electron emissivity and thermal resistance.

Quality of life

Quality control is a key consideration in medical applications. Our refractory metals can be found in X-ray equipment, CT and PET scanners, with molybdenum and tungsten parts within the detector array. Tungsten also acts as a barrier to the X rays themselves.

Heat treatment

We can affect the mechanical strength and electrical properties of refractory metals through heat.

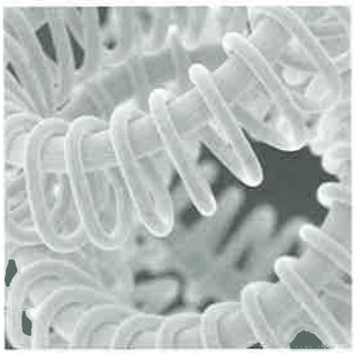
Bar and wire processing

We can process tungsten or molybdenum to be extremely pure, or create alloys with a range of properties. From this we turn the metal into wires, coils, electrodes… in fact, virtually any other form you need.

Surface treatment

The surface of the product affects its interaction with other materials. We can adopt techniques such as etching and laser treatment to clean, smoothen, roughen and polish the product.

Shaping technologies



Magnitude: 200 x

Metal injection molding (MIM)

Complex and precise production of components has been advanced through metal injection molding and, at a microscopic level, by micro injection molding (µMIM).

There are several advantages in addition to 3D precision. We can dope the metal, avoid welding by connecting different materials together and define the density and porosity of the product. MIM can be a reliable and cost-effective way to achieve the product you need. With tolerances within a few microns, MIM removes many of the operations you might expect from machining and shaping.

Lasers

Tungsten is a difficult material to shape, not least because it has one of the highest melting temperature of all metals combined with extreme hardness and brittleness. Lasers have revolutionized the possibilities of tungsten. Even the smallest surface structures can be produced – and reproduced time and again. This makes micro-mass production possible – and highly efficient.

Lasers can also cut, heat and weld at this scale, and ablation is a valuable resource for our customers – turning metal into vapor so that even the finest of structures can be created without changing the properties of the remaining metal.

Coiling

It's hard to imagine a coil of tungsten that is made from wire of 14 µm – and potentially even thinner. It's even less conceivable that a double coil can be made at this scale. You shouldn't be surprised, then, that Philips Advanced Metal Solutions can make triple coils at this size with complete accuracy to comply with high-speed lamp production line requirements.

Making light work

Philips Advanced Metal Solutions established its expertise in a field of tungsten filaments, making the coils, electrodes and wires that have helped illuminate millions of homes across the world. Today Philips is leading the move from incandescent to new lighting products that conserve energy, but still have tungsten at their heart.

Wire

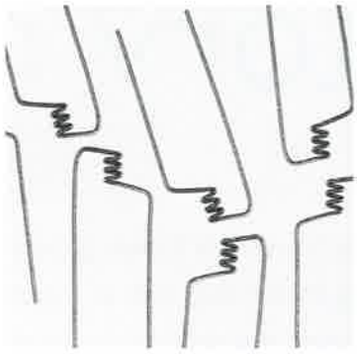
We design our wire properties to meet your needs, with a focus on its properties and accurate tolerances:

- controlled (+/- 1%) diameter down to 8 µm
- controlled (+/- 3%) resistance range from 30 Ω to 250 Ω
- smooth surface, without defects (no split, no noise)
- non-sag properties, excellent interlocking structure
- defined color
- annealing, heated stretching, straightening, electrolitical cleaning.

Coils

We create coils to suit your bespoke requirements and also have the facilities to mass produce common or high-volume coils. Our capabilities include:

- free shapes
- single, double and even triple coiling
- customer specific design and production of highest quality and lifetime coils
- high-level dimension control
- non-sag properties.



We produce coils to any specification and shape, without sag and maintaining the highest quality for a lifetime. Our investment in the finest, accurate machinery gives you the flexibility of mass production or bespoke small-scale production. Our capability is enhanced by the quality of the tungsten wire we produce.

Wire

There's a good reason why we make more than 4 billion meters of tungsten and molybdenum wire per year (which could wrap the globe 100 times). We design it to suit a vast array of customers' needs, with many variations in its make-up – from its material and surface properties through to diameter ranges of 1.3 mm to just 8 µm, a fraction of the diameter of a human hair.

Free miniature forms

Our combined technical competencies enable us to make and manipulate virtually any shape, and reproduce components as small as a few microns on potentially a mass scale.

Magnitude: 10 x

Magnitude: 50 x

Going beyond in refractory metals

Philips Advanced Metal Solutions is known globally as the competence center for high melting point metals such as tungsten and molybdenum. When you have a problem that needs to be solved – such as achieving resilience to high temperatures or attaining a specific mechanical property of a component – we can help.

Historically we have used refractory metals extensively in lamp filaments and discharge lamp electrodes. Our research into their properties has opened new avenues for these versatile metals. In turn this opens new possibilities in, for example, the aerospace, automotive, health, electronics, music and chemical industries. We are at the forefront of development and understanding of what you can achieve.

With our state-of-the-art facilities dedicated to research, processing and production you have an advantage when you approach us with a specific requirement to be reached.

For more details on what we can achieve for you, please contact us. Working together, we can go beyond what you believe to be possible.

Natural resources

When we use natural materials from the earth, we take on the weight of responsibility that comes with it. It is only natural, then, that customers place the care of the planet in our hands, and as a center of excellence we build this into every idea, every solution and every product we create.

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