ELECTRONIC PACKAGING MATERIALS & HEAT SINK PRODUCTS INTRODUCTION

电子封装及热沉材料产品简介

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ATTL Advanced Materials Co.,Ltd.

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R & D, AND MANUFACTURING BASES

研发制造基地

北京海淀永丰基地

- 尖端产品研发基地
- 高新技术创新中心
- 超高精尖产品制造基地
- 国家级工程技术中心
- 净占地60亩

天津宝坻基地

- 高精尖产品研发基地
- 高端产品制造基地
- 特殊异型小批量多品种高端产品制造基地
- 净占地240亩

陕西太白基地

- 电光源用钨钼高端产品研发制造基地
- 与韩国企业进行深度合作的窗口
- 净占地65亩

山东威海基地

- 永丰和宝坻基地研发创新成果转化基地
- 大批量产品制造基地
- 国内客户集中交流服务中心
- 员工培训和疗养基地
- 净占地215亩

ATTL ADVANCED MATERIALS CO.,LTD

安泰天龙钨钼科技有限公司

“安泰天龙钨钼科技有限公司”（以下简称“ATTL”）是央企“中国钢研科技集团”旗下主力上市公司“安泰科技股份有限公司”（以下简称“AT&M”，股票代码 000969)的全资子公司，由原中国钨钼材料精深加工领域的两个领军企业“北京天龙钨钼科技股份有限公司”和“安泰科技股份有限公司难熔材料分公司”合并而成。

ATTL是AT&M中专业从事难熔材料研究、制造和服务的业务单元，承接了中国钢研科技集团在这一领域六十多年不懈耕耘和北京天龙近二十年快速发展所积累的成果，是央企发挥自身优势、整合社会资源、创新发展机制的典范，是中国钨钼材料精深加工领域公认的领导者。

ATTL是中国钨业协会钨材分会的会长单位、中国有色金属协会钼业分会的副会长单位，拥有员工上千人、高工和博士及硕士等高端人才近百名、先进研发制造设备上千台套、经营性净资产近十亿元，在北京中关村创新园区、天津宝坻经济开发区、陕西宝鸡太白县经济园区、山东威海工业新区拥有四个研发制造基地，总占地面积近600亩。

ATTL研发、制造的钨、钼、钽、铌、铼等高性能难熔金属材料及制品不仅广泛应用于航天航空、国防军工、汽车、电子电力、设备制造、金属材料加工、石英和玻璃及玻纤制造、高温工业炉、电光源等传统行业，而且也大量应用于液晶显示、太阳能、核能、核医学、LED照明、大规模集成电路、新能源汽车、消费电子等各种新兴产业。

ATTL是一家具有国际视野、全球布局、国际化的公司，公司以“使钨钼对人类更有价值”为企业使命，秉持“成就客户，惠泽员工，回报股东，造福社会，天人合一，和谐共赢”的企业核心价值观，实行“安全第一、以人为本、科技创新、精益管理”的企业经营方略，不断将“诚信厚德、团结协作、敬业实干、创新自强”的企业精神发扬光大，使ATTL成为受人尊敬、世界一流的钨钼先进材料和高端制品制造商及解决方案提供者。

As a wholly-owned subsidiary of Advanced Technology & Materials Co., Ltd.(AT&M), ATTL Advanced Materials Co., Ltd. (ATTL) is formed by the merger of Beijing Tianlong tungsten and molybdenum Technology Co., Ltd. And Refractory Materials & Ceramics Branch of AT&M. Refractory Materials & Ceramics Branch of AT&M, whose predecessor is Refractory Alloy Laboratory of Central Iron and Steel Research Institute, was founded in 1958. As one of the earliest units devoted to the refractory metal material in domestic market

ATTL has four R&D manufacturing bases in Beijing Zhongguancun innovation park, Tianjin Baodi economic development zone, Shaanxi Baoji Taibai county economic park and Shandong Weihai industrial new area, of which the total area is nearly 400 thousand m2. Now, treating the refractory metal materials like tungsten, molybdenum, rhenium, Tantalum and Niobium as the main research direction, ATTL constantly provides services to the global high-end market.

ATTL owns the largest sized and the most advanced manufacture facilities in the domestic refractory metal fields. The main equipment including hot isostatic pressing machine, cold isostatic pressing machine, plasma spraying equipment, vacuum induction sintering furnace, controlled atmosphere heat treatment furnace, high temperature sintering furnace, ultrasonic testing, universal testing machine, three coordinate measuring instrument, TC600C oxygen-nitrogen analyzer, C600C carbon analyzer etc.
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ATTL products are widely applied not only in the traditional industries such as aviation, Aerospace, national defense, automobile, electronic and electric power, equipment manufacturing, metal material processing, quartz and glass and glass fiber manufacturing, high-temperature industrial furnaces and electric light sources , but also in the new and emerging ones such as LCD, solar energy, nuclear energy, nuclear medicine, LED lighting, large-scale integrated circuits, new energy vehicles and consumer electronics.

ATTL is committed to provide customers with consistent, reliable, high quality products, prompt deliveries, responsive customer services and to develop mutually profitable partnerships.

