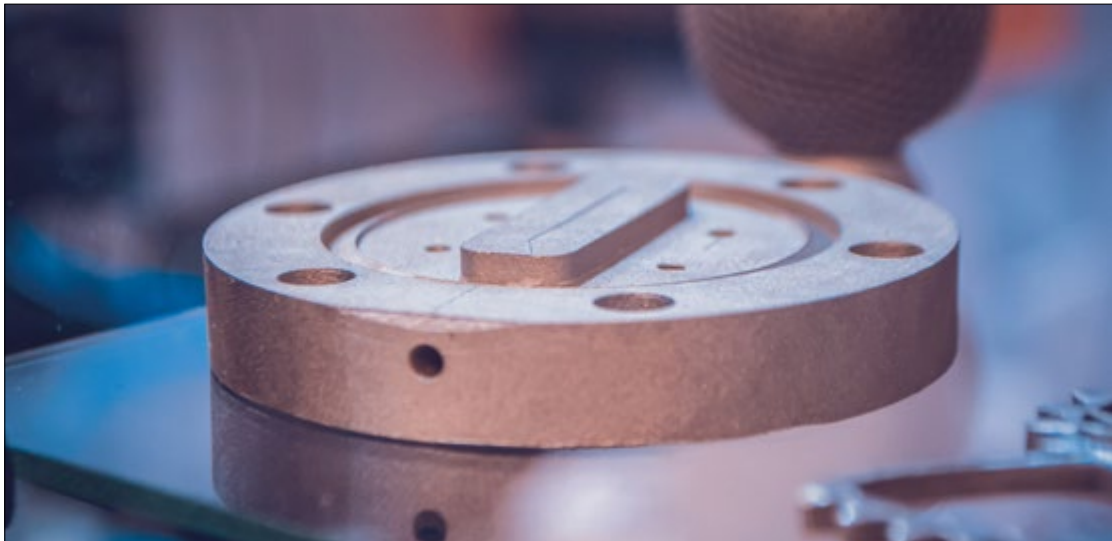
POWDERS FOR METALLIC MATERIALS

Copper & Copper alloy Powders

FOR FUTURE TECHNICAL APPLICATIONS

SCHLENK

Content



General Introduction

Ever since there has been metallurgy, a wide range of metals and alloys have been applied by many different techniques.

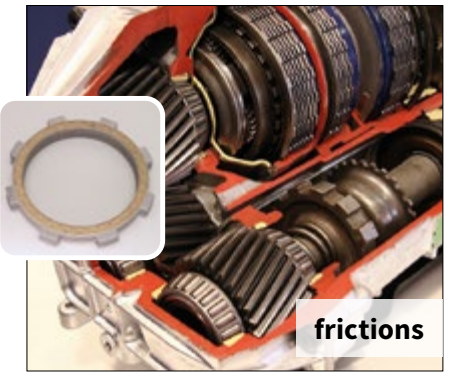
Schlenk Metallic Pigments GmbH, a member of Carl Schlenk AG, offers perfect solutions through its portfolio of atomized copper and copper alloy powders.

SCHLENK works in close cooperation with customers to provide the best product qualitiy and service for established and for future applications.

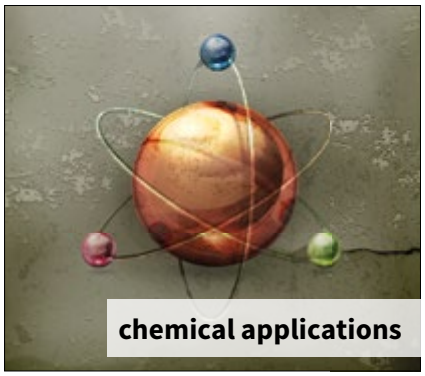
As one of the leading powdered metal suppliers we support the following markets:

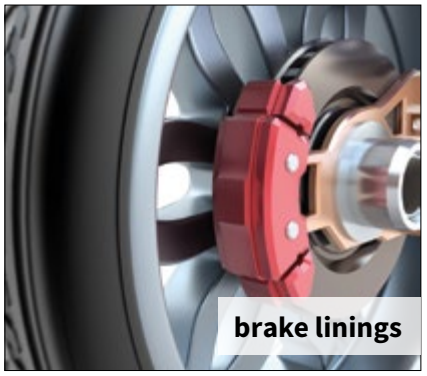
- bearings
- friction and brake linings
- contact materials
- compounds
- soldering and joining materials
- blasting abrasive materials
- lubricants
- powder metallurgy
- sintering materials
- additive manufacturing
- chemical-technical applications
- and other similar niche applications

