Copper & Copper alloy Powders
FOR FUTURE TECHNICAL APPLICATIONS
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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 quality 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
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.

**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*.

**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.

**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

**SPHERICAL SHAPE**

The particle shape depends on process parameters such as composition, 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.

**IRREGULAR SHAPE**

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

**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.

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

### 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.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Copper content *1 (%)</th>
<th>Phosphor content *1 (%)</th>
<th>Sieve analysis *2 (%)</th>
<th>Apparent density *3 (g/cm³)</th>
<th>Flow properties *4</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rogal Copper GK 0/25</td>
<td>min. 99</td>
<td>max. 0.4</td>
<td>&gt;25μm: max. 5</td>
<td>approx. 5</td>
<td>not flowable</td>
<td><img src="image1.png" alt="soldering &amp; joining techniques" /> <img src="image2.png" alt="spherical shape" /> <img src="image3.png" alt="chemical technical applications" /></td>
</tr>
<tr>
<td>Rogal Copper GK 0/50</td>
<td>min. 99</td>
<td>max. 0.4</td>
<td>&gt;50μm: max. 5</td>
<td>approx. 5</td>
<td>flowable</td>
<td><img src="image1.png" alt="soldering &amp; joining techniques" /> <img src="image2.png" alt="spherical shape" /> <img src="image3.png" alt="chemical technical applications" /></td>
</tr>
<tr>
<td>Rogal Copper GK 0/63</td>
<td>min. 99</td>
<td>max. 0.4</td>
<td>&gt;63μm: max. 5</td>
<td>approx. 5</td>
<td>flowable</td>
<td><img src="image1.png" alt="soldering &amp; joining techniques" /> <img src="image2.png" alt="spherical shape" /> <img src="image3.png" alt="chemical technical applications" /></td>
</tr>
<tr>
<td>Rogal Copper GK 50/100</td>
<td>min. 99</td>
<td>max. 0.4</td>
<td>&gt;100μm: max. 5 &lt;50μm: max. 10</td>
<td>approx. 5</td>
<td>flowable</td>
<td><img src="image1.png" alt="soldering &amp; joining techniques" /> <img src="image2.png" alt="spherical shape" /> <img src="image3.png" alt="chemical technical applications" /></td>
</tr>
<tr>
<td>Rogal Copper GK 0/250</td>
<td>min. 99</td>
<td>max. 0.4</td>
<td>&gt;250μm: max. 5</td>
<td>approx. 5</td>
<td>flowable</td>
<td><img src="image1.png" alt="soldering &amp; joining techniques" /> <img src="image2.png" alt="spherical shape" /> <img src="image3.png" alt="chemical technical applications" /></td>
</tr>
<tr>
<td>Rogal Copper GK 0/315</td>
<td>min. 99</td>
<td>max. 0.4</td>
<td>&gt;315μm: max. 5</td>
<td>approx. 5</td>
<td>flowable</td>
<td><img src="image1.png" alt="soldering &amp; joining techniques" /> <img src="image2.png" alt="spherical shape" /> <img src="image3.png" alt="chemical technical applications" /></td>
</tr>
</tbody>
</table>


