



## Heraeus Precious Metals



# Heraeus Precious Metals

## The Precious Metals Specialist at Heraeus



Mankind has always been fascinated by precious metals. They have accompanied us throughout the ages: initially as jewelry, as objects of religious worship or as currency, later as a fundamental constituent of technological evolution. Today, for instance, no electronic device would be able to function without one of the conductive, heat resistant, formable and robust precious metals.

With the original process for melting platinum, Wilhelm Carl Heraeus laid the foundation for Heraeus in 1856. Today the precious metals and technology company operates successfully throughout the world. Heraeus Precious Metals is the precious metals specialist company within the group and produces innovative, technologically demanding products in areas with great future potential: environment, mobility, communications, energy and health.

The developments of Heraeus Precious Metals are largely invisible to the observer; they are, however, indispensable components in a wide variety of products which make every-

day life easier for mankind. Today the production facilities for the extraction and processing of gold, silver, the platinum group metals and special metals are distributed across the whole world and are entwined in a closely knit network of companies.

Our in-house precious metals management with industrial precious metal trading provides a complete representation of all the processes in the precious metal cycle – from purchasing to recycling the valuable materials. With the competence acquired over many years, the precious metal management ensures the efficient supply of valuable and rare raw materials.

As a global leader in technology Heraeus Precious Metals has set itself high goals and, in all fields of business, is determined to belong to the leading suppliers worldwide. In order to achieve this, the company gathers its strengths into technology fields in which it can employ its core competencies most effectively. With employees acting on their own initiative and an integrated management system, a healthy and sustainable growth can also be achieved.

In this way Heraeus Precious Metals will continue to be the preferred partner for its customers in the future.



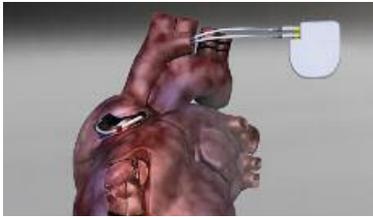
# Heraeus Precious Metals

## Key Markets and Industries



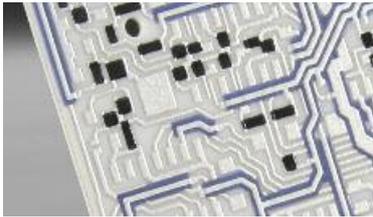
### Chemical and Pharmaceutical Industry

The product range for the chemical industry is very broad. Just one of many examples are the catalysts coated with precious metals which play an important role in keeping the environment clean not only in combustion engines but also in large scale chemical processes. Today active constituents containing platinum play a decisive role in the treatment of cancer. Heraeus Precious Metals is one of the market leaders in their production.



### Medical Technology

The need for medical services is growing steadily with increased life expectancy and improved standards of diagnosis. Components are becoming smaller and more demanding to support miniaturization of implants like cardiac pacemakers and other devices including those used for the treatment of vascular disease. Heraeus Precious Metals is a worldwide market leader in this field.



### Electronics Industry

For years Heraeus Precious Metals has been one of the leading manufacturers of materials for the packaging of integrated circuits in the electronics industry. Versatile thick film pastes, powders and polymers make possible the smallest electronic components which are robust and have good conductivity. Organic conductive polymer materials are widely used in the production of capacitors and antistatic films.

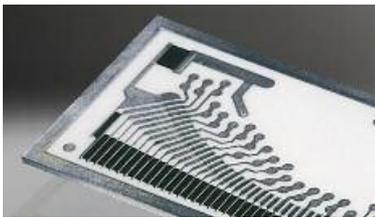


### Glass and Ceramics Industry

Whether trendy or classical, noble decorations on ceramics and glass have always been very popular. Using high grade precious metal colours, lusters and finely adjusted decoration systems from Heraeus Precious Metals, the widest range of ceramic decorations can be achieved to meet all demands for glass, porcelain and tiles.

### Further Markets and Industries

- Fuel cell technology
- Communications and telecommunications
- Environmental protection and environmental technology
- Laboratory and analysis
- Lamp and lighting industry
- Measurement, control and process technology
- Prosthetics and implants



### **Automotive and Commercial Vehicle Industry**

In the automotive industry the products of Heraeus Precious Metals are also indispensable. Thick film pastes from the Thick Film Materials Division are in demand wherever space is at a premium and the environmental conditions are too extreme for conventional circuits. The products are used in electronic circuits and in passive components such as engine control units, fuel senders or temperature sensors.



### **Alternative Energies**

If we are talking about environmentally friendly energy, solar technology currently offers a suitable solution for a wide variety of applications. Conductive pastes, for example, must be capable of conducting the current created by the solar cells reliably in a compact space under all the weather conditions and maintain its performance for over 20 years. A Heraeus Business Unit devotes itself solely to the development and production of contacting pastes for this market.



### **Precious Metal Trading**

The Trading Division is part of Heraeus Precious Metals. With a total of four precious metal trading units worldwide it is in a position to control the complete precious metal cycle: from purchasing, processing and manufacturing to recycling. Furthermore, the Precious Metal Trading Division is a leading supplier of precious metal bars for investors and banks.



### **Recycling and Refining**

Ecological and economical interests meet when it is a matter of extracting rare precious metals from production residues and used products. As technological leader in this field Heraeus Precious Metals achieves an excellent rate of recovery of these materials, thus making an enormous contribution to maintaining resources which are globally in short supply.

# Trading Division TRD



The main task of the Trading Division is to provide Heraeus production facilities with precious metals, i.e. in many cases, with their most important raw materials. The highly specialized employees of the Trading Division manage all risks that arise with regards to the quality of the precious metals, the price variations and the necessary financing.

All precious metal requirements within the Heraeus Group cover in the Trading Division. This applies to both purchases and sales. The traders react promptly to price movements on the international markets and are thus in a position to offer Heraeus' customers competitive prices for gold, silver and the platinum group metals at any time.

With trading offices in Hanau, New York, Hong Kong and Shanghai, Heraeus covers all time zones and can offer customers a comprehensive service which extends beyond state frontiers and economic systems.

Amongst the customers of the Trading Division are not only the other Divisions with their Business Units and their respective customers but also companies that simply wish to purchase raw materials from Heraeus or to complete hedging deals. In addition, there are also the institutional investors who buy physical precious metals or maintain weight accounts. Via banks and precious metal trade houses, Heraeus also offers investment bars to private individuals in many parts of the world.