Applications


frictions


contact materials

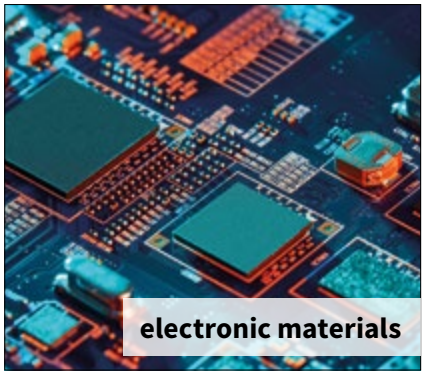

chemical applications


brake linings


bearings


diamond tools

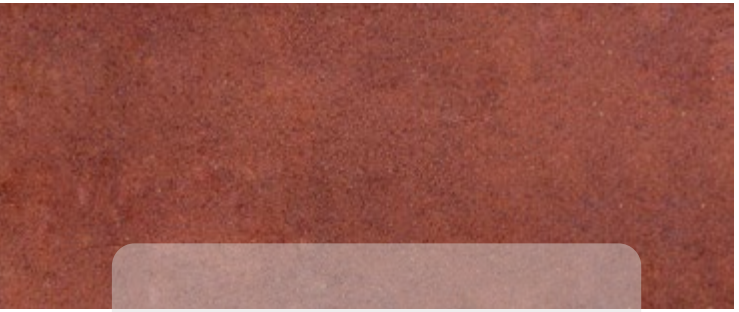

surface metallization


electronic materials


additive manufacturing

Metal powders

SCHLENK metal powders are based on copper & copper alloys. The powder production process includes the following steps: Smelting, alloying (bronze and brass), classification, homogenization and packaging.



COPPER POWDER

In the area of metallic materials, SCHLENK copper powders are produced from high purity electrolytic copper or refined copper (high purity of copper).

Spherical copper powders are produced through melting with the addition of small amounts of phosphor (max. 0.4%) and by air atomization. They are available as Rogal® Copper Powder GK* in various particle size distributions.

Further grinding in a ball mill generates lamellar copper powder, known as Cubrotec. This product is used in carbon brushes and various technical processes.

BRONZE POWDER

Bronze is an alloy composed of copper and tin. In powder metallurgy, in addition to the standard alloy CuSn10, bronzes with copper contents of approx. 85 - 95% are used.

Using air atomization, irregularly shaped bronze powder is produced from the molten metal. This is available in various particle size distributions as Rogal® Bronze Powder GS*.

When small amounts of phosphor are added (max. 0.4%), spherical bronze powder is produced. This material is also used in powder metallurgy and is known as Rogal® Bronze Powder GK*.

BRASS POWDER

Brass is an alloy composed of copper and zinc. The following alloys are commonly used:

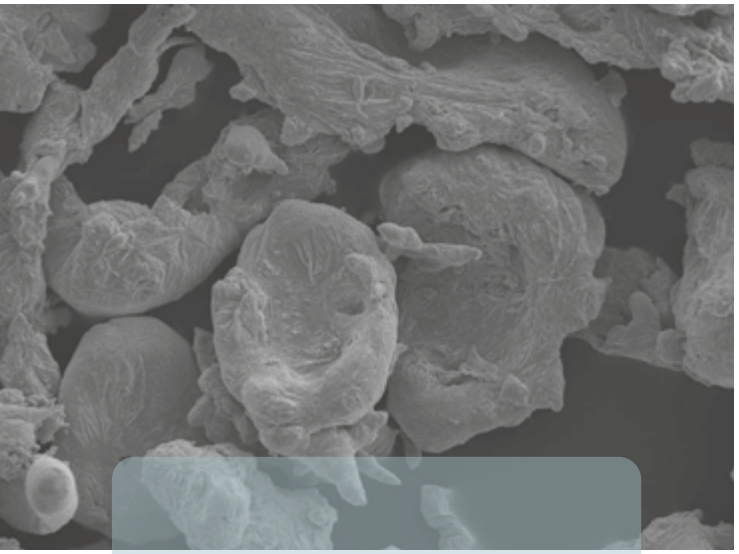
- CuZn8 (Rogal® Brass Powder I GS*)
- CuZn18 (Rogal® Brass Powder II GS*)
- CuZn30 (Rogal® Brass Powder III GS*)

Other compositions are available with individual, agreed upon specifications.
Air atomization of molten brass produces irregularly shaped metal powders.

