

Tungsten-Carbide Silver (WCAg) Contact Materials for Vacuum Contactors



A Step ahead in Technology.

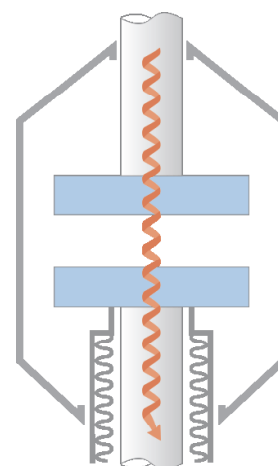


Vacuum Contactors must be able to interrupt high short-circuit currents. For application in vacuum contactors (e.g. 7,1 kV / 4 kA) Tungsten-Carbide Silver (WCAg) is the best material of choice whenever little chopping currents and long lifetime are required. For a contactor for instance, a service life of 1.000.000 or more operations at rated current may be expected.

Nominal chemical composition *

	WCAg40 infiltrated	WCAg40 PSR
WC [wt.-%]	60	60
Ag [wt.-%]	40	40
Additives [wt.-%]	up to max. 0.5	up to max. 4.0

** Typical data for calculations in contact design but not valid for specifications
Special compositions on request.*



Operating principle

Impurities*

	WCAg40 infiltrated	WCAg40 PSR
O [mg/g]	40	450
N [mg/g]	5	60
H [mg/g]	2	10

* Typical data for calculations in contact design but not valid for specifications

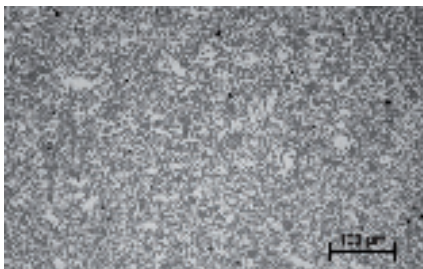
Physical properties*

	WCAg40 infiltrated	WCAg40 PSR
Density [g/cm ³]	12.8	12.4
Hardness [HV 10]	190	120
Electrical conductivity [m/Ωmm ²]	25	16

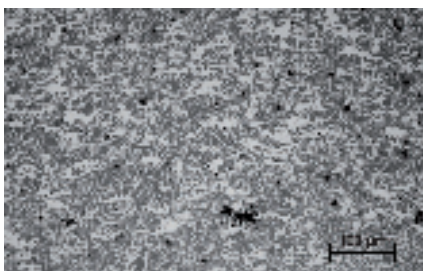
* Typical data for calculations in contact design but not valid for specifications

For practical applications the Ag content varies between 40 and 60 wt.-%. WCAg40 is the best material of choice for applications where very low chopping currents are required. The WCAg contact materials from PLANSEE Powertech are produced following ASTM B 663-94 where the production processes for consolidation and material properties are defined.

Microstructure of PLANSEE Powertech WCAg Materials for Vacuum Contactors



Microstructure of WCAg40 infiltrated



Microstructure of WCAg40 PSR

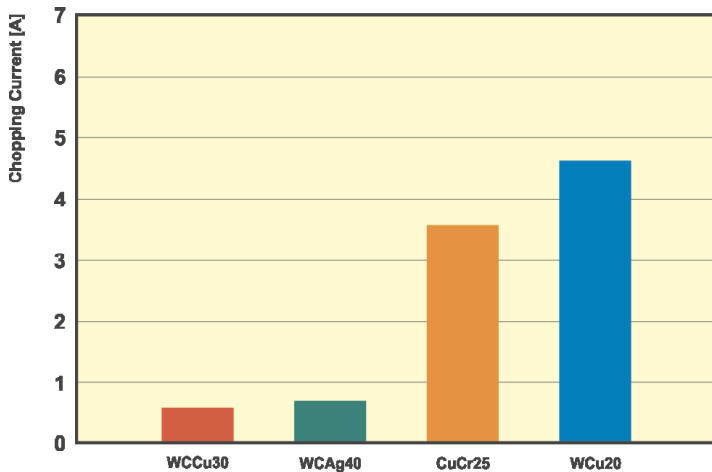
Technical requirements for electrical switches and contact materials lead to contradictory material properties which can be met successfully by composite materials made by the use of powder metallurgy. The steps of the powder metallurgical process are mixing, pressing, sintering. To get full density after sintering a repressing step or an infiltration step is necessary. The press sinter infiltration route ensures the best electrical properties for WCAg contacts. This process produces the most densified composites, generally 97 % or more of theoretical density.

The press sinter repress route leads to a higher content of residual porosity and gaseous impurities. Furthermore, the material has weak bonding between the WC particles caused by the repressing operation which can lead to a higher erosion rate and lower breakdown strength, respectively, coming from free WC particles on the contact surface. The homogeneity of a contact material is defined by the degree of uniformity of the two mixed phases and can be influenced by the mixing operation and the process used for production. The grain size of the WC powder is optimised with respect to minimization of erosion rate and is typically in a range of 1 to 5 µm (Fisher Sub Sieve Grain Size). The PSR variant is used for cost driven standardized commodity vacuum connectors.

Overview about PLANSEE Powertech Materials for Vacuum Contactors

Beside WCAg PLANSEE Powertech produces a variety of contact materials based on refractory components even used as contacts for vacuum contactors. Depending on the composition the materials have different material properties.

Chopping current of different PLANSEE Powertech contact materials



Tested in 20 kA / 24 kV vacuum contactor (max. current 630 A)
(F. Heitzinger et al., 15th ISDEIV, Darmstadt, 1992)

Material properties of different PLANSEE Powertech contact materials

	WCCu30	WCAg40	CuCr25	WCu20
Density [g/cm ³]	12.5	12.6	8.15	15.2
Vickers Hardness [HV]	330	190	80	200
Electrical conductivity [m/Ωmm ²]	20	22	32	18

Typical data for calculations in contact design but not valid for specifications
(R. Grill et al., 21st ICEC, Zürich, 2002)

PLANSEE Powertech has been established as the competence center for contact materials and components within the PLANSEE Group. All contact materials from PLANSEE Powertech are produced under ISO 9001 and are designed to meet more detailed specifications. We are pleased to support you in selecting the optimum material.

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