



**Heraeus Precious Metal Powders –
State of the Art Conductive Powder for
your Electronic Application**

Heraeus Electronics – Our Materials Solutions Enabling Your Success

Heraeus

As an innovator since 1851, Heraeus portfolio ranges from components to coordinated material systems which are used in a wide variety of industries, including the steel, electronics, chemical, automotive and telecommunications industries. Today, Heraeus has more than 100 subsidiaries and affiliates worldwide to serve a diverse and growing customer base.

Heraeus Electronics – Thick Film Materials

Heraeus Electronics is one of the leading R&D partners and manufacturers of materials for the packaging of integrated circuits in the electronics industry. The company deals with sophisticated material solutions and material sub-systems for semiconductor and automotive industry, consumer goods, energy & power electronics, industrial electronics as well as communications and telecommunications. Heraeus Electronics' core competences include bonding wires, assembly materials, thick film pastes, DCB substrates as well as roll clad strips and stamped lead frames.

In the range of thick film, Heraeus offers thick film pastes, precious metal powders as well as advanced materials like LTCC products, photoetchable pastes and energy products.



Precious Metal Powders – Our Products

Heraeus Powders

As a part of its business, Heraeus Electronics produces precious metal powders. Originally the powders were created to support the thick film and ceramic colours production and to be applied in thick film pastes. Thus, the powder production is designed to meet the high requirements of the thick film business, resulting in outstanding expertise and reproducibility from the very beginning.

Other compositions and development materials are available upon request. Please discuss your specific needs with your Heraeus technical sales contact.



Heraeus produces a broad range of chemically precipitated palladium powders ranging from high surface area, fine particles to low surface area, larger particles. These materials are used primarily in electrode inks, hybrid

thick film pastes, and end termination pastes. The listing below provides a basic summary of our most widely used palladium powders.

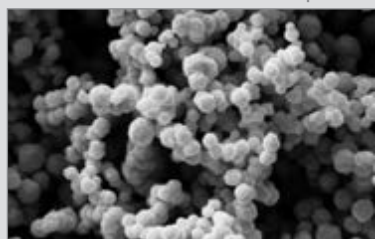
Palladium Powders—Target Properties

Product Name	Description	Surface Area m ² /g	Tap Density g/ml	Particle Size Distribution (µm)			Applications
				90 %	50 %	10 %	
Pd 600-01	Spherical Pd Powder	0.8 – 1.2	1.5 – 2.0	2.3 – 3.3	1.6 – 2.1	0.9 – 1.3	High Fire MLCC Inner Electrode Inks
Pd 600-02	Very High SA Powder	20.0 – 30.0	0.3 – 1.5	1.0 – 3.0	0.3 – 1.0	0.15 – 0.4	Thick Film Pastes
Pd 600-03	Agglomerated Pd Powder	2.0 – 3.0	1.2 – 1.6	3.5 – 6.0	1.5 – 2.1	0.6 – 1.0	High Fire MLCC Thick Film Pastes
Pd 600-07	High SA Pd Powder	5.5 – 8.0	1.3 – 1.8	1.3 – 2.0	0.7 – 1.3	0.4 – 0.8	Thick Film Pastes
Pd 600-08	Spherical Pd Powder, High Tap Density	1.5 – 3.5	3.0 – 4.5	1.2 – 2.5	0.8 – 1.8	0.4 – 0.7	High Fire MLCC Inner Electrode Inks
Pd A3939	High SA Pd Powder	10.5 – 15.0	0.8 – 0.9	2.3 – 4.7	0.5 – 2.0	0.2 – 0.7	Thick Film Pastes
Pd 600-10	Low SA Pd Powder	0.40 – 0.55	1.4 – 2.4	14.0 – 30.0	5.0 – 11.0	1.0 – 2.2	SOFC Thick Film Pastes Solder Pastes

Typical SEM images of products

Pd 600-01

1 µm



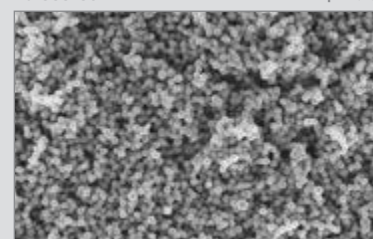
Pd 600-03

1 µm



Pd 600-08

1 µm



Silver-Palladium Powders

Ag/Pd

Heraeus's spherical, co-precipitated silver-palladium powders are designed for use in inner electrode component inks and hybrid thick film pastes. The fine, mono-sized particles provide the ability to produce thin continuous conductive layers. The powders can be

supplied with carefully selected organics coatings for superior dispersion performance in typical ink formulations. The table below highlights our standard offering. Other alloys and uncoated powders are available upon request.