## Worldwide Trading Units

- Hanau (Germany)
- New York (USA)
- Hong Kong (China)
- Shanghai (China)



Gold granules



Heraeus platinum bars

# Precious Metal Cycle and Management



The supreme competence of Heraeus Precious Metals can be seen in their mastery of the complete precious metal cycle. Only through the control of all steps in the production chain can the highest quality of the products be guaranteed at all times.

The extraction of the precious metals marks the beginning of the cycle. Risks regarding price fluctuations are eliminated by long term supply contracts with mining companies which, together with the recycling, ensure access to the necessary raw materials. The precious metal management operates as the control center during the complete cycle. For instance, it controls purchasing and selling through the Precious Metal Trading or the return delivery of products containing precious metals.

In refining, the precious metals are extracted from the ores or primary metals in the required degree of purity. This is where the actual core business of Heraeus Precious Metals begins: the production of innovative and technologically demanding products for the diverse key markets.

The reclamation of precious metals from production residues or used products is of decisive economic and ecological significance. This is where the precious metal cycle completes its circuit through recycling and refining. The great strength of the company lies in the generation of worldwide uniform standards, production processes and purities.

27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.61
45 Rh 101.07	46 Pd 106.36	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71
77 Ir 223.03	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2

Extract from the periodic table of the elements



Precious metal sponge

## Precious Metals

- Ag
- Au
- Ir
- Os
- Pd
- Pt
- Rh
- Ru

# Chemicals Division

## CHD



In the organizational structure of Heraeus Precious Metals, individual Business Units are grouped together in what are known as Divisions. The Business Units which are united in the Chemicals Division are those whose products have their main customers in the chemicals industry or those which, for the manufacture of products, primarily employ complex chemical processes.

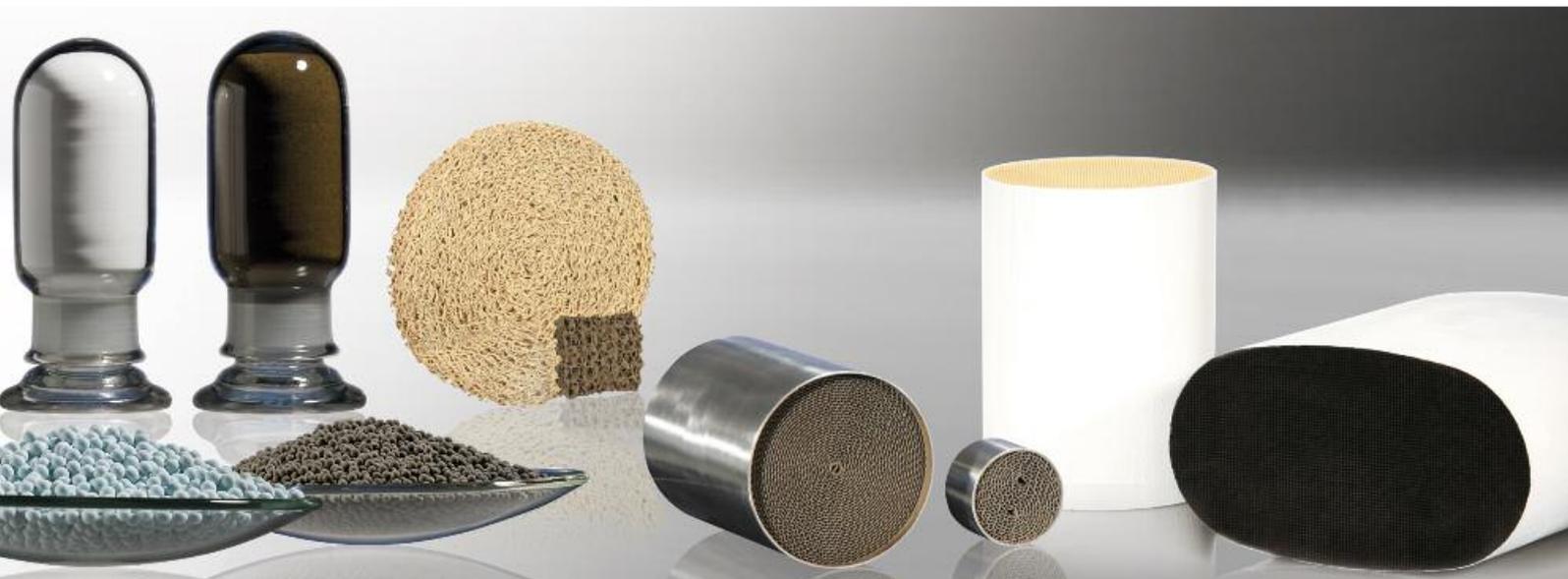
Besides exhaust gas catalysts, the Business Unit Catalysts principally manufactures catalysts for use in the chemical industry. Using chemical processes, the Business Unit Chemical Products supplies synthesized precious metal

compounds to many branches of industry. In contrast, the Business Unit Pharmaceutical Ingredients with its highly active agents is focused solely on the pharmaceutical market. Their products are also mainly manufactured by chemical processes, but are also being increasingly produced using biological technology.

In the recovery of precious metals from production residues or used products, aqueous chemical processes are mainly used alongside melting processes. This is why the Business Unit Recycling is to be found in the Chemicals Division.

# Catalysts

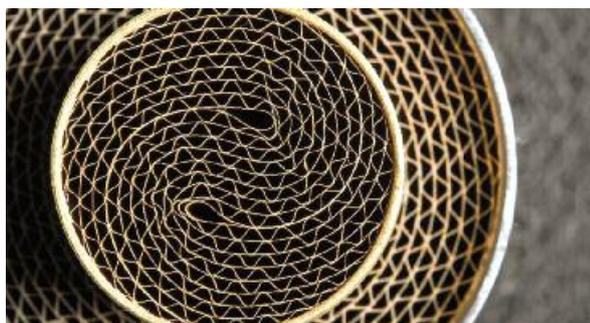
## CHD-CA



In the chemical industry it is nearly impossible to find a process which runs without a catalyst. This widespread prevalence is easily explained if one examines their exceptionally advantageous properties more closely. A catalyst accelerates chemical reactions, increases the reaction yield at reduced energy input and afterwards remains unchanged.

The product program of the Business Unit Catalysts comprises chemical catalysts, environmental catalysts and special catalysts. Various support systems and coatings, individually tailored to customers' requirements serve as the basis.