Brass alloy powders of various compositions also serve as the starting material for production of „gold bronze pigments“ for the printing ink, paint and plastics industries.

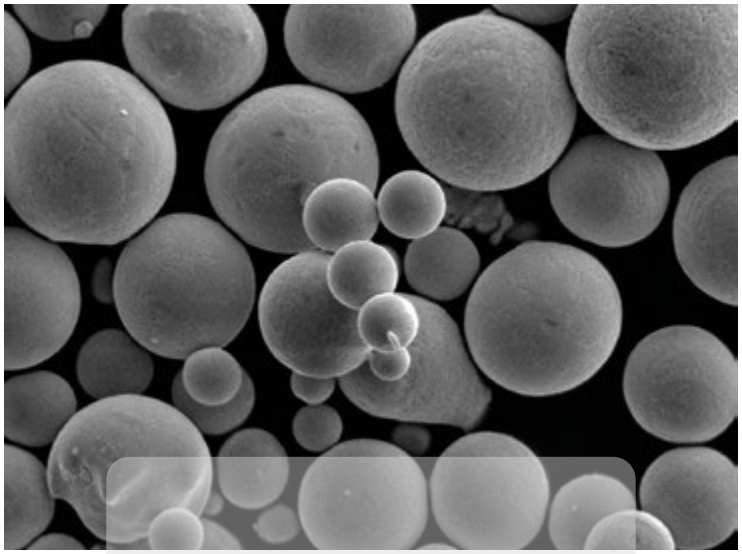
* GK = spherical powders GS = irregular powders

Morphology



IRREGULAR SHAPE

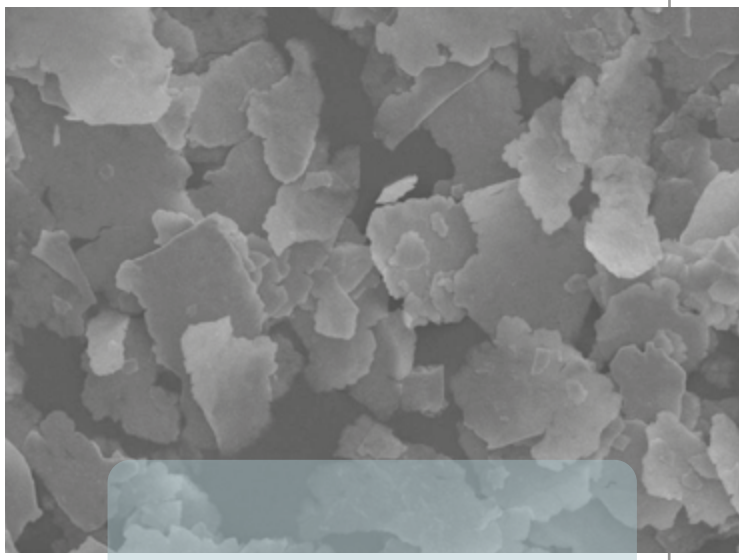
The irregular shape of Rogal® Bronze Powder GS and Rogal® Brass Powder GS is achieved with the addition of alloyed zinc.



SPHERICAL SHAPE

The particle shape depends on process parameters such as composititon, spray medium, surface tension of the molten material. If air atomization is used, copper is generally spherical.

The spherical shape of Rogal® Bronze Powder GK is achieved with the addition of small amounts of phosphor (max. 0,4%) which has a deoxidizing effect.



LAMELLAR SHAPE

The grinding process gives metal powders in a ball mill a lamellar form. The lamellar shape (so called „Flakes“) is typically for the technical copper powder CUBROTEC.