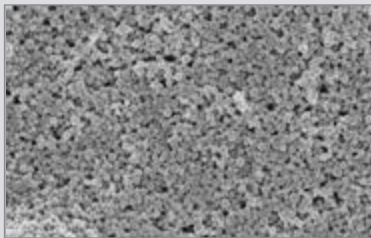
Silver-Palladium Powders — Target Properties

Product Name	Description	Surface Area m ² /g	Tap Density g/ml	Particle Size Distribution (µm)			Applications
				90 %	50 %	10 %	
Ag/Pd 630-10 C	95/5 Ag/Pd Powder	1.0 – 2.0	> 2.5	< 3.0	0.7 – 1.7	> 0.3	ULF MLCC Inner Electrodes
Ag/Pd 630-11 C	90/10 Ag/Pd Powder	0.9 – 1.9	> 2.5	< 3.0	0.6 – 1.6	> 0.3	ULF MLCC Inner Electrodes
Ag/Pd 630-12 C	85/15 Ag/Pd Powder	0.9 – 1.9	> 2.5	< 3.0	0.6 – 1.6	> 0.3	LF MLCC Inner Electrodes
Ag/Pd 630-13 C	80/20 Ag/Pd Powder	1.0 – 2.0	> 2.5	< 3.0	0.6 – 1.6	> 0.3	LF MLCC Inner Electrodes
Ag/Pd 630-14 C	70/30 Ag/Pd Powder	0.9 – 1.9	> 2.5	< 3.0	0.6 – 1.6	> 0.3	LF MLCC Inner Electrodes
Ag/Pd 630-15 C	45/55 Ag/Pd Powder	1.5 – 3.5	> 2.5	< 3.0	0.6 – 1.6	> 0.3	Surge Resistor Pastes
Ag/Pd 630-16 C	30/70 Ag/Pd Powder	1.5 – 3.5	> 2.5	< 3.0	0.6 – 1.6	> 0.3	HF MLCC Inner Electrodes
Ag/Pd 630-17 C	75/25 Ag/Pd Powder	1.0 – 2.0	> 2.5	< 3.0	0.6 – 1.6	> 0.3	LF MLCC Inner Electrodes

Typical SEM images of products

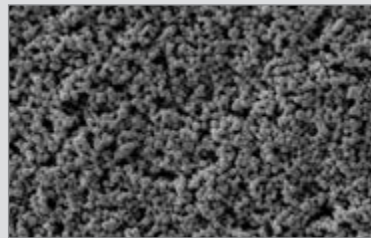
Ag/Pd 630-14

1 µm



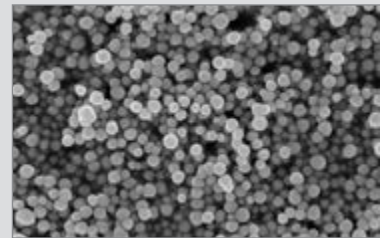
Ag/Pd 630-15

1 µm



Ag/Pd 630-16

1 µm



Silver Powders and Flakes

Ag

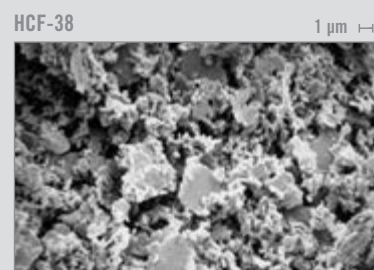
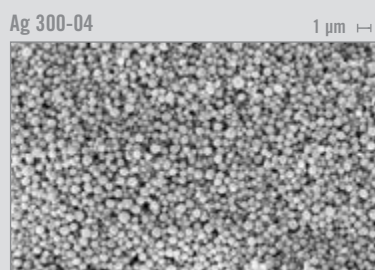
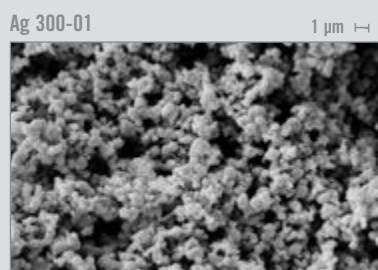
Heraeus offers both silver powder and silver flakes for use in all fired conductive paste applications. In addition to the products highlighted in the table below, Heraeus

is developing sub-micron and nano-sized silver powders in both wet and dried form.