The products are used, for instance, in the petrochemical industry for the production of aromatic compounds, in the manufacture of plastic materials (PET/PTA), for the reduction of pollutants ( $N_2O$ ), for the manufacture of high purity technical gases or in fuel cells. Emission control catalysts are offered for small engines, motorcycles and automobiles, commercial vehicles, ships and industrial diesel engines. Furthermore, they are used worldwide in the purification of industrial exhaust gases.



3-Way catalyst



Oxidation catalyst

### Markets and Industries

- Automotive and commercial vehicle industry
- Chemical industry
- Environmental protection and environmental technology

# Chemical Products

## CHD-CP



A broad spectrum of precious metal compounds and solutions for industrial requirements is the hallmark of the Business Unit Chemical Products. Besides a comprehensive program of inorganic precious metal chemicals and their solutions, organometallic compounds and homogeneous catalyst are developed and produced globally on a commercial scale.

The products are used worldwide in key technologies of various branches of industry such as the chemical, pharmaceutical, energy and automotive industries and in surface technology or the jewelry industry.

Selected non-precious metal compounds are also part of the portfolio. Rhenium, for instance, is used in "superalloys" under extreme conditions in aircraft jet engines and stationary power turbines.

The Business Unit Chemical Products is also your reliable partner for the research and development of new compounds for future oriented markets such as light emitting diodes, CVD processes or photovoltaics.

Customer proximity and service account for the success of the Business Unit Chemical Products.

### Markets and Industries

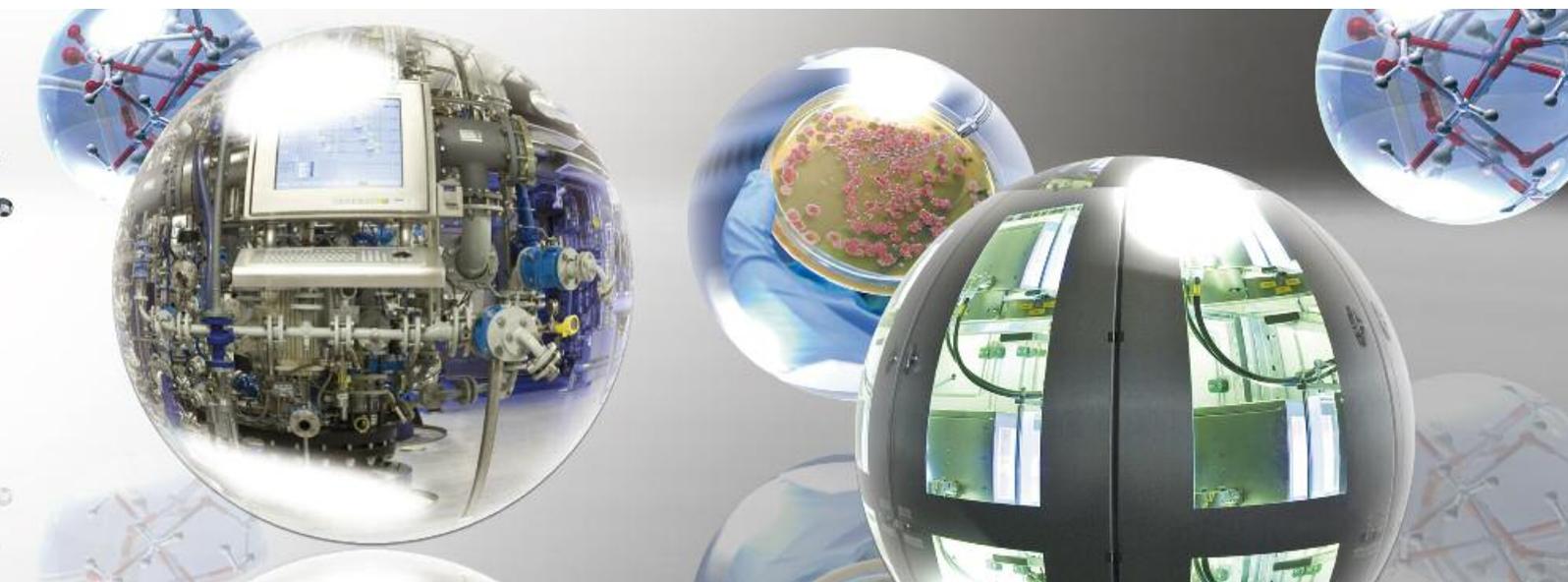
- Chemical and pharmaceutical industries
- Photovoltaics
- Electronics
- Automotive industry
- Lamp and lighting industry



Wilkinson catalyst

# Pharmaceutical Ingredients

## CHD-PI



The manufacture of active ingredients for the pharmaceutical industry is the core business of the Business Unit Pharmaceutical Ingredients. Its focus is the manufacture of highly potent active pharmaceutical ingredients (hAPIs), such as Cisplatin, Carboplatin, and Oxaliplatin – compounds containing precious metals for cancer therapy.

Besides the production of generic hAPIs, the Business Unit specializes in the development and the manufacture of new chemical entities; and in close co-operation with our customers we provide exclusive research and development services

for new agents. These projects pass the full range of clinical phases until taken over into commercial production.

Also in the promising field of biotechnology, the Business Unit Pharmaceutical Ingredients is a preferred partner for the pharmaceutical industry. Through fermentation hAPIs are manufactured more economically than just by chemical processes. The key strength of the Business Unit is the combination of chemical and biotechnological manufacturing capabilities. Only a few companies worldwide can offer such expertise.