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 spherically 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.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Copper content *1 (%)</th>
<th>Tin content *1 (%)</th>
<th>Phosphor content *1 (%)</th>
<th>Sieve analysis *2 (%)</th>
<th>Apparent density *3 (g/cm³)</th>
<th>Flow properties *4</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rogal Bronze GK 0/25</td>
<td>approx. 90</td>
<td>approx. 10</td>
<td>max. 0.4</td>
<td>&gt;25μm: max. 5</td>
<td>approx. 5</td>
<td>not flowable</td>
<td>bearings</td>
</tr>
<tr>
<td>Rogal Bronze GK 0/80</td>
<td>approx. 90</td>
<td>approx. 10</td>
<td>max. 0.4</td>
<td>&gt;80μm: max. 5</td>
<td>approx. 5</td>
<td>flowable</td>
<td>spherical shape</td>
</tr>
<tr>
<td>Rogal Bronze GK 0/125</td>
<td>approx. 90</td>
<td>approx. 10</td>
<td>max. 0.4</td>
<td>&gt;125μm: max. 5</td>
<td>approx. 5</td>
<td>flowable</td>
<td>bearings</td>
</tr>
<tr>
<td>Rogal Bronze GK 80/180</td>
<td>approx. 90</td>
<td>approx. 10</td>
<td>max. 0.4</td>
<td>&gt;180μm: max. 5 &lt;80μm: max. 10</td>
<td>approx. 5</td>
<td>flowable</td>
<td>brake linings</td>
</tr>
<tr>
<td>Rogal Bronze GK 0/250</td>
<td>approx. 90</td>
<td>approx. 10</td>
<td>max. 0.4</td>
<td>&gt;250μm: max. 5</td>
<td>approx. 5</td>
<td>flowable</td>
<td>bearings</td>
</tr>
<tr>
<td>Rogal Bronze GK 0/180-01</td>
<td>approx. 89</td>
<td>approx. 11</td>
<td>max. 0.4</td>
<td>&gt;180μm: max. 5</td>
<td>approx. 5</td>
<td>flowable</td>
<td>bearings</td>
</tr>
<tr>
<td>Rogal Bronze GK 0/63-03</td>
<td>approx. 96</td>
<td>approx. 4</td>
<td>max. 0.4</td>
<td>&gt;63μm: max. 5</td>
<td>approx. 5</td>
<td>flowable</td>
<td>bearings</td>
</tr>
</tbody>
</table>


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.
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.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Copper content *1 (%)</th>
<th>Tin content *1 (%)</th>
<th>Zinc content *1 (%)</th>
<th>Sieve analysis *2 (%)</th>
<th>Apparent density *3 (g/cm³)</th>
<th>Flow properties *4</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rogal Bronze GS 0/32</td>
<td>approx. 88</td>
<td>approx. 10</td>
<td>approx. 2</td>
<td>&gt;32μm: max. 5</td>
<td>approx. 3</td>
<td>not flowable</td>
<td>![Gear] ![Machined] ![Powder] ![Blast]</td>
</tr>
<tr>
<td>Rogal Bronze GS 0/32-01</td>
<td>approx. 85</td>
<td>approx. 11</td>
<td>approx. 4</td>
<td>&gt;32μm: max. 5</td>
<td>approx. 5</td>
<td>not flowable</td>
<td>![Gear] ![Machined] ![Powder] ![Blast]</td>
</tr>
<tr>
<td>Rogal Bronze GS 0/63</td>
<td>approx. 88</td>
<td>approx. 10</td>
<td>approx. 2</td>
<td>&gt;63μm: max. 5</td>
<td>approx. 3</td>
<td>not flowable</td>
<td>![Gear] ![Machined] ![Powder] ![Blast]</td>
</tr>
<tr>
<td>Rogal Bronze GS 0/160</td>
<td>approx. 88</td>
<td>approx. 10</td>
<td>approx. 2</td>
<td>&gt;160μm: max. 5</td>
<td>approx. 3</td>
<td>flowable</td>
<td>![Gear] ![Machined] ![Powder] ![Blast]</td>
</tr>
<tr>
<td>Rogal Bronze GS 0/200-03</td>
<td>approx. 89</td>
<td>approx. 10</td>
<td>max. 1</td>
<td>&gt;200μm: max. 5</td>
<td>approx. 3.8</td>
<td>flowable</td>
<td>![Gear] ![Machined] ![Powder] ![Blast]</td>
</tr>
<tr>
<td>Rogal Bronze GS 0/160-04</td>
<td>approx. 84</td>
<td>approx. 15</td>
<td>max. 1</td>
<td>&gt;160μm: max. 5</td>
<td>approx. 3.8</td>
<td>flowable</td>
<td>![Gear] ![Machined] ![Powder] ![Blast]</td>
</tr>
<tr>
<td>Rogal Bronze GS 45/100-05</td>
<td>approx. 87</td>
<td>approx. 10</td>
<td>approx. 3</td>
<td>&gt;100μm: max. 5</td>
<td>approx. 3</td>
<td>flowable</td>
<td>![Gear] ![Machined] ![Powder] ![Blast]</td>
</tr>
<tr>
<td>Rogal Bronze GS 100/200-05</td>
<td>approx. 87</td>
<td>approx. 10</td>
<td>approx. 3</td>
<td>&gt;200μm: max. 5&lt;45μm: max. 15</td>
<td>approx. 3</td>
<td>flowable</td>
<td>![Gear] ![Machined] ![Powder] ![Blast]</td>
</tr>
</tbody>
</table>


