CuAg0,04 OF

UNS:C10400, C10500
EN:CW017A, CR017A

Manufactures list:
Aurubis (http://www.aurubis.com/en/) - OS35
KGHM Polska Miedź S.A. (http://www.kghm.pl/) - CuAg0,04(OF)
Luvata (http://www.luvata.com/) - CuAg0,04 (OF)

Excellent consistency, machinability and cleanliness of strips enable good stamping behaviors. Commutator strips and wires offer higher softening temperature and improved properties. [Ref: 47]
Increasing addition of silver give increase in creep strength and resistance to softening in elevated service temperatures. Good creep resistance to 250°C (short times at350°C) provides suitability for electrical motor parts, semi-conductor components and etching plates. [Ref: 52]

The addition of silver increases the resistance to recrystallization up to 450°C and improves creep properties up to 250 °C. The resistance to recrystallization and creep increases with increasing silver content. [Ref: 41]

The oxygen-free quality is maintained throughout the casting process without the addition of deoxidising elements. With a maximum impurity content of 65 ppm, CuAg0,04OF meets the enhanced requirements for electronic applications. The quality is free of oxygen and so insensitive to hydrogen embrittlement. The quality is also free of phosphorous and so provides an excellent and reliable electrical conductivity. [Ref: 41]

Oxygen-free copper grade containing silver, resistance to hydrogen embrittlement, increased resistance to softening with high conductivity. [Ref: 43]

Basic properties

Basic properties	Value	Comments	Literature
Density [g/cm^3]	8,94		[Ref: 41]
Specific heat capacity [J/(kg*K)]	386		[Ref: 41]
Temperature coefficient of electrical resistance (0...100°C) [10^{-3}/K]	No data		
Electrical conductivity [T=20°C, (% IACS)]	100-101,5		[Ref: 47]
Thermal conductivity [W/(m*K)]	385	20°C	[Ref: 41]
Thermal expansion coefficient 20...300°C [10^{-6}/K]	16,8	20-100°C	[Ref: 41, 47]

Applications

Main applications

Commutator strips, wires, electrical motor parts, semi-conductor components and etching plates, radiators, [Ref: 47, 52]
Electrical commutator segments, conductors, busbars, conductivity wire, contacts, windings, switches, terminal connectors, terminal connectors, radio parts, printed circuit foil, industrial chemical process equipment, printing rolls, clad metals, heat exchanger tube, [Ref: 91]

Kinds of semi-finished products/final products

Applicable Specifications [Ref: 91]

Product	Specification
Bar	ASME SB152, ASTM B152
Bar, bus	ASTM B187
Pipe, bus	ASTM B188
Plate	ASME B152, ASTM B152
Rod, bus	ASTM B187
Shapes, bus	ASTM B187
Sheet	ASME SB152, ASTM B152
Sheet, clad	ASTM B506
Strip	ASME SB152, ASTM B152
Strip, clad	ASTM B506
Tube, bus	ASTM B188
Wire, medium-hard drawn	ASTM B2, FEDERAL QQ-W-343
Wire, coated with lead alloy	ASTM B189
Wire, coated with nickel	ASTM B355
Wire, coated with silver	ASTM B298
Wire, coated with tin	ASTM B246
Wire, flat	ASTM B272
Wire, hard drawn	ASTM B1, FEDERAL QQ-W-343
Wire, soft	ASTM B3, EDERAL QQ-W-343

Tempers Most Commonly Used [Ref: 91]

Flat Products	
Bar, drawn	H01, H04, H06, O60
Bar, rolled	H01, H04, H06, M20, O60
Plate	H00, M20
Sheet	H00, H02, M20, O60
Strip, drawn	H04, O60
Strip, rolled	H00, H01, H02, H04, H08, H10, M20, O60
Wire, drawn	H04, H06, O60
Wire, rolled	H04, O60

Other	
Rof	H04, M20
Shapes	H04, M20, M30, O60
Wire	H00, H01, H04, H08, O60

EN 13601 (2002) Copper and copper alloys - Copper rod, bar and wire for general electrical purposes [Ref: 91]

Specifications	UTS, MPa	YS, MPa	A, %	Hardness HB	Hardness HV
Round, square, multigonal; H035; > 2 <= 80 mm	-	-	-	35-65	35-65
Rectangular; H035; > 0.5 <= 40 mm	-	-	-	35-65	35-65
Round, square, multigonal; R200; > 2 <= 80 mm	Min. 200	Max. 120	Min. 35	-	-
Rectangular; R200; > 0.5 <= 40 mm	Min. 200	Max. 120	Min. 35	-	-
Round, square, multigonal; H065; > 2 <= 80 mm	-	-	-	65-90	70-95
Rectangular; H065; > 0.5 <= 40 mm	-	-	-	65-90	70-95
Round, square, multigonal; R250; > 2 <= 10 mm	Min. 250	Min. 200	Min. 12	-	-
Round, square, multigonal; R250; > 10 <= 30 mm	Min. 250	Min. 180	Min. 15	-	-
Round, square, multigonal; R230; > 30 <= 80 mm	Min. 230	Min. 160	Min. 18	-	-
Rectangular; R250; > 1 <= 10 mm	Min. 250	Min. 200	Min. 12	-	-
Round, square, multigonal; R230; > 10 <= 40 mm	Min. 230	Min. 160	Min. 18	-	-
Round, square, multigonal; H085; > 2 <= 40 mm	-	-	-	85-110	90-115
Round, square, multigonal; H075; > 40 <= 80 mm	-	-	-	75-100	80-105
Rectangular; H085; > 0.5 <= 20 mm	-	-	-	85-110	90-115
Rectangular; H075; > 20 <= 40 mm	-	-	-	75-100	80-105
Round, square, multigonal; R300; > 2 <= 20 mm	Min. 300	Min. 260	Min. 8	-	-
Round, square, multigonal; R300; > 20 <= 40 mm	Min. 280	Min. 240	Min. 10	-	-
Rectangular; R300; > 1 <= 10 mm	Min. 300	Min. 260	Min. 8	-	-
Rectangular; R300; > 10 <= 20 mm	Min. 280	Min. 240	Min. 10	-	-
Round, square, multigonal; R260; > 40 <= 80 mm	Min. 260	Min. 220	Min. 12	-	-
Rectangular; R260; > 20 <= 40 mm	Min. 260	Min. 220	Min. 12	-	-
Round, square, multigonal; H100; > 2 <= 10 mm	-	-	-	Min. 100	Min. 110

