



CT!

**Practical Application
of Copper-Based
High-Temperature
Materials**

**Creating
powerful
materials.**

“C” FOR CONDUCTIVITY. “T” FOR TEMPERATURE RESISTANCE.

Applications in the field of **welding and cutting** require a combination of two material properties that are almost impossible to achieve with conventional conductor materials: high electrical and / or thermal conductivity combined with excellent resistance to high temperatures. Similar challenges must also be overcome in other industries, such as in **electrical and railroad engineering**, or in **electron beam technology**.

CEP DISCUP® copper-based high-temperature materials solve this problem. They exhibit a distinctive **CT property** – that is, they are both highly conductive and temperature-resistant at the same time. They also have other beneficial properties, such as wear resistance, good sliding behavior, and elastic properties. This opens up a range of potential applications in other fields; for example, in mechanical and plant engineering, or in precision engineering.

One particularly impressive characteristic is the material’s strength-memory effect: even after exposure to high thermal stress during processing or application, the material’s original strength properties are restored automatically after cooling down.



Finished Products

LONG-LIFETIME CONTACT TIPS.

Contact tips are the most important wearing part in arc welding equipment. Made of **CEP DISCUP®+Cu** composite tubes, they exhibit the conductivity of pure copper, but last significantly longer than tips made of CuCr1Zr. Both the semi-finished and finished products are manufactured by CEP Freiberg. The company can supply contact tips to fit the systems of most manufacturers of MIG, MAG, and submerged-arc welding equipment. Special nozzles are also available; for example, those required for electric-arc spraying.

The tips are available with round or pentagonal internal geometries. The latter improves electrical contact and, in addition, reduces wear caused by welding-wire friction, because the voids offered by the profile accommodate abraded particles.

Another end product made from composite tubes are CEP Freiberg's patented **TIG welding collets**. They, too, are characterized by a service-life extension when compared with conventional collets.



Contact tips made of CEP DISCUP®+Cu composite tube. The longitudinal cross-section shows the CEP DISCUP® core surrounded by a copper sheath



Also made from composite tube: Patented TIG welding collets

SERVICE LIFETIME compared to contact tips made of CuCr1Zr:

UP TO 500 %  LONGER

ELECTRICAL CONDUCTIVITY

(of pure copper sheath):

 100 % IACS

OPERATING TEMPERATURE:



UP TO 900 °C

PRODUCT RANGE:

A wide range of geometries are possible



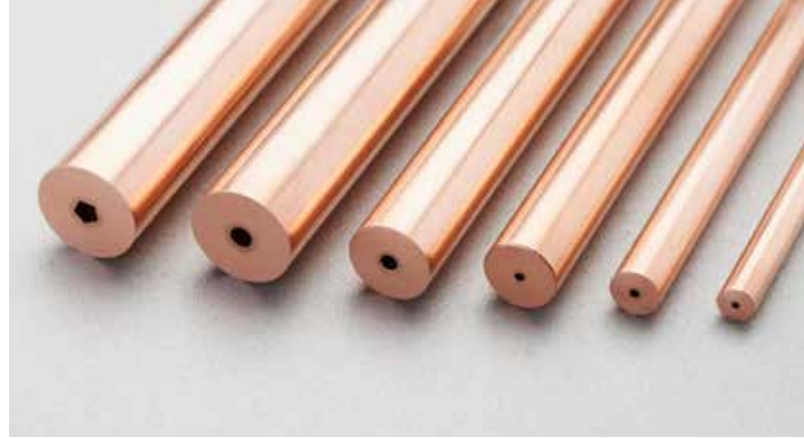
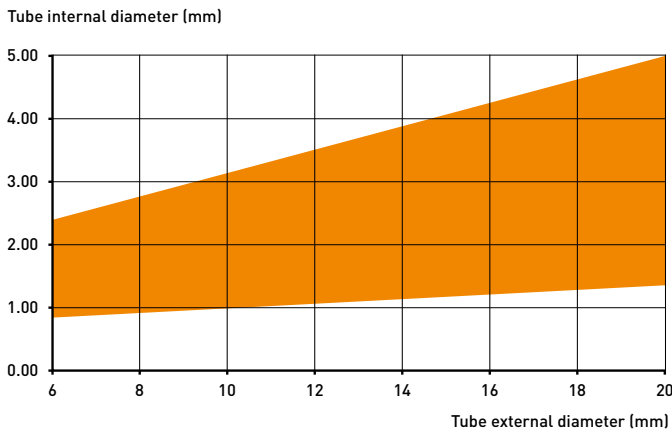
Semi-Finished Products

COMPOSITE TUBE FOR PREMIUM CT-PRODUCTS.