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)

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


Different fractions out of a particle size range 0/500 μm can be produced. Further variations of alloys are possible.
**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.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Particle Size *2</th>
<th>Sieve residue *3 (µm/%)</th>
<th>Apparent Density *4 (g/cm³)</th>
<th>Tap Density *5 (g/cm³)</th>
<th>Flow rate *6 (s/50g)</th>
<th>Recommended Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rogal Copper GK 0/10 VP/50347</td>
<td>~ 4 ~ 8 ~ 15</td>
<td>&gt; 25 / max. 1</td>
<td>~ 3</td>
<td>~ 5</td>
<td>not flowable</td>
<td><img src="image1" alt="Image" /></td>
</tr>
<tr>
<td>Rogal Copper GK 10/25 VP/50522</td>
<td>~ 13 ~ 20 ~ 27</td>
<td>&gt; 25 / max. 5</td>
<td>~ 4.1</td>
<td>~ 5</td>
<td>not flowable</td>
<td><img src="image2" alt="Image" /></td>
</tr>
<tr>
<td>Rogal Copper GK 0/25</td>
<td>~ 8 ~ 16 ~ 25</td>
<td>&gt; 25 / max. 5</td>
<td>~ 4.4</td>
<td>~ 5.5</td>
<td>not flowable</td>
<td><img src="image3" alt="Image" /></td>
</tr>
<tr>
<td>Rogal Copper GK 10/50 VP/50487</td>
<td>~ 21 ~ 36 ~ 52</td>
<td>&gt; 50 / max. 5</td>
<td>~ 4.6</td>
<td>~ 5</td>
<td>~ 11</td>
<td><img src="image4" alt="Image" /></td>
</tr>
<tr>
<td>Rogal Copper GK 0/50</td>
<td>~ 16 ~ 32 ~ 55</td>
<td>&gt; 50 / max. 5</td>
<td>~ 4.6</td>
<td>~ 5.3</td>
<td>~ 12</td>
<td><img src="image5" alt="Image" /></td>
</tr>
<tr>
<td>Rogal Copper GK 0/63</td>
<td>~ 19 ~ 39 ~ 63</td>
<td>&gt; 63 / max. 5</td>
<td>~ 4.7</td>
<td>~ 5.4</td>
<td>~ 12</td>
<td><img src="image6" alt="Image" /></td>
</tr>
<tr>
<td>Rogal Copper GK 0/80</td>
<td>~ 20 ~ 46 ~ 78</td>
<td>&gt; 80 / max. 5</td>
<td>~ 5</td>
<td>~ 5.4</td>
<td>~ 12</td>
<td><img src="image7" alt="Image" /></td>
</tr>
<tr>
<td>Rogal Copper GK 45/100</td>
<td>~ 57 ~ 79 ~ 105</td>
<td>&gt;100 / max. 5</td>
<td>~ 5</td>
<td>~ 5.3</td>
<td>~ 13</td>
<td><img src="image8" alt="Image" /></td>
</tr>
<tr>
<td>Rogal Copper GK 0/160</td>
<td>~ 45 ~ 84 ~ 135</td>
<td>&gt;160 / max. 5</td>
<td>~ 4.8</td>
<td>~ 5</td>
<td>~ 15</td>
<td><img src="image9" alt="Image" /></td>
</tr>
</tbody>
</table>


Different fractions out of a particle size range 0/315 µm can be produced.

