Torrey Hills Technologies, LLC.
A Company of G Tech Systems Group, Inc.
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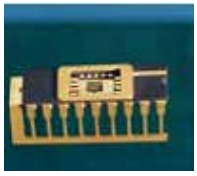
Saneway[tm] Series of Advanced Heat Sink Materials

Our award winning manufacturing facility (Changsha Saneway Electronic Materials Co., Ltd.) locates in the University Science and Technology Park, Central South University in Changsha, Hunan Province, China. We are the leading Chinese manufacturer of advanced thermal management materials like W/Cu, Mo/Cu, Cu/Mo/Cu and Cu/Mo70Cu/Cu.

Our products are being widely used RF/microwave devices, opto-electronics, laser submounts and many other applications (see the product pictures below). Our quality system is ISO9001:2000 certified. We are the sole domestic qualified vendor for Chinese space industry. Internationally our products are shipped to the US, Canada, Mexico, Japan, Korea, Singapore and many European countries.

(1)



(2)

(3)

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(1) Microwave package (2) power package (3) laser package (4) opto-device package

Currently we offer the heat sinks made from the following four types of materials:

1. W-Cu series, composition from 90/10 to 75/25.
2. Mo-Cu series, composition from 70/30 to 50/50
3. Cu/Mo/Cu laminate series, thickness ratio range from 1:1:1 to 13:74:13 etc.
4. Cu/Mo70Cu/Cu laminate series, thickness ratio 1:1:1 to 1:4:1

For more information, please visit www.torreyhillstech.com.

Copper Tungsten (CuW)

CuW is a composite material made from copper and tungsten. By controlling the content of tungsten, we can tailor its coefficient of thermal expansion (CTE) to match that of the materials, such as ceramics (Al_2O_3, BeO), Semiconductors(Si, GaAs), Glass and so on.

Features: * High thermal conductivity
* Excellent hermeticity
* Excellent dimensional control, surface finish and flatness
* Semi-finished or finished (Ni/Au plated) products available

Typical Applications: RF, Microwave and Millimeter Wave Packages LDMOS FET; MSFET; HBT; Bipolar; HEMT; MMIC, Power Packages; Laser Diode Packages and Carriers for Optoelectronics.

Fig.1 Typical CuW components

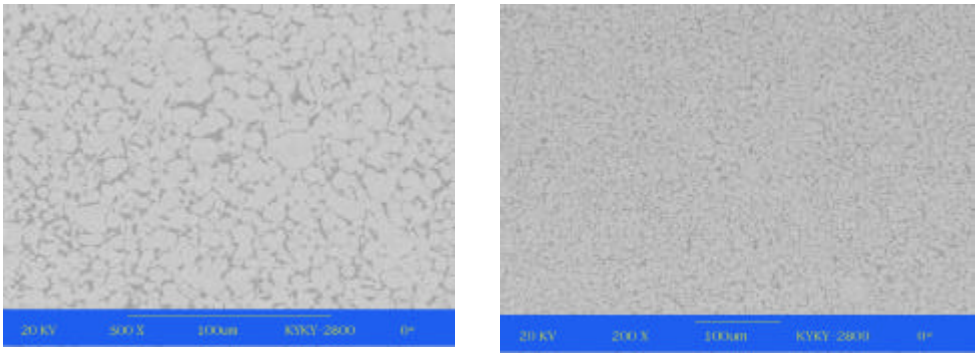

Fig. 2 The Microstructures of Copper Tungsten

Typical Technical Properties

Type	Composition		Properties		
	Element	Content wt%	Density g/cm^3	CTE ppm/K	Thermal Conductivity W/m.K
W90Cu	W Cu	90±1 balance	17.0	6.5	180~ 190
W85Cu	W Cu	85±1 balance	16.3	7.0	190~ 200
W80Cu	W Cu	80±1 balance	15.4	8.3	200~ 210
W75Cu	W Cu	75±1 balance	14.9	9.0	220~ 230

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Copper Molybdenum (CuMo)

CuMo is a composite made from Mo and Cu. Similar to W-Cu, CTE of CuMo can also be tailored by adjusting the composition. But CuMo is much lighter than that of W-Cu so that it is more suitable for applications where lighter weight is preferred.

Features:
* High thermal conductivity due to no sintering additives were used
* Excellent hermeticity
* Relatively small density
* Stampable sheets available (Mo content not more than 70wt-%)
* Semi-finished or finished (Ni/Au plated) parts available

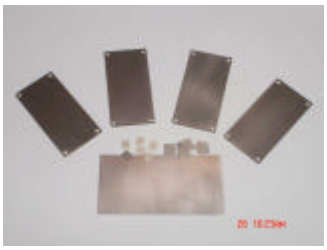

Fig. 3 Typical CuMo Products

Typical Applications: RF, Microwave and Millimeter Wave Packages LDMOS FET; MSFET; HBT; Bipolar; HEMT; MMIC, Power Packages; Laser Diode Packages and Carriers for Optoelectronics.