Compounds in powder form

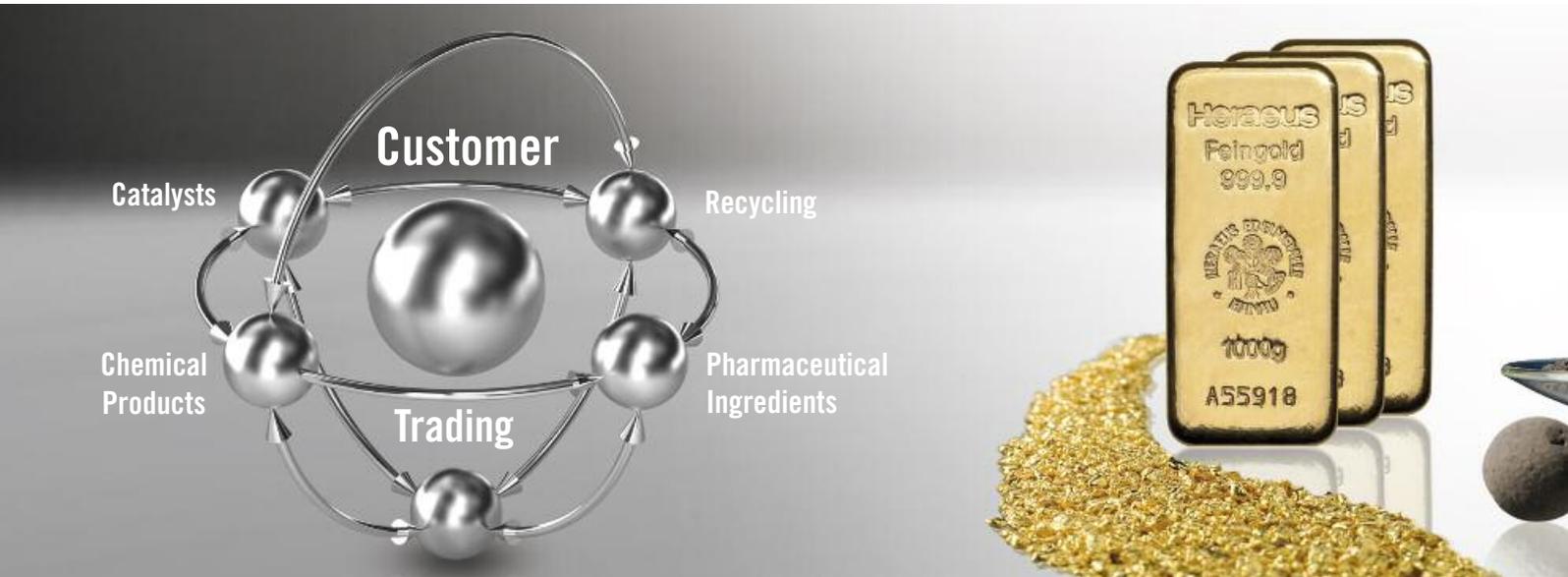


Analysis in our own laboratory

### Markets and Industries

- Pharmaceutical industry

# Recycling CHD-RC



Today precious metals are used either during production or in the product itself in almost all industrially manufactured products, be it in automobiles, cell phones or the window panes of a modern building. Recycling and processing are the preconditions for the economically and ecologically worthwhile application of precious metals. Therefore, it is necessary to recover, for instance, gold and platinum from production residues and from used products. In this case, however, one soon comes up against technical and logistical challenges which have to be resolved. For one thing, in many products precious metals are only present in small quantities, for another they are firmly joined to or mixed with a variety of materials. Heraeus Precious

Metals masters the demanding technologies and processes which are needed in order to extract the valuable precious metals in an ecologically sensible manner and to return them to the required purity.

Apart from ensuring supplies for the company, recycling renders an important contribution to environmental protection and careful handling of resources. For this reason Heraeus Precious Metals has from an early stage continually built up recycling as an essential component of the precious metal cycle. The Business Unit Recycling today successfully processes primary and secondary concentrates, industrial catalysts, alloys and residues

#### Markets and Industries

- Precious metal mines and smelters
- Chemical and pharmaceutical industry
- Petrochemical industry



Processing to pure precious metal solutions using complex chemical processes



from the precious metal processing industry and makes the retrieved precious metals available to our customers. With versatile aqueous chemical and melting processes all precious metals can be retrieved in the desired purity.

Through constant transfer of technology and a comprehensive quality management system uniform standards are guaranteed at all locations. In this way the worldwide production processes and the purity levels meet the internationally specified standards. As a result, the Business Unit Recycling can act on the market offering a high level of retrieval and competitive conditions.

Worldwide locations for processing and recycling:

- Hanau, Germany
- Mendrisio, Switzerland
- Taicang, PR China
- Shanghai, PR China
- Hong Kong, PR China
- Udaipur, India
- Port Elizabeth, South Africa
- Newark, NJ, USA
- Wartburg, TN, USA
- Santa Fe Springs, CA, USA



Chemical processing of aqueous solutions containing precious metals

#### Markets and Industries

- Magnetic data storage
- Jewelry, dental and glass industries
- Production residues from the electronics industry

# Conductive Polymers Division

## CPD



The Conductive Polymers Division (CPD) product portfolio includes the monomer Clevios™ M V2 (ethylenedioxythiophene), a family of oxidizers and a range of Clevios™ PEDOT:PSS polymers, optimized for specific industries. As there are a broad range of applications, the business is divided into three distinct Business Units.

The CPD Business Unit Components (CO) provides materials to the capacitor and printed wire board industries.

Demands made on capacitor components are constantly increasing. Miniaturization and improved performance requires reliable innovative materials for electronics. Increasing processor speeds demand improved components with low series resistance, which is only achievable with

Clevios™ conductive polymers. Extreme temperature loadings and increasing demands on the lifetime of components requires higher durability components. Due to the excellent properties of Clevios™, the performance capability of the newest generation of tantalum and aluminum capacitors is significantly increased.

The CPD Business Unit Functional Coatings (FC) delivers Clevios PEDOT: PSS conductive polymers for the following applications:

- Antistatic polymer coatings
- Electronic packaging
- Touch screens
- Film strips for photography

### Market and Industries

- Capacitors industry
- Printed Circuit Board industry
- Touch Screen industry
- Electronics industry