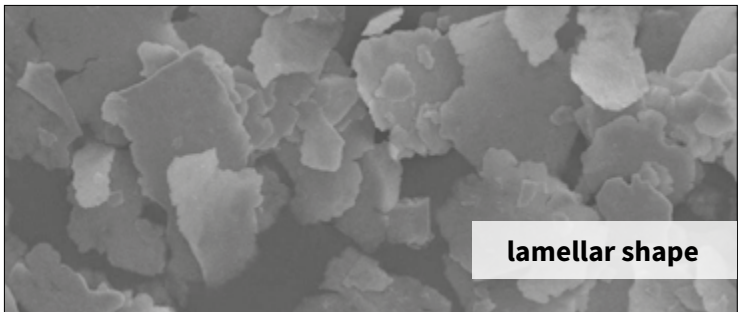
Cubrotec

Lamellar copper powders for use in contact materials, lubricants and in the chemical industry are produced when air atomized copper powder is processed using ball milling procedures.

Product name	Copper content *1 (%)	D50 value *2 (µm)	Grease content *3 (%)	Sieve analysis *4 (%)	Apparent density *5 (g/cm³)	Flow properties *6	Applications
Cubrotec 5000	min. 98	approx. 38	max. 0.3	>45µm: max. 6	approx. 1	not flowable	
Cubrotec 6000	min. 98	approx. 34	max. 0.2	>45µm: max. 5	approx. 1	not flowable	
Cubrotec 7001	min. 95	approx. 14	approx. 1.4	>75µm: traces >45µm: max. 3	approx. 0.7	not flowable	
Cubrotec 7002	min. 96	approx. 20	approx. 0.6	>75µm: traces >45µm: max. 1	approx. 0.8	not flowable	
Cubrotec 8000	min. 95	approx. 4	approx. 0.5	>45µm: traces	approx. 0.8	not flowable	
Cubrotec 8001	approx. 95	approx. 3	approx. 1.5	>45µm: traces	approx. 0.6	not flowable	

Test methods: *1 – chem. analysis, *2 – laser granulometry, SympatecHelos, *3 – chem. analysis, *4 – acc. to DIN 66165, *5 – acc. to DIN EN ISO 3923 part 1, *6 – acc. to DIN EN ISO 4490


carbon brushes


lamellar shape

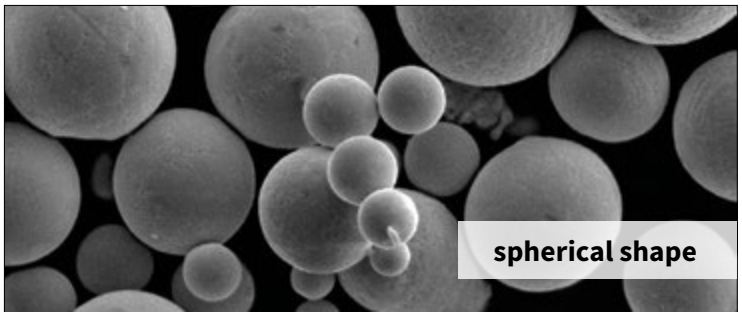

lubricants

Rogal® Copper GK

Smelting and atomization are used to produce copper powders from highly pure refined or electrolytic copper. In the air atomization process used by SCHLENK spherical particles are formed. Then they are classified into the required particle size distributions.

Product name	Copper content *1 (%)	Phosphor content *1 (%)	Sieve analysis *2 (%)	Apparent density *3 (g/cm³)	Flow properties *4	Applications
Rogal Copper GK 0/25	min. 99	max. 0.4	>25µm: max. 5	approx. 5	not flowable	
Rogal Copper GK 0/50	min. 99	max. 0.4	>50µm: max. 5	approx. 5	flowable	
Rogal Copper GK 0/63	min. 99	max. 0.4	>63µm: max. 5	approx. 5	flowable	
Rogal Copper GK 50/100	min. 99	max. 0.4	>100µm: max. 5 <50µm: max. 10	approx. 5	flowable	
Rogal Copper GK0/250	min. 99	max. 0.4	>250µm: max. 5	approx. 5	flowable	
Rogal Copper GK 0/315	min. 99	max. 0.4	>315µm: max. 5	approx. 5	flowable	

Test methods: *1 – chem. analysis, *2 – acc. to DIN 66165, *3 – acc. to DIN EN ISO 3923 part 1, *4 – acc. to DIN EN ISO 4490
Different fractions out of a particle size range 0/315 µm can be produced. Phosphorus contents up to 0.4 % on demand.