Typical Technical Properties

Type	Composition		Properties		
	Element	Content wt-%	Density g/cm^3	CTE ppm/K	Thermal conductivity W/m.K
Mo70Cu	Mo Cu	70±1 balance	9.8	9.1	170~ 200
Mo60Cu	Mo Cu	60±1 balance	9.66	10.3	210~ 250
Mo50Cu	Mo Cu	50±1 balance	9.54	11.5	230~ 270

Cu/Mo/Cu (CMC Laminate)

Cu/Mo/Cu (CMC) is a sandwich composite including a molybdenum core layer and two copper clad layers. It has variable CTE, high thermal conductivity and high strength. All types of Cu/Mo/Cu sheets can be stamped into components.

Features:
* Variable sheet size available (length up to 16",width up to 4")
* Can be stamped into components
* Very strong interface bonding which can repeatedly resist 850^{o}C thermal shock
* Variable CTE matching that of semiconductor and ceramic materials
* High thermal conductivity
* No magnetism

Typical Applications: Microwave carriers and heat sinks, BGA Packages, LED packages, GaAs device mounts

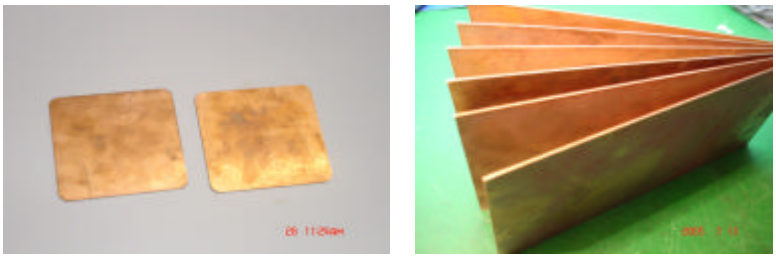

Fig. 4 Typical Cu/Mo/Cu Laminate Products

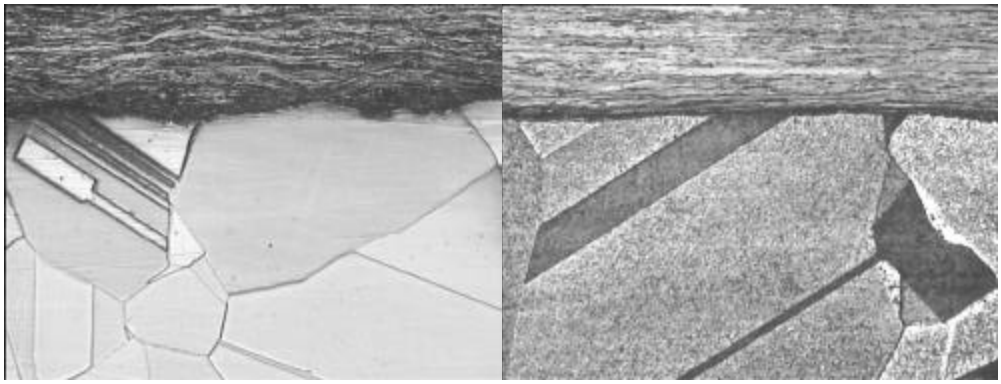

Fig. 5 Microstructure of Cu/Mo/Cu interface

Typical Technical Properties

Cu/Mo/Cu	Density g/cm^3	CTE , ppm/K	Thermal conductivity, W/m.K	
			In-plane	Thru-thickness
13:74:13	9.88	5.6	200	170
1:4:1	9.75	6.0	220	180
1:3:1	9.64	6.8	240	190
1:2:1	9.52	7.8	260	210
1:1:1	9.37	8.8	310	250

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Cu/Mo70Cu/Cu (CPC) Laminate

Cu/Mo70Cu/Cu (CPC) is a sandwich composite similar to that of Cu/Mo/Cu including a Mo70-Cu alloy core layer and two copper clad layers. The ratio of the thickness in Cu:Mo-Cu:Cu is 1:4:1. It has different CTE in X and Y direction, higher thermal conductivity than that of W (Mo)-Cu？ Cu/Mo/Cu and less expensive. All types of Cu/Mo70Cu/Cu sheets can be stamped into components.

Features: * Variable sheet size available (length up to 16",width up to 4")
* Can be stamped into components
* Very strong interface bonding which can repeatedly resist 850°C thermal shock
* Variable CTE matching that of semiconductor and ceramic materials
* High thermal conductivity
* No magnetism

Typical Applications: Microwave carriers and heat sinks, BGA Packages, LED packages, GaAs device mounts

Fig. 6 Typical Cu/Mo70Cu/Cu Laminate Products

Typical Technical Properties

Cu/Mo70Cu/Cu	Density g/cm^3	CTE， ppm/K		Thermal conductivity, W/m.K	
		X direction	Y direction	In-plane	Thru-plane
1:4:1	9.52	6.9	9.0	340	300

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