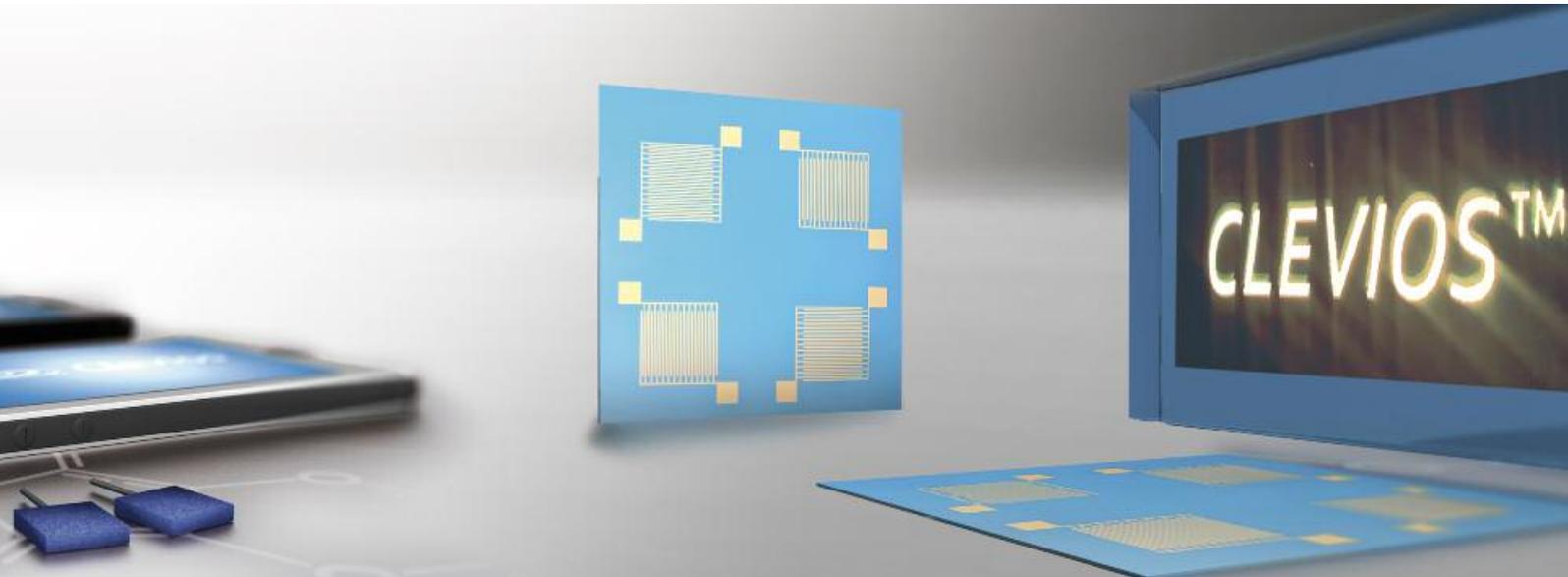
Clevios™ dispersions



Patterned highly conductive Clevios™

# Conductive Polymers Division

## CPD

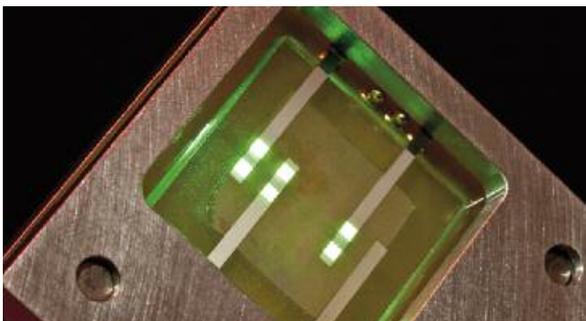


In the world of electronics touch screens are increasingly making their presence felt in navigation systems, cell phones and tablet PCs. Up to now indium tin oxide has been used here as the material for transparent electrodes. It has, however, only limited availability and does not stand up well to mechanical loading. The conductive polymer CLEVIOS™ solves these problems and also makes it possible to manufacture the touch screens more simply and economically.

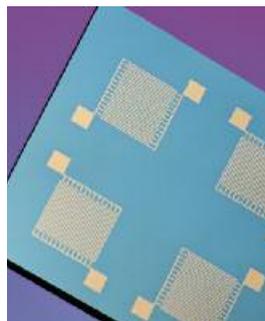
The CPD Business Unit New Technologies (NT) innovates and develops new applications for conductive polymers.

The emerging technology organic light emitting diodes (OLEDs), in which Clevios™ P materials are incorporated, will in future be used in displays and large area lighting for rooms. Clevios™ improves efficiency of the device and reduces defects through providing smooth surfaces. New generation OLEDs will use less energy and ultimately provide light at lower cost.

In the future printable, economic, organic materials will be used for the manufacture of electronic circuits and solar cells instead of silicon. With its electrical properties and its simple processability, Clevios™ is making a considerable contribution to the rapid development of these new technologies.



Organic light emitting diodes



Organic field effect transistor

### Markets and Industries

- Coating technologies
- Display & Lighting industry
- Solar industry
- Printable electronics

# Medical Components Division

## MCD



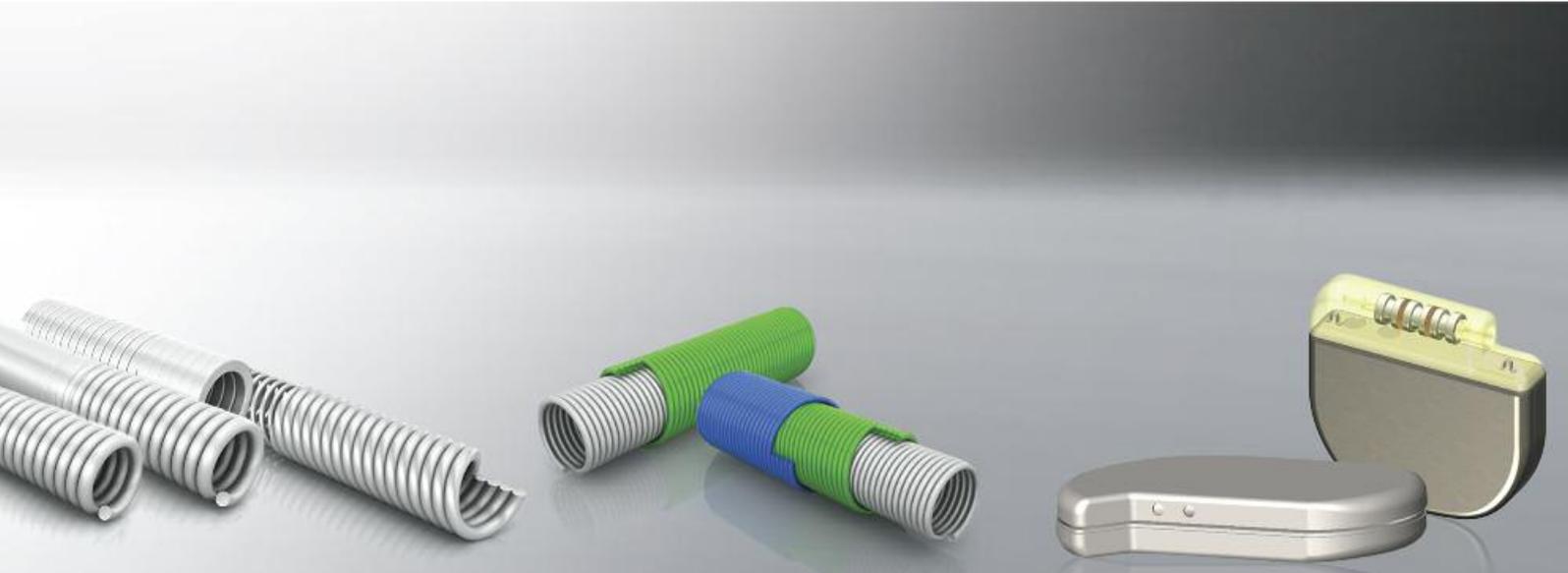
The Medical Components Division develops and manufactures both individual parts and complex components for the medical technology industry. They find their application in, for instance, active implants such as cardiac pacemakers and neurostimulators and also in catheters and implants for the treatment of vascular and neurovascular diseases.