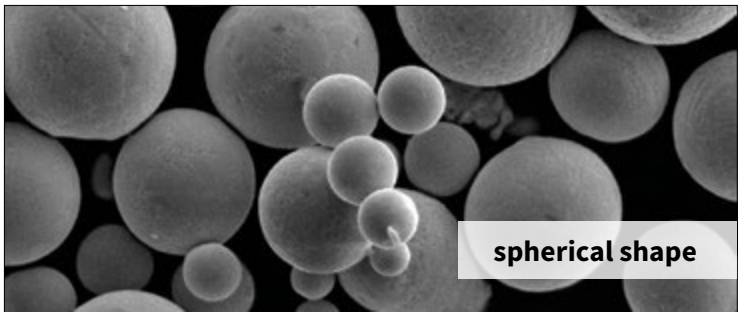
Rogal® Bronze GK

Alloying and atomization of copper, tin and phosphor in air produces sphericaly shaped bronze powder. The standard alloy contains approx. 90% copper, 10% tin and small amounts of phosphor. Special alloys and their respective particle size distributions are available with customer specific specifications, and are ensured through effective process and quality control.

Product name	Copper content *1 (%)	Tin content *1 (%)	Phosphor content *1 (%)	Sieve analysis *2 (%)	Apparent density *3 (g/cm³)	Flow properties *4	Applications
Rogal Bronze GK 0/25	approx. 90	approx. 10	max. 0.4	>25µm: max. 5	approx. 5	not flowable	
Rogal Bronze GK 0/80	approx. 90	approx. 10	max. 0.4	>80µm: max. 5	approx. 5	flowable	
Rogal Bronze GK 0/125	approx. 90	approx. 10	max. 0.4	>125µm: max. 5	approx. 5	flowable	
Rogal Bronze GK 80/180	approx. 90	approx. 10	max. 0.4	>180µm: max. 5 <80µm: max. 10	approx. 5	flowable	
Rogal Bronze GK 0/250	approx. 90	approx. 10	max. 0.4	>250µm: max. 5	approx. 5	flowable	
Rogal Bronze GK 0/180-01	approx. 89	approx. 11	max. 0.4	>180µm: max. 5	approx. 5	flowable	
Rogal Bronze GK 0/63-03	approx. 96	approx. 4	max. 0.4	>63µm: max. 5	approx. 5	flowable	

Test methods: *1 – chem. analysis, *2 – acc. to DIN 66165, *3 – acc. to DIN EN ISO 3923 part 1, *4 – acc. to DIN EN ISO 4490
Different fractions out of a particle size range 0/315 µm can be produced. Further variations of alloys are possible. Phosphor contents up to 0.4 % on demand.


bearings


spherical shape

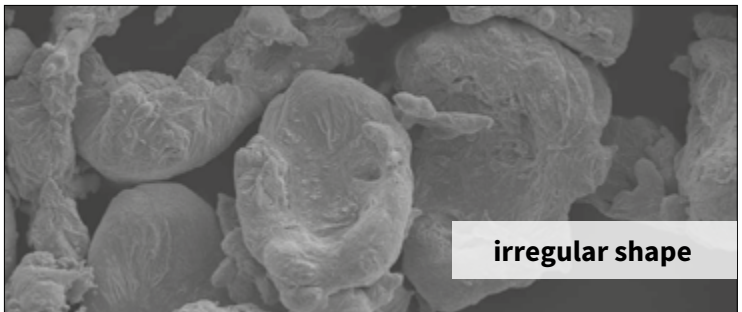

brake linings

Rogal® Bronze GS

Alloying and atomization of copper, tin and zinc in air produces irregularly shaped bronze powder. The standard alloy contains approx. 88% copper, 10% tin and 2% zinc. Special alloys and their respective particle size distributions are available with customer specific specifications, and are ensured through effective process and quality control.