CEP DISCUP®+Cu composite tubes consist of a highly conductive pure copper sheath on the outside with a temperature- and wear-resistant copper-based high-temperature material on the inside. This makes it a premium product in terms of its CT property.

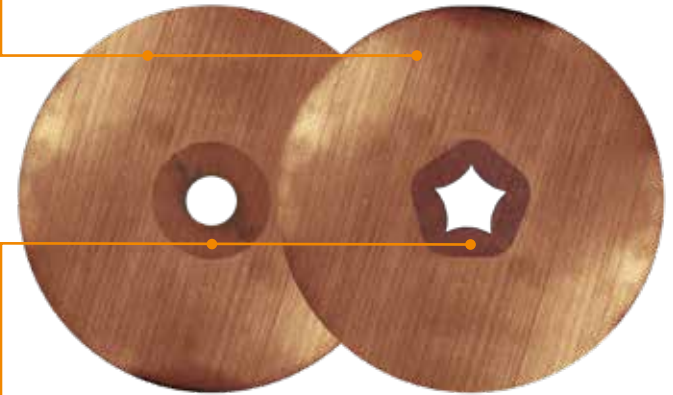
The maximum tube length is approx. 3 meters. Composite tubes can be produced with round or pentagonal internal geometries. This is the semi-finished product from which CEP Freiberg also produces its long-lifetime contact tips.

CEP DISCUP®+Cu: Tube dimensions



CEP DISCUP®+Cu composite tube as a semi-finished product

Pure copper sheath –
for maximum electrical conductivity



CEP DISCUP® core tube –
for maximum temperature- and wear resistance,
with round or pentagonal internal geometry

The tips are available with round or pentagonal internal geometries. For the pentagonal geometry, the internal diameter specified applies to the smaller inscribed circle.

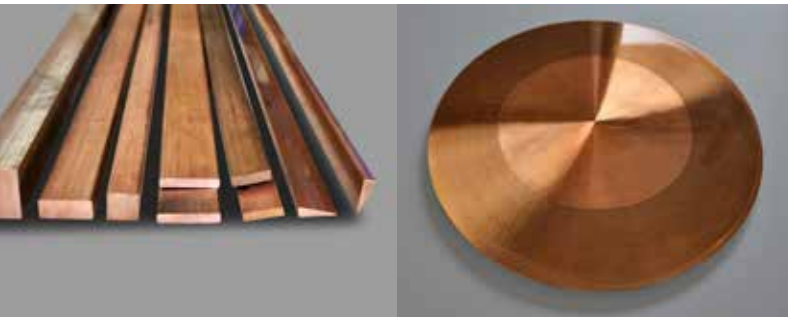
Semi-Finished Products

ROUND BARS, PROFILES AND LARGE-DIAMETER SEMI-FINISHED PRODUCTS.

CEP DISCUP® copper-based high-temperature materials are supplied primarily as round bars. Square, rectangular, or other polygonal profiles are also available on request. CEP Freiberg offers a wide range of standard geometries, but tailor-made developments are also possible.

With **CEP DISCUP® C3/30** and **CEP DISCUP® VOLT** – which is specially tailored to electrical engineering applications – material variants are offered that satisfy CT requirements superbly. Other CEP products are specifically designed for mechanical strength and, thus, exhibit excellent wear resistance. **CEP DISCUP® C3/11-M**, for example, matches the strength of unalloyed steel. All material variants are temperature resistant up to 900 °C, and exhibit the associated strength-memory effect.

Large volumes of semi-finished products are available on request. They are produced by hot isostatic pressing (HIP).



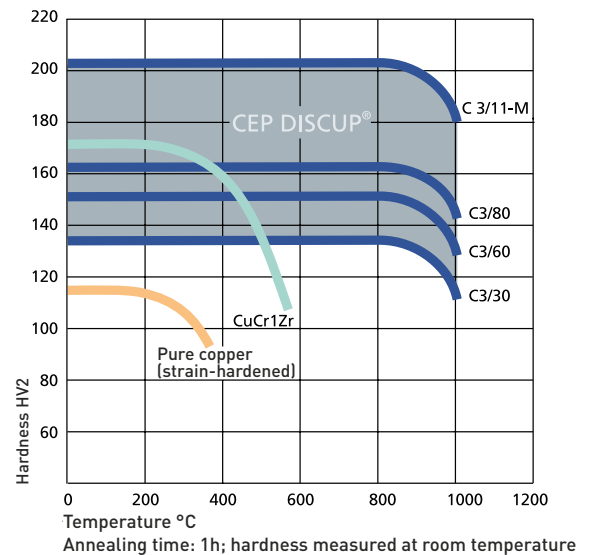
Available as bar stock or as large-diameter semi-finished products: Copper-based high-temperature materials from CEP Freiberg



CEP DISCUP®: Available dimensions of round bars

Diameter	3.0 mm to 30.3 mm
Maximum length	3,200 mm

Resistance to high temperatures:
Comparison of the room-temperature hardness values of CEP DISCUP®, pure copper, and CuCr1Zr after annealing.