**Chemical properties:**
- Copper content: min. 99 %
- Phosphor content: max. 0.02 %
- Total oxygen content: max. 1.0 %

**Images:**
- Thermal management materials
- Additive manufacturing
- Conductive materials
Rogal® Bronze GK for Additive Manufacturing

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

<table>
<thead>
<tr>
<th>Product name</th>
<th>Tin content *1 (%)</th>
<th>Particle Size *2</th>
<th>Sieve residue *3 (µm/%)</th>
<th>Apparent Density *4 (g/cm³)</th>
<th>Tap Density *5 (g/cm³)</th>
<th>Flow rate *6 (s/50g)</th>
<th>Recommended Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rogal Bronze GK 0/10 VP/50468</td>
<td>~ 10</td>
<td>~ 4</td>
<td>~ 8</td>
<td>~ 12</td>
<td>&gt; 25 / max. 1</td>
<td>~ 3</td>
<td>~ 4</td>
</tr>
<tr>
<td>Rogal Bronze GK 0/25</td>
<td>~ 10</td>
<td>~ 6</td>
<td>~ 13</td>
<td>~ 21</td>
<td>&gt; 25 / max. 5</td>
<td>~ 4</td>
<td>~ 5</td>
</tr>
<tr>
<td>Rogal Bronze GK 10/45 VP/50468</td>
<td>~ 10</td>
<td>~ 16</td>
<td>~ 28</td>
<td>~ 43</td>
<td>&gt; 45 / max. 5</td>
<td>~ 5</td>
<td>~ 5.1</td>
</tr>
<tr>
<td>Rogal Bronze GK 0/63-03</td>
<td>~ 4</td>
<td>~ 20</td>
<td>~ 41</td>
<td>~ 62</td>
<td>&gt; 63 / max. 5</td>
<td>~ 5</td>
<td>~ 5.3</td>
</tr>
<tr>
<td>Rogal Bronze GK 0/63-06</td>
<td>~ 6</td>
<td>~ 20</td>
<td>~ 41</td>
<td>~ 62</td>
<td>&gt; 63 / max. 5</td>
<td>~ 5</td>
<td>~ 5.3</td>
</tr>
<tr>
<td>Rogal Bronze GK 0/80</td>
<td>~ 10</td>
<td>~ 26</td>
<td>~ 52</td>
<td>~ 79</td>
<td>&gt; 80 / max. 5</td>
<td>~ 5</td>
<td>~ 5.3</td>
</tr>
<tr>
<td>Rogal Bronze GK 32/125</td>
<td>~ 10</td>
<td>~ 45</td>
<td>~ 79</td>
<td>~ 121</td>
<td>&gt; 125 / max. 5 &lt; 32 / max. 5</td>
<td>~ 5.2</td>
<td>~ 5.5</td>
</tr>
</tbody>
</table>


Different contents of tin and phosphor and fractions out of a particle size range 0/315 µm can be produced.
Friction and brake linings
Contact materials
Surface metallization
Chemical technical applications
Technical plastics, compounds
Lubricants
Soldering and joining techniques
Powder metallurgy, sintering materials
Blasting abrasive techniques
Binder Jetting (BJT)
Powder laser deposition (LMD)
Coldspray
Electron beam powder bed fusion (EBM)
Selective laser sintering (SLS)
Friction Welding
Laser Beam powder bed fusion (LB-PBF), Selective Laser Melting (SLM), Direct Metal Laser Sintering (DMLS)
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