Ti-2.5Cu

TIMETAL® 230

COLD FORMABLE MEDIUM-STRENGTH ALLOY

TIMETAL 230, a binary alloy containing 2.5% copper, combines the formability and weldability of unalloyed titanium with improved mechanical properties, particularly at elevated temperatures. The alloy can be used at temperatures up to 660°F (350°C), and is used in the annealed condition as sheet, for gings and extrusions for fabricating components such as bypass ducts of gas-turbine engines. Its use spread to the airframe industry, following the development of an ageing treatment which raises room-temperature tensile properties by about 25%, and nearly doubles the elevated temperature properties. Such a material is particularly attractive since it can be formed in the soft condition, thus lowering fabrication costs.

TABLE 1

CHEMICAL COMPOSITION

ELEMENT	WEIGHT %	
	Minimum	*Maximum*
Copper	2.00	3.00
Iron	—	0.20
Oxygen	—	0.20
Carbon	—	0.08
Nitrogen	—	0.03
Hydrogen	—	0.01
Residual Elements, each	—	0.10
Residual Elements, total	—	0.40
Titanium	Remainder	

TABLE 2

PHYSICAL PROPERTIES

PROPERTY	VALUE	
	English	*SI*
Density	0.165 lb in^{-3}	4.56 g cm^{-3}
Beta Transus	1640°F	890°C
Thermal Conductivity	7.50 Btu hr^{-1} ft^{-1} $°F^{-1}$	12.97 W m^{-1} K^{-1}
Electrical Resistivity	26 μΩ•in	0.65 μΩ•m
Magnetic Permeability	Nonmagnetic	
Mean Coefficient of Thermal Expansion [a]	5.0 x 10^{-6} in in^{-1} $°F^{-1}$	9.0 x 10^{-6} m m^{-1} $°C^{-1}$
Elastic Modulus [b]	15.2-17.4 Msi	105-120 GPa

[a] Mean coefficient from room temperature to 212°F (100°C)
[b] Typical values at room temperature of about 68-78°F (20-25°C)

TABLE 3

HEAT TREATMENT

Anneal	*Solution Heat Treatment*	*Aging Heat Treatment*
1454°F (790°C) 1 hour / Air Cool	1481°F (805°C) 1 hour / Rapid Air Cool	752°F (400°C) 8-24 hours / Air Cool + 887°F (475°C) 8 hours / Air Cool

TABLE 4

GUARANTEED MINIMUM MECHANICAL PROPERTIES

Condition	*UTS ksi (MPa)*	*0.2% YS ksi (MPa)*	*Elongation %*	*Reduction in Area %*	*Bend Radius*
Annealed	90 (620)	74 (510)	25	35	2.5T
STA	110 (760)	87 (600)	20	25	2.5T

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TABLE 5

FATIGUE AND TENSILE PROPERTIES

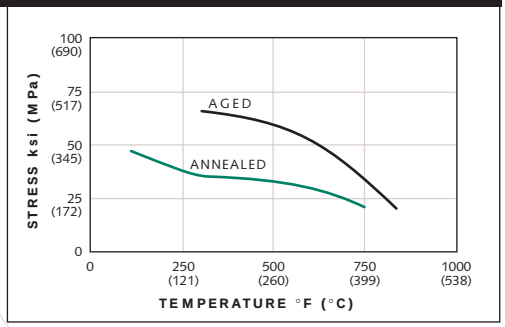
ROD

Condition	Ultimate Tensile Strength ksi (MPa)	Fatigue Limit 10^7 Cycles ksi (MPa)	Fatigue Ratio
Direct Stress			
Annealed	93 (638)	±41 (280)	0.43
Aged	115 (792)	±68 (470)	0.58
Aged K_t=3.3	–	±29 (200)	–
Rotating Bend			
Annealed	87 (598)	±54 (370)	0.62
Aged	115 (791)	±65 (450)	0.57
Rotating Bend at 752°F (400°C)			
Annealed	–	±22 (150)	–
Aged	–	±42 (290)	–
SHEET			
Reverse Bend			
Annealed	82 (564)	±57 (390)	0.68
Aged	112 (772)	±71 (490)	0.64
Direct Stress			
Aged	110 (761)	0-83 (0-570)	–

FIGURE 2

CREEP PROPERTIES

STRESS FOR 0.1% TOTAL PLASTIC STRAIN IN 100 HOURS



The data and other information contained herein are derived from a variety of sources which TIMET believes are reliable. Because it is not possible to anticipate specific uses and operating conditions, TIMET urges you to consult with our technical service personnel on your particular applications.

FIGURE 1

EFFECT OF TEMPERATURE ON TENSILE PROPERTIES

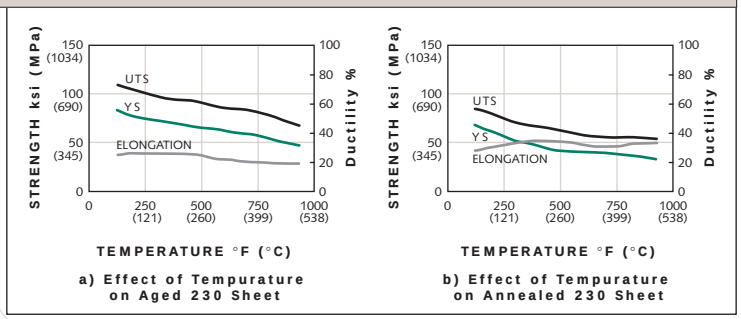


TABLE 6

COLD ROLLED SHEET TENSILE PROPERTIES

Condition	0.1% Proof Stress ksi (MPa)	Tensile Strength ksi (MPa)	Elongation on 1 in (25mm) %
1. Solution treated (ST)	80.2 (553)	91.7 (632)	21
2. ST + 752°F(400°C)/24h	84.4 (582)	99.9 (689)	21
3. ST + duplex age	99.6 (687)	119.2 (822)	16
4. As 2 + 20% cold work + 887°F(475°C)/8h	117.6 (811)	131.0 (903)	10
5. As 2 + 30% cold work + 887°F(475°C)/8h	116.5 (803)	130.4 (899)	10
6. As 2 + 40% cold work + 887°F(475°C)/8h	113.3 (781)	127.5 (879)	9
7. As 3 + 30% cold work	129.7 (894)	138.4 (954)	8
8. As 3 + 30% cold work + 887°F(475°C)/6h	101.2 (698)	125.5 (865)	8

For more information, please contact the TIMET Sales Office/Service Center nearest you, TIMET's Technical Laboratories or TIMET's Website @ www.timet.com

NORTH AMERICA

Hartford, CT	860-627-7051
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TECHNICAL SUPPORT

Henderson, NV	702-566-4416
Birmingham, England	44-121-332-5381

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