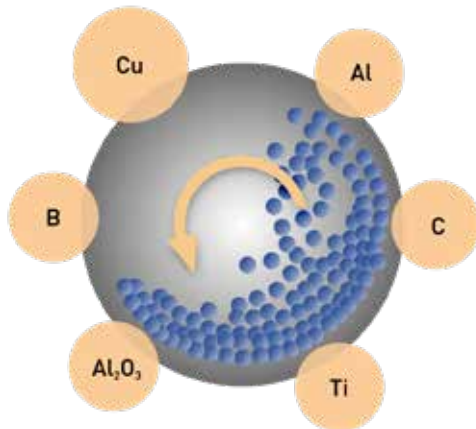


FROM GRANULATE TO SEMI-FINISHED PRODUCTS.

At CEP Freiberg, special processes called **reaction milling** and **mechanical alloying**, are used to transform high-purity copper powder and additives into a granulate consisting of copper-based high-temperature material.

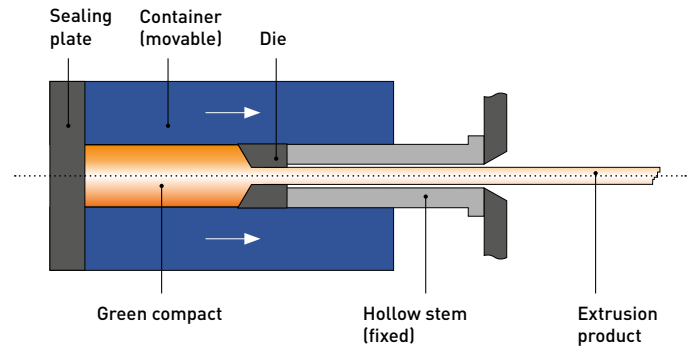
This granulate is then processed into bar material by **indirect extrusion**. To this end, it is first formed into an extrusion-ready intermediate product: the green body. Composite tubes are produced by an innovative process called **hydrostatic extrusion**. This involves processing billets of pure copper into which a core of copper-based high-temperature material has been inserted. Bars and composite tubes are produced in-house by CEP Freiberg.

During **hot isostatic pressing** of large-diameter semi-finished products, on the other hand, the granulate is converted into a solid billet in a specially manufactured molding chamber by means of a lengthy process involving high pressures and temperatures.

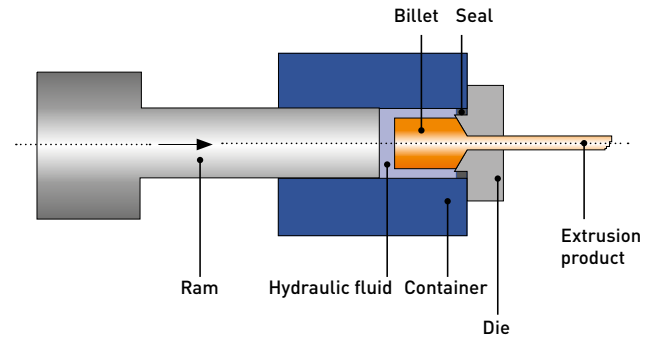


Granulate production by reaction milling / mechanical alloying

Indirect extrusion



Hydrostatic extrusion



Properties of CEP DISCUP® at room temperature

CEP DISCUP®	C3/30	C3/60	C3/80	C3/11-M
Hardness HV2	130 ± 10	152 ± 5	161 ± 6	205 ± 15
Tensile strength MPa	400	450 - 510	470 - 540	600 - 690
0.2 % Yield strength MPa	340	360 - 400	380 - 420	480 - 520
Elongation %	15 - 20	15 - 20	8 - 12	6 - 10
Electrical conductivity % IACS	87 ± 3	79 ± 3	77 ± 3	59 ± 4


The properties apply to the diameter range of 8 to 30 mm. The data are approximate values and may vary depending on the processing method. The right to revise technical specifications is, therefore, reserved.



cep-freiberg.de

App_2023/06_DE

CEP – Compound Extrusion Products GmbH
Maxim-Gorki-Straße 31 | 09599 Freiberg/Germany
Phone: +49 3731 7732 0 | Fax: +49 3731 7732 11
E-Mail: cep@cep-freiberg.de

made in 
germany