Product name	Copper content *1 (%)	Tin content *1 (%)	Zinc content *1 (%)	Sieve analysis *2 (%)	Apparent density *3 (g/cm³)	Flow properties *4	Applications
Rogal Bronze GS 0/32	approx. 88	approx. 10	approx. 2	>32µm: max. 5	approx. 3	not flowable	
Rogal Bronze GS 0/32-01	approx. 85	approx. 11	approx. 4	>32µm: max. 5	approx. 5	not flowable	
Rogal Bronze GS 0/63	approx. 88	approx. 10	approx. 2	>63µm: max. 5	approx. 3	not flowable	
Rogal Bronze GS 0/160	approx. 88	approx. 10	approx. 2	>160µm: max. 5	approx. 3	flowable	
Rogal Bronze GS 0/200-03	approx. 89	approx. 10	max. 1	>200µm: max. 5	approx. 3.8	flowable	
Rogal Bronze GS 0/160-04	approx. 84	approx. 15	max. 1	>160µm: max. 5	approx. 3.8	flowable	
Rogal Bronze GS 45/100-05	approx. 87	approx. 10	approx. 3	>100µm: max. 5 <45µm: max. 15	approx. 3	flowable	
Rogal Bronze GS 100/200-05	approx. 87	approx. 10	approx. 3	>200µm: max. 5 <100µm: max. 15	approx. 3	flowable	

Test methods: *1 – chem. analysis, *2 – acc. to DIN 66165, *3 – acc. to DIN EN ISO 3923 part 1, *4 – acc. to DIN EN ISO 4490
Different fractions out of a particle size range 0/315 µm can be produced. Further variations of alloys are possible.

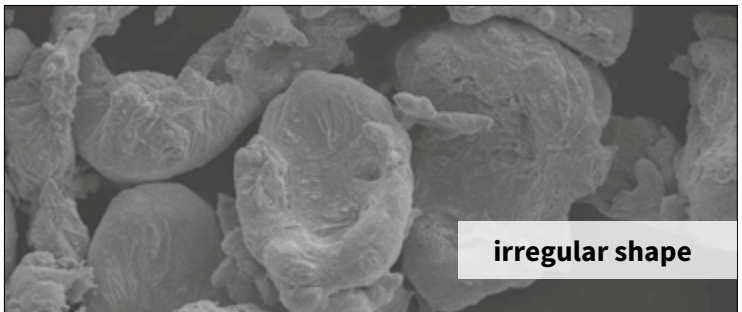


Rogal® Brass GS

Brass is an alloy made of copper and zinc in various compositions. Air atomization of the molten material results in irregularly shaped powders. Common compositions are brass I (approx. 92%Cu/8%Zn), brass II (approx. 82%Cu/18% Zn) and brass III (approx. 70%Cu/30%Zn)

Product name	**Copper content** *1 (%)	**Zinc content** *1 (%)	**Sieve analysis** *2 (%)	**Apparent density** *3 (g/cm³)	**Flow properties** *4	**Applications**
Rogal Brass I GS 0/63	approx. 92	approx. 8	>63µm: max. 5	approx. 3	flowable	
Rogal Brass II GS 0/250	approx. 82	approx. 18	>250µm: max. 5	approx. 3	flowable	
Rogal Brass II GS 0/200-01	approx. 80	approx. 20	>200µm: max. 5	approx. 3	flowable	
Rogal Brass III GS 0/160	approx. 70	approx. 30	>160µm: max. 5	approx. 3	flowable	

Test methods: *1 – chem. analysis, *2 – acc. to DIN 66165, *3 – acc. to DIN EN ISO 3923 part 1, *4 – acc. to DIN EN ISO 4490
Different fractions out of a particle size range 0/500 µm can be produced. Further variations of alloys are possible.



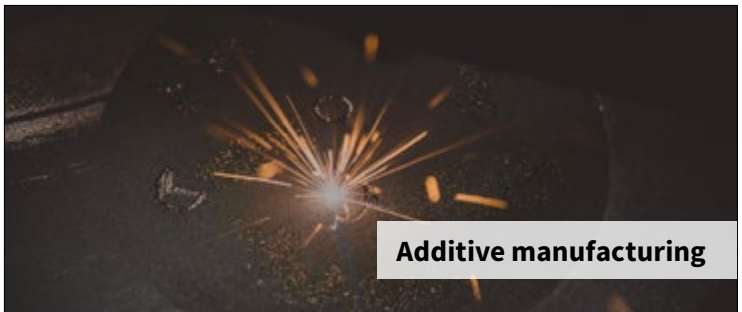
Chemical properties *1: Copper content: min. 99 %
Phosphor content: max. 0,02 % | Total oxygen content: max. 1.0 %

Rogal® Copper GK for Additive Manufacturing

SCHLENK offers special products of its portfolio of Rogal® Copper GK for a wide range of modern era applications of additive manufacturing.

