Copper, Cu; Annealed

Categories: Metal; Nonferrous Metal; Copper Alloy; Pure Element

Material Notes: Annealed applies only to tensile and/or hardness values; other property values are typical of the element. This entry is for pure Cu, MatWeb also has entries for many alloys.

In general, copper alloys exhibit good to excellent corrosion resistance and high thermal conductivity and very high electrical conductivity. Pure copper's electrical conductivity is so high that many metals are measured against it in the form of the IACS (International Annealed Copper Standard). Applications include architectural uses, coinage, condenser/heat exchangers, plumbing, radiator cores, musical instruments, locks, fasteners, hinges, ammunition components, and electrical connectors. Small amounts of alloying elements are often added to copper to improve certain characteristics. Alloying can increase or reduce the strength, hardness, electrical and thermal conductivity, corrosion resistance, or change the color. Common primary alloying elements include tin (resulting in bronze) or zinc (resulting in brass).

Physical Properties	Metric	English	Comments
Density	7.764 g/cc @Temperature 1300 °C	0.2805 lb/in³ @Temperature 2370 °F	
	7.846 g/cc @Temperature 1200 °C	0.2835 lb/in³ @Temperature 2190 °F	
	7.924 g/cc @Temperature 1100 °C	0.2863 lb/in³ @Temperature 2010 °F	
	7.94 g/cc @Temperature 1083.6 °C	0.287 lb/in³ @Temperature 1982.5 °F	
	8.93 g/cc @Temperature 20.0 °C	0.323 lb/in³ @Temperature 68.0 °F	

Chemical Properties	Metric	English	Comments
Atomic Mass	65.546	65.546	1995
Atomic Number	29	29	
Thermal Neutron Cross Section	3.8 barns/atom	3.8 barns/atom	
X-ray Absorption Edge	1.38 Å	1.38 Å	K
	11.269 Å	11.269 Å	L_I
	12.994 Å	12.994 Å	L_{II}
	13.2578 Å	13.2578 Å	L_{III}
Electrode Potential	-0.520 V	-0.520 V	monovalent
	-0.340 V	-0.340 V	divalent
Electronegativity	1.9	1.9	Pauling
Ionic Radius	0.720 Å	0.720 Å	Crystal Ionic Radius for Valence +2
	0.960 Å	0.960 Å	Crystal Ionic Radius for Valence +1
Electrochemical Equivalent	1.185 g/A/h	1.185 g/A/h	divalent
	2.38 g/A/h	2.38 g/A/h	monovalent

Mechanical Properties	Metric	English	Comments
Hardness, Vickers	50	50	
Tensile Strength, Ultimate	210 MPa	30500 psi	
Tensile Strength, Yield	33.3 MPa	4830 psi	
Elongation at Break	60 %	60 %	
Modulus of Elasticity	110 GPa	16000 ksi	
Bulk Modulus	140 GPa	20300 ksi	
Poissons Ratio	0.343	0.343	
Shear Modulus	46.0 GPa	6670 ksi	

Electrical Properties	Metric	English	Comments
Electrical Resistivity	0.00000170 ohm-cm	0.00000170 ohm-cm	

Magnetic Susceptibility	-8.00e-8	-8.00e-8	cgs/g

Thermal Properties	Metric	English	Comments
Heat of Fusion	204.8 J/g	88.10 BTU/lb	
Heat of Vaporization	5234 J/g	2252 BTU/lb	
CTE, linear	16.4 µm/m-°C @Temperature 20.0 - 100 °C	9.11 µin/in-°F @Temperature 68.0 - 212 °F	
	18.5 µm/m-°C @Temperature 250 °C	10.3 µin/in-°F @Temperature 482 °F	
	20.2 µm/m-°C @Temperature 500 °C	11.2 µin/in-°F @Temperature 932 °F	
	24.8 µm/m-°C @Temperature 925 °C	13.8 µin/in-°F @Temperature 1700 °F	
Specific Heat Capacity	0.385 J/g-°C	0.0920 BTU/lb-°F	
Thermal Conductivity	385 W/m-K	2670 BTU-in/hr-ft²-°F	
	357 W/m-K @Temperature 727 °C	2480 BTU-in/hr-ft²-°F @Temperature 1340 °F	
	398 W/m-K @Temperature 27.0 °C	2760 BTU-in/hr-ft²-°F @Temperature 80.6 °F	
	401 W/m-K @Temperature 0.000 °C	2780 BTU-in/hr-ft²-°F @Temperature 32.0 °F	
	483 W/m-K @Temperature -173 °C	3350 BTU-in/hr-ft²-°F @Temperature -279 °F	
	10500 W/m-K @Temperature -253 °C	72900 BTU-in/hr-ft²-°F @Temperature -423 °F	
	19600 W/m-K @Temperature -263 °C	136000 BTU-in/hr-ft²-°F @Temperature -441 °F	
Melting Point	1083.2 - 1083.6 °C	1981.8 - 1982.5 °F	
Boiling Point	2562 °C	4644 °F	

Optical Properties	Metric	English	Comments
Emissivity (0-1)	0.15 @Wavelength >=655 nm, Temperature 807 °C	0.15 @Wavelength >=655 nm, Temperature 1480 °F	polished
Reflection Coefficient, Visible (0-1)	0.63	0.63	

Component Elements Properties	Metric	English	Comments
Copper, Cu	100 %	100 %	

Descriptive Properties

CAS Number	7440-50-8

References for this datasheet.