Particularly in demand is the ability to manufacture increasingly small and complex precision micro components for devices developed to perform multiple functions in the body's vascular and nervous systems. The Medical Components Division offers a unique spectrum of technologies and specialized production processes.

Biocompatibility, corrosion resistance, and sufficient strength must be guaranteed in the development and manufacture of alloys for the medical devices. Semi-finished products and micro-precision parts are manufactured from cast ingots. Special coatings adapt the surface of these components to their intended application. Wires and tubes are ground, formed and coiled. Plastic injection molded features are added to these parts as required. The precision stamping of titanium shell halves provides the casings for a wide range of implants.

# Coils / Implantable Housings

## MCD-CO / MCD-IH



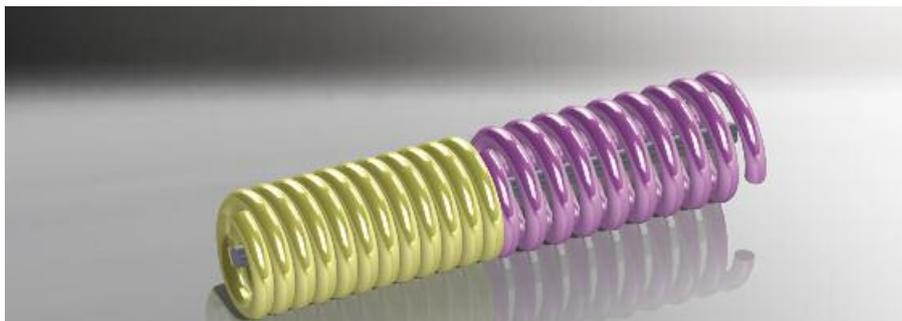
### Coils

Material technology and the ability to draw ultra-fine wires are combined with a broad spectrum of manufacturing processes for coils of all dimensions and configurations. Fine wire coils, with diameters smaller than a human hair, are implanted in aneurysms in order to stabilize these through embolization.

Multilayer coils transmit torque and thus are used to manufacture thin catheters with rotating tools, for instance, for intra-vascular ultrasonics (IVUS) or atherectomy. Heraeus BiFlex™ and TriFlex™ Torque Coils give you the required reliability for your application.

### Implantable Housings

The casings for active implants such as cardiac pacemakers and neurostimulators are produced from titanium alloys. A proprietary forming technology which dovetails the shell halves together makes assembly easier for the customers and increases the reliability of the laser welding process.



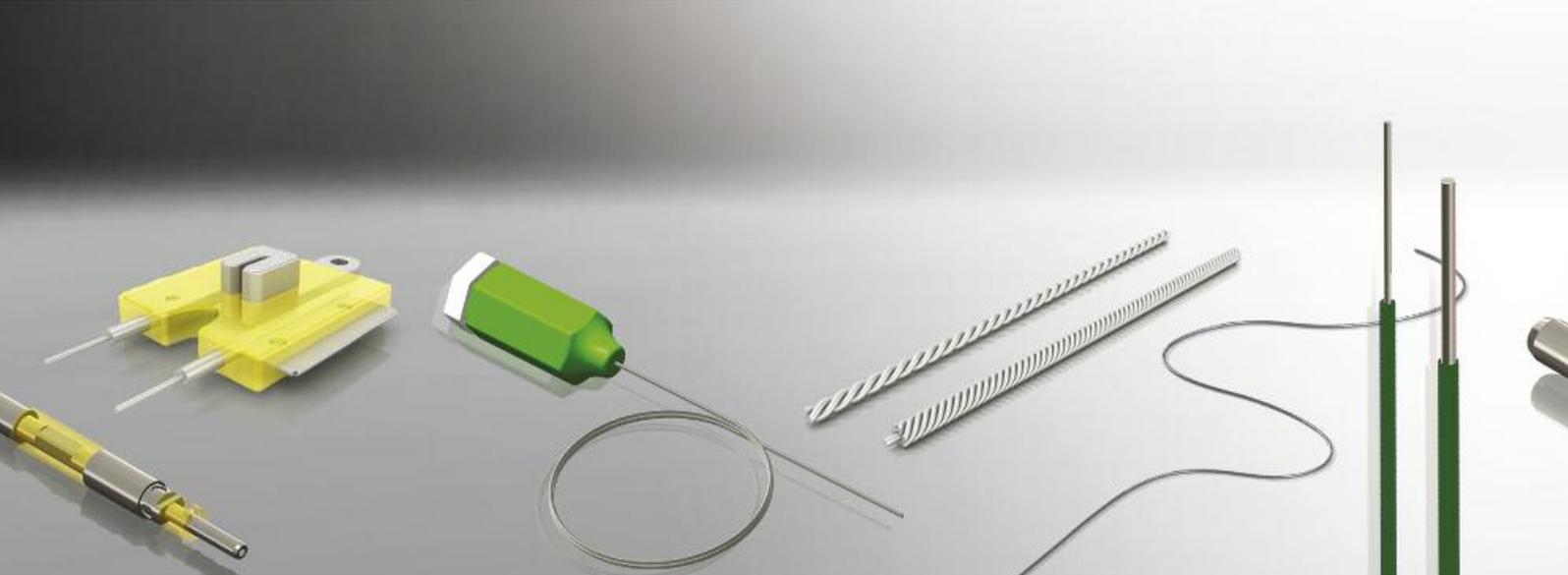
Dual Pitch Medical Coil

### Markets and Industries

- Medical technology
- Cardiology
- Interventional radiology
- Neurology
- Surgery

# Assembly and Molding / Medical Wire

## MCD-AM / MCD-MW



### Assembly and Molding

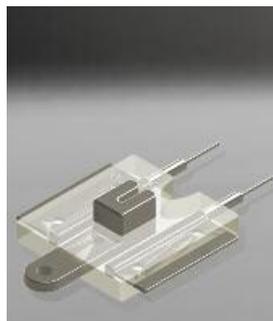
The combination of different metal components with plastic parts permits the production of complex assembled products. In-house plastic injection molding allows MCD to support our customers from initial concept through production. As an example, stylets assembled from engineered wire and plastic components, help the doctor to implant cardiac pacemakers reliably.