Rectangular; H100; > 0.5 <= 5 mm	-	-	-	Min. 100	Min. 110
Round, square, multigonal; R350; > 2 <= 10 mm	Min. 350	Min. 320	Min. 5	-	-
Rectangular; R350; > 1 <= 5 mm	Min. 350	Min. 320	Min. 5	-	-

Chemical composition

Chemical composition	Value	Comments
Ag [wt.%]	0,03-0,05	
Bi [wt.%]	0-0,0005	max.
Cu [wt.%]	99,943-99,9635	Calculated
Others [wt.%]	0,0065	max. (excluding Ag, O2)
[Ref: 41]		

Chemical composition, ppm [Ref: 41]																
Ag	**Sn**	**Ni**	**Si**	**Cr**	**Zr**	**Fe**	**P**	**As**	**Bi**	**Cd**	**Co**	**Mn**	**Pb**	**S**	**Zn**	**Cu**
400	<1	<1		<1		<2	<1	<1	<0,5	<0,1	<1	<1	<1	<5	<1	rest

Mechanical properties

Mechanical properties	Value	Comments	Literature
UTS [MPa]	200-350		[Ref: 91]
YS [MPa]	120-320		[Ref: 91]
Elongation [%]	5-35		[Ref: 91]
Hardness	35-65 35-70	[HB] [HV]	[Ref: 91] [Ref: 91]
Young's modulus [GPa]	110		[Ref: 41]
Kirchhoff's modulus [GPa]	No data		
Poisson ratio	No data		

EN 13605 (2002) Copper profiles and profiled wire for electrical purposes [Ref: 91]

Specifications for wires	UTS, MPa	YS, MPa	A, %	Hardness HB	Hardness HV
H035; t < 50 mm	-	-	-	35-65	35-70
R200; t < 50 mm	Min. 200	Max. 120	Min. 35	-	-
H065; t < 10 mm	-	-	-	65-95	70-100
R240; t < 10 mm	Min. 240	Min. 160	Min. 15	-	-
H080; t < 5 mm	-	-	-	80-115	85-120
R280; t < 5 mm	Min. 280	Min.240	Min. 8	-	-

Exploitation properties

Heat resistance

Mechanical and electrical properties vs temperatures

NO DATA AVAILABLE

Long-therm heat resistance, e.g. Arrhenius curve

NO DATA AVAILABLE

Half- softening temperature

NO DATA AVAILABLE

Corrosion resistance

Hydrogen embrittlement resistance

CuAg0,04 (OF) has a good hydrogen-resistant [Ref: 47]

Other kind of corrosion elements

Type of corrosion	Suitability	Literature
Atmospheric	No data	-
Marine environment	No data	-
Stress crack	No data	-
Hydrogen embrittlement	CuAg0,04 (OF) has a good hydrogen-resistant	[Ref: 47]
Electrolytic	No data	-
Other - oxidising acids	No data	-

Rheological resistance

Stress relaxation

NO DATA AVAILABLE

Creep

NO DATA AVAILABLE

Wear resistance

Friction resistance

NO DATA AVAILABLE

Fatigue resistance

Fatigue cracking

NO DATA AVAILABLE

Impact strength

NO DATA AVAILABLE

Fabrication properties

Fabrication properties	Value	Comments
Soldering	Excellent	
Brazing	Good	
Oxyacetylene Welding	Fair	
Gas Shielded Arc Welding	Fair	
Capacity for Being Cold Worked	Excellent	
Capacity for Being Hot Formed	Good	
Forgeability Rating	65	
Machinability Rating	20	
[Ref: 52]		

Technological properties

Technological properties	Value	Comments
Casting temperature [°C]	1120-1200	
Stress relievieng temperature [°C]	250-350	
Hot working temperature [°C]	750-950	
[Ref: 52]		

References:

41. **CuAg0.04(OF) / CuAg0.1(OF)** - Aurubis

43. **Copper sections for various applications** - Wieland

47. **Data sheet - Commutator Copper** - Luvata

52. **High Conductivity Coppers For Electrical Engineering** - CDA Publication 122, 1998

91. **Key to Metals - Data Base** - www.keytometals.com