Product name	Particle Size *2			Sieve residue *3 (µm/%)	Apparent Density *4 (g/cm³)	Tap Density *5 (g/cm³)	Flow rate *6 (s/50g)	Recommended Application
	d_{10} (µm)	d_{50} (µm)	d_{90} (µm)					
Rogal Copper GK 0/10 VP/50347	~ 4	~ 8	~ 15	> 25 / max. 1	~ 3	~ 5	not flowable	
Rogal Copper GK 10/25 VP/50522	~ 13	~ 20	~ 27	> 25 / max. 5	~ 4.1	~ 5	not flowable	
Rogal Copper GK 0/25	~ 8	~ 16	~ 25	> 25 / max. 5	~ 4.4	~ 5.5	not flowable	
Rogal Copper GK 10/50 VP/50487	~ 21	~ 36	~ 52	> 50 / max. 5	~ 4.6	~ 5	~ 11	
Rogal Copper GK 0/50	~ 16	~ 32	~53	> 50 / max. 5	~ 4.6	~ 5.3	~ 12	
Rogal Copper GK 0/63	~ 19	~ 39	~ 63	> 63 / max. 5	~ 4.7	~ 5.4	~ 12	
Rogal Copper GK 0/80	~ 20	~ 46	~ 78	> 80 / max. 5	~ 5	~ 5.4	~ 12	
Rogal Copper GK 45/100	~ 57	~ 79	~ 105	>100 / max. 5 <45 / max. 10	~ 5	~ 5.3	~ 13	
Rogal Copper GK 0/160	~ 45	~ 84	~ 135	>160 / max. 5	~ 4.8	~ 5	~ 15	

Test methods: *1 chem. Analysis, *2 laser granulometry, SympatecHelos, *3 acc. to DIN 66165, *4 acc. to DIN EN ISO 3923 part 1, *5 AQSR-026, *6 acc. to DIN EN ISO 4490
Different fractions out of a particle size range 0/315 µm can be produced.



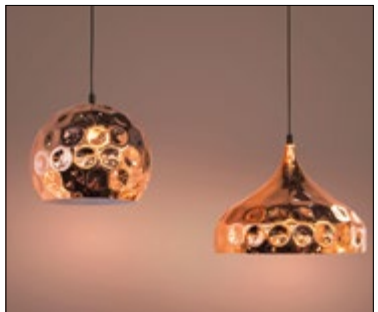
Rogal® Bronze GK for Additive Manufacturing

Chemical properties *1: Copper content: approx. 90 % | Tin content: approx. 10 %
Phosphor content: approx. 0.1 % | Total Oxygen content: max. 0.2 %

SCHLENK offers special products of its portfolio of Rogal® Bronze GK for a wide range of modern era applications of additive manufacturing.

Product name	Tin content *1 (%)	Particle Size *2			Sieve residue *3 (µm/%)	Apparent Density *4 (g/cm³)	Tap Density *5 (g/cm³)	Flow rate *6 (s/50g)	Recommended Application
		d_{10} (µm)	d_{50} (µm)	d_{90} (µm)					
Rogal Bronze GK 0/10 VP/50468	~ 10	~ 4	~ 8	~ 12	> 25 / max. 1	~ 3	~ 4	not flowable	
Rogal Bronze GK 0/25	~ 10	~ 6	~ 13	~ 21	> 25 / max. 5	~ 4	~ 5	not flowable	
Rogal Bronze GK 10/45 VP/50468	~ 10	~ 16	~ 28	~ 43	> 45 / max. 5	~ 5	~ 5.1	not flowable	
Rogal Bronze GK 0/63-03	~ 4	~ 20	~ 41	~ 62	> 63 / max. 5	~ 5	~ 5.3	~ 12	
Rogal Bronze GK 0/63-06	~ 6	~ 20	~41	~62	> 63 / max. 5	~ 5	~ 5.3	~ 12	
Rogal Bronze GK 0/80	~ 10	~ 26	~ 52	~ 79	> 80 / max. 5	~ 5	~ 5.3	~ 13	
Rogal Bronze GK 32/125	~ 10	~ 45	~ 79	~ 121	> 125 / max. 5 < 32 / max. 5	~ 5.2	~ 5.5	~ 12	