Silver Flakes/Powders – Target Properties

Product Name	Description	Surface Area m ² /g	Tap Density g/ml	Particle Size Distribution (µm)			Applications
				90 %	50 %	10 %	
Ag 300-01	Spherical Silver Powder	1.0 – 1.3	1.4 – 2.2	3.0 – 5.0	1.7 – 2.5	0.9 – 1.4	Thick Film Pastes
Ag 300-02	Mid Range SA Ag Powder	2.1 – 2.7	1.4 – 1.9	6.0 – 9.0	2.0 – 3.0	0.5 – 0.9	Low Fire Pastes and Thick Film Pastes
Ag 300-03	Low Surface Ag Powder	0.7 – 1.0	1.0 – 2.0	6.0 – 9.0	2.6 – 4.0	1.0 – 2.0	Thick Film Pastes
Ag 300-04	Spherical, High Tap Density Silver Powder	1.0 – 3.3	1.0 – 4.0	1.5 – 3.0	1.0 – 1.9	0.6 – 1.1	Thick Film Pastes
Ag 300-20	High SA Ag Powder	5.0 – 7.0	0.4 – 1.2	10.0 – 20.0	3.0 – 7.0	0.5 – 1.5	Low Fire Paste Systems
Ag 300-30	Nano Ag Suspension Aqueous (brown colour)			0.009 – 0.015	0.006 – 0.009	0.003 – 0.006	Ink Jet, Antimicrobial, Coatings
HCF-38	Flake Powder Mixture	1.2 – 1.9	2.8 – 3.8	2.6 – 5.0	1.0 – 2.0	0.6 – 1.0	Thick Film Pastes MLCC Terminations

Typical SEM images of products



Heraeus produces a broad line of chemically precipitated platinum powders with varied surface area and particle size properties. The products range from low surface area powders to very high surface area, platinum black type

powders. These materials are typically used in thick film hybrid pastes, oxygen sensor pastes, solid oxide fuel cell pastes and component electrode and termination inks.

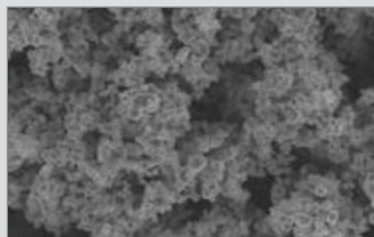
Platinum Powders – Target Properties

Product Name	Description	Surface Area m ² /g	Tap Density g/ml	Particle Size Distribution (µm)			Applications
				90 %	50 %	10 %	
Pt 100-03	Low SA Pt Powder – SA can be adjusted to customers request	0.5 – 3.0	2.0 – 3.5	9.0 – 16.0	3.0 – 7.0	0.9 – 2.0	Hybrid, Sensor and SOFC Thick Film Pastes
Pt 100-06	Mid Range SA Pt Powder	5.0 – 10.0	1.5 – 3.5	1.5 – 2.5	0.6 – 1.0	0.3 – 0.5	Hybrid, Sensor and SOFC Thick Film Pastes
Pt 100-08	SA can be adjusted to customers request	8.0 – 12.0	0.9 – 1.5	1.5 – 3.0	0.7 – 1.2	0.3 – 0.5	Hybrid, Sensor and SOFC Thick Film Pastes
Pt 100-10	High SA Pt Powder	13.0 – 16.0	0.8 – 1.1	1.3 – 2.0	0.6 – 0.9	0.25 – 0.45	Hybrid, Sensor and SOFC Thick Film Pastes
Pt 100-11	Pt-Black Very High SA Pt Powder	20.0 – 29.0	0.8 – 1.2	1.3 – 3.5	0.3 – 0.7	0.15 – 0.4	Hybrid, Sensor and SOFC Thick Film Pastes
Pt M579B	Low SA High Tap Density	0.8 – 2.0	3.0 – 4.0	1.5 – 3.0	0.9 – 1.9	0.5 – 0.9	Hybrid, Sensor and SOFC Thick Film Pastes
Pt A2757	Powder/Flake High Tap Density	2.5 – 4.4	2.9 – 5.8	2.0 – 5.0	0.5 – 1.2	0.2 – 0.6	Hybrid, Sensor and SOFC Thick Film Pastes
Pt 100-30	Nano Pt Suspension	–	–	< 0.06	< 0.02	< 0.01	Ink Jet, Catalytic Coating

Typical SEM images of products

Pt M579B

1 µm



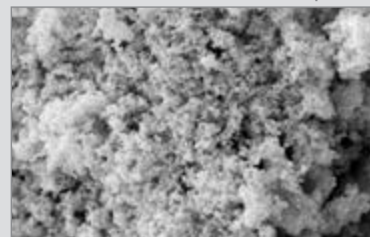
Pt 100-08

1 µm



Pt 100-10

1 µm



Gold Powders and Flakes

Au

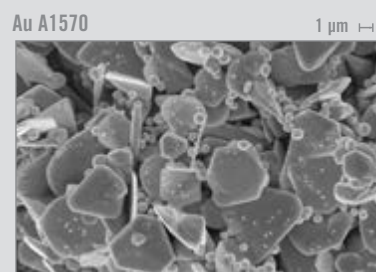
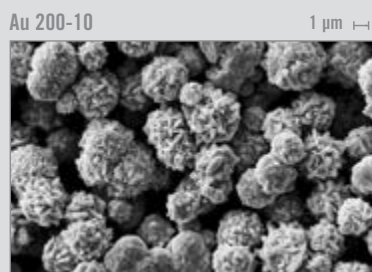
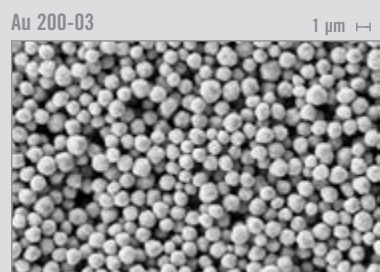
Heraeus produces a broad variety of chemically precipitated gold powders and flakes. The products range from mono-sized, low surface area powders to precipitated

