

Cu/Invar/Cu Electronic Materials

Copper/Invar/Copper is a wrought, metallic composite material used in printed circuit boards, power planes, metal cores, hybrid enclosures, heat sinks, and other applications where coefficient of thermal expansion (CTE) match or constraint of thermal expansion is required. The laminated Cu/Invar/Cu composite material is metallurgically clad by roll bonding and has been the design of choice for high end PWBs and military avionics for years.



Product Description - Key Attributes

EMS Material Designation

CIC

Composition

Copper/ Invar/ Copper

Ratios

12.5 / 75 / 12.5 20 / 60 / 20

Chemical Composition

UNS

Grade Eur

Chemistry(%)

C10300

Cu-OF

Cu incl Ag 99.95; P 0.005 max

K93600 (Invar)

1.3912

Ni 35.5 - 36.5; Mn 0.50, Si 0.25, C 0.12, P 0.025, Si 0.25 max; bal Fe

Physical Properties

12.5/75/12.5

20/60/20

CTE - 55 to 125 C

2.4 - 5.6 ppm / C

6.3 - 6.8 ppm / C

Density

8.33 g/cm³

8.43 g/cm³

Modulus of Elasticity

1.40 x 10⁵ MPa

1.35 x 10⁵ MPa

Thermal Conductivity

1.1, 0.2 w/(cm*°C)

1.67, 0.2 w/(cm*°C)

Electrical Conductivity

25 %IACS

40 %IACS

America

Michael Hardy

New Business Development

Phone: +1 508 342 2304

Email: mhardy@emsclad.com

Asia

C.W. Kong

General Manager

Phone: +86 514 8891 6888

Email: c.w.kong@wickedergroup.com.cn

Europe

James Craggs

European Business Manager

Phone: +44 (0)7799 358 150

Email: jcraggs@emsclad.com



Mechanical Properties

| | | |
|----------------------------|---------------|---------------|
| Yield Strength 0.2% offset | 241 - 345 MPa | 173 - 276 MPa |
| Tensile Strength | 379 - 482 MPa | 310 - 413 MPa |
| Elongation 2" gage length | 20 % min | 25 % min |
| Hardness (Invar Layer) | 137 - 150 HV | 137 - 150 HV |

Other Properties

ENGLISH

METRIC

| | | |
|---------------|--------------|------------|
| Peel Strength | 100 lbs / in | 18 kg / cm |
|---------------|--------------|------------|

Heat Treatment

Cu/Invar/Cu is provided normally in the fully annealed condition and therefore does not need heat treatment prior to processing or forming. To soften the material after cold work, anneal in the range of 650° C to 955° C (1200° F - 1750° F). Actual annealing temperature and time depend on the material dimension, annealing furnace type and material property needs. Low temperature annealing introduces less diffusion between Cu and Invar, when high electrical conductivity is required in the Cu. Stress relief heat treatment is performed at a much lower temperature in the range of 300° to 375° C (570° to 705° F). Stabilizing heat treatment can follow the same process used for Invar.

Formability

Cu/Invar/Cu has excellent formability to meet common manufacturing requirements in the products where the material is used.

Joinability

Cu/Invar/Cu sheet can be readily joined by adhesive lamination process for multilayer board, sometimes with a certain surface treatment being performed first for better adhesion with epoxy. The Cu/Invar/Cu can be edge-joined to some dissimilar alloys by laser or electron beam welding. Soldering of the copper surface can also be used as a joining method.

Corrosion Resistance

Since outside surfaces of Cu/Invar/Cu are copper, material has similar corrosion and corrosion resistance behavior as can be found in commercial.



Availability

| | |
|--------------------------|--|
| Gauge | 0.006 - 0.075" (0.5 - 1.9 mm) |
| Width | Widths up to 25", (635mm) available |
| Ratio | others available upon request |
| Surface Roughness | Less than 1.27 micro meters |
| Temper | Annealed. Other tempers available upon request |
| Form | Coil or cut to length sheets |