Test Methods: *1 - chem. analysis, *2 - laser granulometry, SympatecHelos, *3 - acc. to DIN 66165, *4 - acc. to DIN EN ISO 3923 part 1, *5 - AQSR-026, *6 - acc. to DIN EN ISO 4490
Different contents of tin and phosphor and fractions out of a particle size range 0/315 µm can be produced.



Contact materials

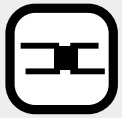
Suface metallization

Chemical technical applications

Technical plastics, compounds

Friction and brake linings

Lubricants



Soldering and joining techniques

Powder metallurgy, sintering materials

Blasting abrasive techniques

Binder Jetting (BJT)

Powder laser desposition (LMD)

Coldspray

Friction Welding

Electron beam powder bed fusion (EBM)

Selective laser sintering (SLS)

Laser Beam powder bed fusion (LB-PBF), Selective Laser Melting (SLM), Direct Metal Laser Sintering (DMLS)

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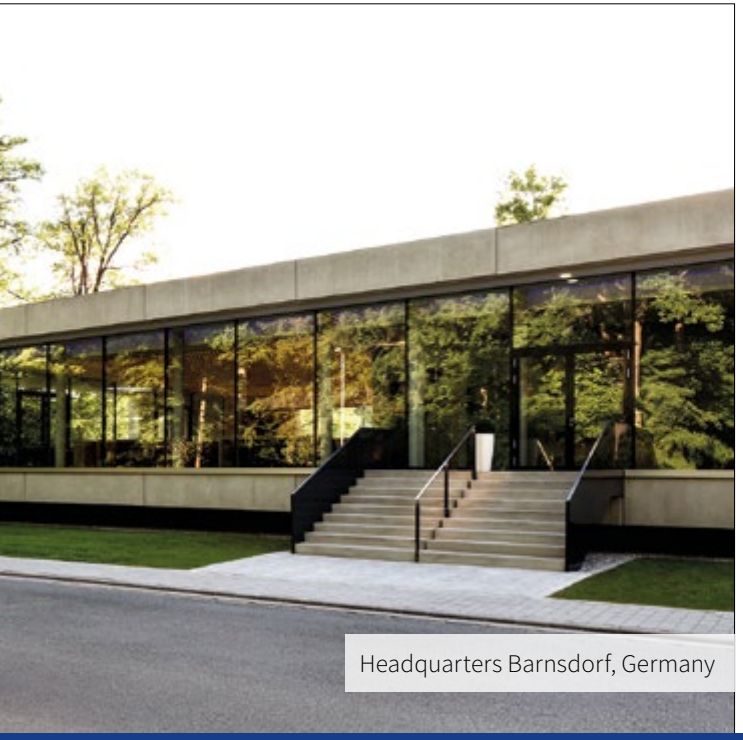

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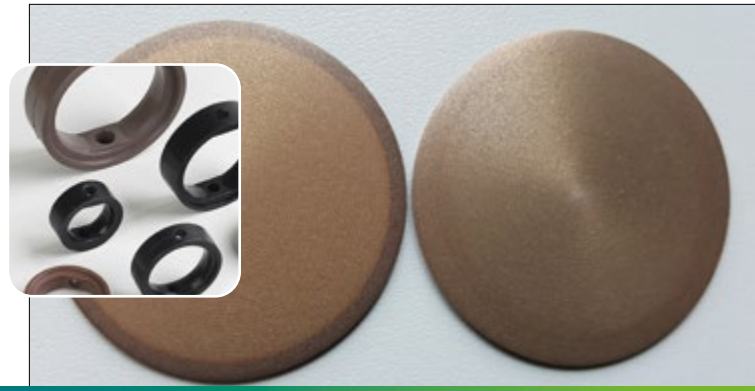

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