### Medical Wire

Extremely high demands are made on material properties in medical technology. Quality simply cannot be compromised. Among other things mechanical properties, corrosion resistance, electrical conductivity, shape memory and especially biocompatibility are given special consideration in the finishing and preparation of the alloys. In addition to precious metals, refractory metals and high performance alloys are processed. Depending on the requirements, the materials are offered as ingots, rods, strips, tubes, wires or wire products. To achieve desired surface properties various functional polymer coatings can be applied.

### Markets and Industries

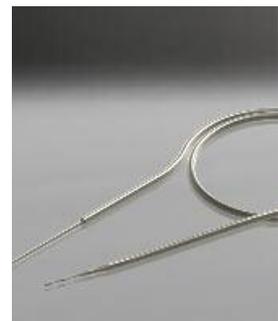
- Medical technology
- Cardiology
- Interventional radiology
- Neurology
- Surgery



Medical Tooling



Ablation Catheter



Ground Medical Wire

# Machining/Wire and Tube Components

## MCD-MA/MCD-WTC



### Machining

A comprehensive program of mechanical processing is included in the spectrum of services provided by Heraeus Medical Components. In precision turning centers, for example, medical components are manufactured both as individual prototypes and also in large scale, long run production. Processes include milling, turning, laser cutting and EDM (electric discharge machining). Thus, even complex geometric shapes can be manufactured in the smallest components. Surface coatings improve compatibility with the body and the medical function.

### Wire and Tube Components

A catheter must include different properties over its length so that the doctor can move it reliably to the treatment

area. Some portions of the catheter are soft and flexible, others strong and rigid. Heraeus Medical Components forms wires and tubes for this purpose. They are straightened, ground and profiled at the tip. In this way one can prevent balloon catheters from kinking at the transition between the stiff metal shaft and the soft plastic tip. Different metals are reliably welded with lasers. Polymer coatings of PTFE ensure that the instruments effortlessly slide through each other. Components are produced which are less than a millimeter in diameter but more than a meter in length. This permits the surgeon, entering via the artery in the patient's thigh, for example, to accurately position implants in the blood vessels of the brain or to remove blood clots from this area.



Implantable Lead Electrodes

### Markets and Industries

- Medical technology
- Cardiology
- Interventional radiology
- Neurology
- Surgery

# Thick Film Materials Division TFD



Developed over the decades, the competence in the high precision application of functional and decorative coatings on the widest range of materials is united by the Business Units Precious Colours, Thick Film and Photovoltaic under one roof – the Thick Film Materials Division (TFD).

Although the products of the Business Units are applied in very different areas, they do have one aspect in common. The processes with which the precious metal coatings are applied are very similar and have their origin in printing

technology. This common expertise is the basis for a broad range of products. For instance, the screen printing process is used not only for the application of glass decorations but also for modern electronic circuitry.

The metallic or siliceous coating are valued worldwide and are used in a multitude of applications ranging from air and space travel, communications technology, and photovoltaic to the glass and ceramic industry.

# Precious Colours

## TFD-PC



One of the most visually attractive possibilities for the use of precious metals is decoration and finishing. In this way durable objects suitable for investment can be created from basic articles for everyday use. In extremely thin layers precious metal colours, lusters and finely adjusted decoration systems embellish glass, porcelain, or tiles.

The decoration methods are as varied as the materials. The high quality decorating materials are applied by brush and spray coating, or by screen or pad printing processes.

The Business Unit Precious Colours works continuously on the further development and improvement of its products to ensure that these stand up to permanent usage in daily life.

The combination of more than a century of experience in the manufacture of decorative preparations with the most modern production technologies makes it possible to provide optimal products for individual applications and requirements.



Porcelain decoration



Luster colours for glass

### Markets and industries

- Glass and ceramics industry

# Thick Film TFD-TH



The Business Unit Thick Film is specialized in the manufacturing of innovative thick film and resinate pastes, fine precious metal and glass powders, LTCC materials and organic special chemicals. The thick film products, which are usually applied by screen printing, achieve thicker material layers than would be possible, for instance, by sputtering. They are in particular demand in cases where space is at a premium and the environmental conditions are too extreme for conventional circuits.

Besides their excellent technical properties, the new paste systems of the Business Unit Thick Film also offer a decisive ecological advantage. They are free from lead and cadmium and so meet all environmental regulations.

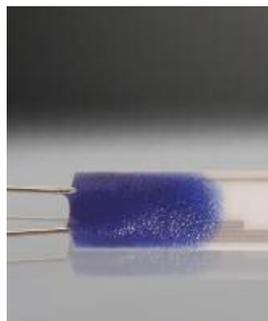
The thick film pastes are used amongst other applications in modern electronic circuits and passive components.

Furthermore organic special chemicals such as monomers, polymers, and photoinduced acid generators (PAGs) for photoresists are supplied. These are typically processed in microchips and in display fabrication industries. The product portfolio of the Business Unit Thick Film:

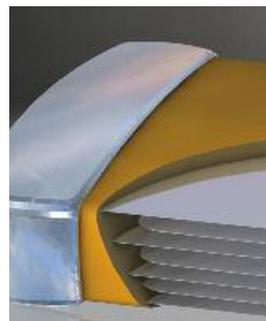
- Conductor, resistor and resinate pastes
- Ultra-fine precious metal powders
- Multilayer and crossover dielectrics
- LTCC materials
- Monomers, polymers and PAGs

## Markets and industries

- Electronics industry
- Automotive industry
- Communications and telecommunications
- Semiconductor industry
- Microelectronics



Temperature sensor



Multi-layer chip capacitor



Steel-ceramics application

# Photovoltaics

## TFD-PV



Photovoltaic applications – one of the most important markets of the future – make rigorous demands on materials based on the environmental condition they experience. Metallization pastes, for example, must be capable of reliably transmitting the current created by the solar cells while remaining stable over many years under all weather conditions.

The Business Unit Photovoltaics focuses exclusively on the development and production of conductive pastes for this market. The PV Application Centers, which were set up precisely for this purpose, support the further development of metallization paste technologies worldwide and encourage the exchange of experiences with customers. Heraeus benefits from expertise acquired from over forty years of manufacturing thick film pastes for a multitude of applica-

tions to successfully serve this market. As a result, an exceptionally successful series of pastes were developed: the SOL Series. With its introduction, it has continued to demonstrate very good printing properties for both contact lines and busbars of first generation and leading edge photovoltaic cell technologies. Our R&D group is focused on reducing the cost of solar energy by improving solar cells' efficiency and manufacturing cost by leveraging innovative paste designs.