flake/powder mixtures ideally suited for thick film conductive pastes.

Gold Powders – Target Properties

Product Name	Description	Surface Area m ² /g	Tap Density g/ml	Particle Size Distribution (µm)			Applications
				90 %	50 %	10 %	
Au 200-03	Mono-Sized, Spherical Au Powder	0.27 – 0.35	7.3 – 9.0	1.8 – 2.4	1.4 – 1.7	1.0 – 1.3	LTCC, Dental Applications, Thick Film Pastes and Ceramic Colours
Au 200-04	Fine Mono-Sized, Spherical Au Powder	0.9 – 1.2	5.0 – 7.0	1.1 – 1.5	0.8 – 1.0	0.4 – 0.7	High Reliability Thick Film Pastes
Au 200-09	Precipitated Coarse Au Flake	0.08 – 0.15	3.0 – 5.0	15.0 – 45.0	5.0 – 12.0	3.0 – 6.0	Glitter Effect, Ceramic Colours
Au 200-10	Coarse Au Powder Rough Surface	0.1 – 0.3	4.5 – 7.0	5.0 – 20.0	4.0 – 10.0	2.0 – 6.0	
Au 200-20	High SA Low Tap Density	6.5 – 7.5	0.9 – 1.3	2.5 – 5.0	0.8 – 1.5	0.4 – 0.9	Ceramic Colours
Au 200-30	Nano Au Suspension Aqueous (red colour)			0.004 – 0.006	0.002 – 0.003	0.001 – 0.002	Ink Jet, Coatings
Au A1570	Precipitated Au Powder/Flake	0.15 – 0.45	5.8 – 7.8	3.0 – 6.0	2.0 – 4.0	0.6 – 1.3	High Reliability Thick Film Pastes

Typical SEM images of products



Ruthenium Oxide Powders

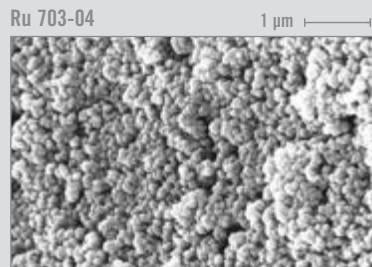
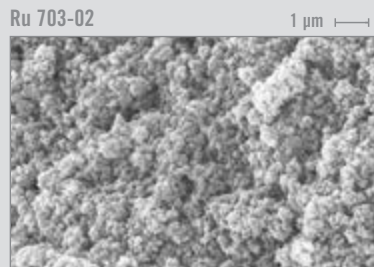
Ru

Heraeus produces ruthenium oxide powders with very high surface area. The powders can be used in thick film resistor inks and catalytic applications.

Ruthenium Oxide Powders—Target Properties

Product Name	Description	Surface Area	Tap Density	Loss (%)	Particle Size Distribution			Applications
		m ² /g	g/ml		90 %	50 %	10 %	
RuO ₂ 703-02	High SA, High Purity Powder	35 – 45	–	24 – 26	–	–	–	Thick Film Pastes
RuO ₂ 703-04	Very High SA, High Purity Powder	100 – 140	–	26 – 29	–	–	–	Catalytic Properties

Typical SEM images of products



Further Products and Services

In addition to the powders and flakes detailed in this brochure, other pure powders and alloys (e.g. Au/Pd, Pt/Pd and Pd-Oxide powder) are available. For more information please contact us directly.

The descriptions and engineering data shown here have been compiled by Heraeus using commonly accepted procedures, in conjunction with modern testing equipment, and have been compiled as according to the latest factual knowledge in our possession. The information was up-to-date on the date this document was printed (latest versions can always be supplied upon request).

Although the data is considered accurate, we cannot guarantee accuracy, the results obtained from its use, or any patent infringement resulting from its use (unless this is contractually and explicitly agreed in writing, in advance). The data is supplied on the condition that the user shall conduct tests to determine materials suitability for a particular application.

Heraeus Metal Management

Integrated precious metal solutions – that's our specialty!

Heraeus Metal Management is your partner for precious metal risk management, financing and recovery of precious metals from various materials.

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