Due to the continuous efforts of Heraeus Precious Metals towards the development of environmentally friendly technologies, the silver-based conductive pastes are available both in cadmium-free and lead-free versions.



Photovoltaic cells



Metallization paste

Markets and industries  
■ Photovoltaic industry

# Mega-Trends



In its role as precious metals specialist within the Heraeus Group, Heraeus Precious Metals is represented in many markets with its innovative products. Some of these markets are currently developing into fields for the future with special worldwide economic importance. Energy, mobility, communications, health and environment are the mega-trends which specially motivate the innovative products of Heraeus Precious Metals.

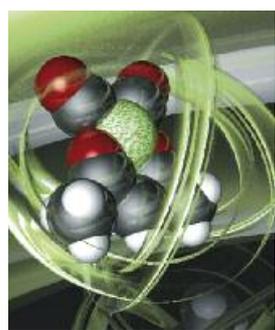
In these areas with a promising future the main challenge is to create harmony between mankind, nature and technology. Every day the employees of Heraeus Precious Metals make a valuable contribution to meeting this challenge with new technological innovations.

## Environment

One of the great challenges of the future is to live in balance with our environment and to deal responsibly with the natural resources of our planet. With intelligent solutions for products and processes, Heraeus Precious Metals helps to conserve the environment and to increase the quality of our lives.

Production residues containing precious metals and used products are reintroduced into the cycle using highly developed recycling processes. In this way resources which are in short supply worldwide are conserved. At the same time, precious metal catalysts from Heraeus Precious Metals ensure clean air through the efficient treatment of exhaust gases from combustion engines and industrial plants.

- Mega-Trends
  - Environment
  - Energy
  - Health
  - Communications
  - Mobility



**Catalysts:**  
A catalyst increases the rate of a chemical reaction without being consumed itself. By means of process catalysts most chemical processes are now designed more efficiently or are even made possible.



## Energy

Constantly increasing energy consumption on the one hand and limited natural resources in the form of crude oil, gas and coal on the other demand innovative solutions. Seen from an ecological standpoint atomic power is also not a long-term solution – the sun, however, is a permanent source of energy which “only” needs to be tapped.

In photovoltaics, technologies are demanded which, with minimum loss and defying all weather conditions, will reliably transport the current captured from the solar cells over the course of many years in a very restricted space. The extremely conductive metallization pastes and polymers from Heraeus Precious Metals offer the optimal solution for all generations of cells. In this way, they make their contribution to more economical energy sources and innovative solutions for the future.



**Metallization pastes:**  
Heraeus Precious Metals metallization pastes are extremely conductive and meet the highest demands in the photovoltaic industry.



## Health

Due to increased life expectancy and higher demands on the quality of life the need for medical services to maintain health is also increasing. Heraeus Precious Metals develops and produces a wide variety of innovative medical products which help to save lives or make life worth living again.

The Medical Components Division produces, for example, stimulation electrodes which transfer essential impulses to the heart in cardiac pacemakers and defibrillators. Minimal invasive surgical instruments ensure lower risks in surgery and allow for shorter periods of hospitalization. The Business Unit Pharmaceutical Ingredients develops highly active pharmaceutical agents which are successfully used in the treatment of cancer.



**Anti-tumor agents:**  
Epirubicin belongs to the group of the rubicins, which have been used for 20 years as anti-tumor agents in the treatment of cancer. It is difficult to synthesize by a purely chemical route. Heraeus produces the agents biotechnologically.

# Mega-Trends



## Mobility

The dream of many people is unlimited mobility – be it by train, plane or car. Obviously Heraeus Precious Metals does not manufacture automobiles itself, but today no car would move without one of their products.

Heraeus Precious Metals produces extremely conductive and corrosion resistant contacting pastes, ultra-fine precious metal powders, and polymers which are used in control systems, for instance in gear boxes, motors, ABS, and airbag systems. In addition, they are also used in navigation equipment and dashboard lighting.



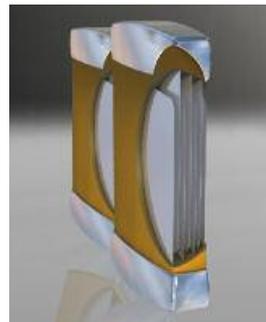
HeraPur® emission control catalysts: make possible the effective treatment of exhaust gas in motors which are driven by gasoline, diesel, or alternative fuels. Emission goals can thus be achieved with minimal precious metal loadings and a long catalyst service life.



## Communications

Modern communications technology is vital for globally operating companies. But also in the private sphere electronic communications are gaining in importance – whether in the internet, computer, or cell phone. Here, too, products from Heraeus Precious Metals are in constant use as indispensable aids.

Besides the contacting pastes for capacitors from the Thick-Film Division, the Conductive Polymers Division offers functional materials for use in the latest capacitors that are found in the latest computers, game platforms and cell phones.



Thick film pastes and resinate pastes from the Business Unit Thick Film designed for printing thin layers create new perspectives for capacitors in communications technology which are becoming increasingly small and efficient.

# Heraeus Precious Metals Contacts



## **Heraeus Precious Metals**

[www.heraeus-precious-metals.com](http://www.heraeus-precious-metals.com)

## **Further contact addresses**

### **Trading Division**

[www.heraeus-trading.com](http://www.heraeus-trading.com)

### **Location addresses worldwide**

[www.heraeus-precious-metals.com/locations](http://www.heraeus-precious-metals.com/locations)

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### **Chemicals Division**

[www.heraeus-catalysts.com](http://www.heraeus-catalysts.com)

[www.heraeus-chemicalproducts.com](http://www.heraeus-chemicalproducts.com)

[www.heraeus-pharma.com](http://www.heraeus-pharma.com)

[www.heraeus-recycling.com](http://www.heraeus-recycling.com)

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### **Conductive Polymers Division**

[www.heraeus-clevios.com](http://www.heraeus-clevios.com)

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### **Medical Components Division**

[www.heraeus-medicalcomponents.com](http://www.heraeus-medicalcomponents.com)

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### **Thick Film Materials Division**

[www.heraeus-preciouscolours.com](http://www.heraeus-preciouscolours.com)

[www.heraeus-thickfilm.com](http://www.heraeus-thickfilm.com)

[www.pvsilverpaste.com](http://www.pvsilverpaste.com)

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