Heat Sink
热沉材料

功率电子器件和集成电路在运行时会产生大量的热。热沉材料有助于消除芯片产生的热量，将其传输到其他介质，维持芯片稳定工作。

钼铜、钨铜、CMC和CPC材料结合了钼、钨的低热膨胀率和铜的高热导率，可有效释放电子器件的热量，有助于冷却 IGBT 模块、RF功率放大器、LED 芯片等各种产品，可用于大规模集成电路和大功率微波器件中作为绝缘金属基片、热控板和散热元件（热沉材料）和引线框架。

我们可以按照客户要求提供以上各种材料的板材和成品。如果需要，也可以提供镀镍、镀金、镀银产品。

Power electronics and circuits produce a lot of heat when they work. Heatsink materials help to eliminate chip heat, transferring it to other media and keeping the chip stable.

Molybdenum copper, tungsten copper, CMC and CPC materials, combined with low thermal expansion rate of molybdenum, tungsten and conductivity of copper heat, can effectively release the heat of electronic device and contributes to the cooling of IGBT module, RF power amplifier, LED chips and other products. They are thus applied as a metal substrate, thermal control and heat insulation components (heat sink materials) and the lead frame in large-scale integrated circuit and high power microwave devices.

We can offer WCu, MoCu, CMC, CMCC and S-CMC finished and semi-finished products. And we can also provide these products coated with Ni, NiAu or NiAg.

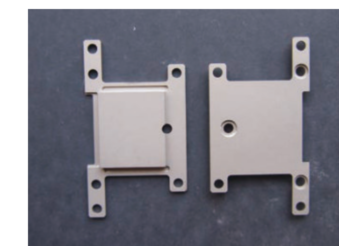
Wcu alloy
钨铜合金

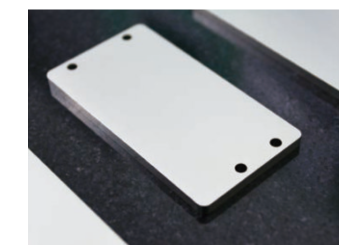
钨铜合金是以钨元素为基、铜元素为副组成的一种两相结构伪合金，是金属中的复合材料 WCu电子封装片，既具有钨的低膨胀特性，又具有铜的高导热特性，尤为可贵的是，其热膨胀系数和导热导电性可以通过调整材料的成分而加以设计，因而给该材料的应用带来了极大的方便。我们采用高纯的优质原料，经压制成形、高温烧结及熔渗后，得到性能优良的WCu电子封装材料及热沉材料。适用于与大功率器件封装的材料，如基片、电极等；高性能的引线框架；热控装置的热控板和散热器等。

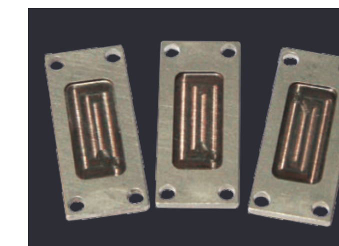
优点：具有与不同基体相匹配的热膨胀系数及高的热导率；优良的高温稳定性及均一性；优良的加工性能。

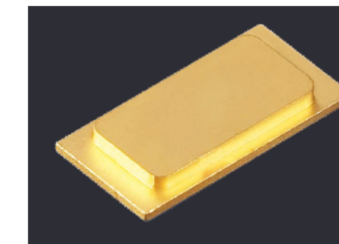
W-Cu electronic packaging materials possess both the low expansion of tungsten and the high thermal conductivity of copper. What is particularly valuable is that its thermal expansion coefficient and thermal conductivity can be adjusted by the material composition and then be designed so as to bring great convenience of the applications of the material. We use high-purity raw materials with good quality, and then by molding, sintered and infiltrated at high temperature, the W-Cu electronic packaging materials and heat sink material with excellent performance are made. It is suitable for material for the package of high-power device, such as a substrate, electrodes and so on; the lead frame of good performance; military and civilian thermal control device such as thermal control board and the heat sink.

Advantages: low thermal expansion coefficient; high thermal conductivity; excellent high temperature stability; uniformity and excellent processing properties;









典型的钨铜合金性能 Typical WCu alloy properties

牌 号 Materials	成分 （wt%） Composite		密度 Density	热膨胀系数 CTE	热导率 Thermal Conductivity
	Cu	W	g/cm³	10^{-6}/K	W/M·K
W94Cu6	6±1	Balance	17.6	6.0	140-160
W90Cu10	10±1	Balance	17.0	6.5	180-190
W85Cu15	15±1	Balance	16.4	7.0	190-200
W80Cu20	20±1	Balance	15.6	8.3	200-210
W75Cu25	30±1	Balance	14.8	9.0	220-230
W50Cu50	50±1	Balance	12.0	12.5	310-340

产品规格：表面电镀Ni、NiAu、NiAg、NiCu或裸片。
Surface: plating Ni, NiAu, NiAg, NiCu or non-plating.

钼铜合金 MoCu alloy

钼铜合金是由两种互不固溶的金属所组成的假合金，兼具钼和铜的特性，具有高热传导率、低热膨胀系数、无磁性、低气体含量、良好的真空性能、良好的机加工性及特殊的高温性能等特性。

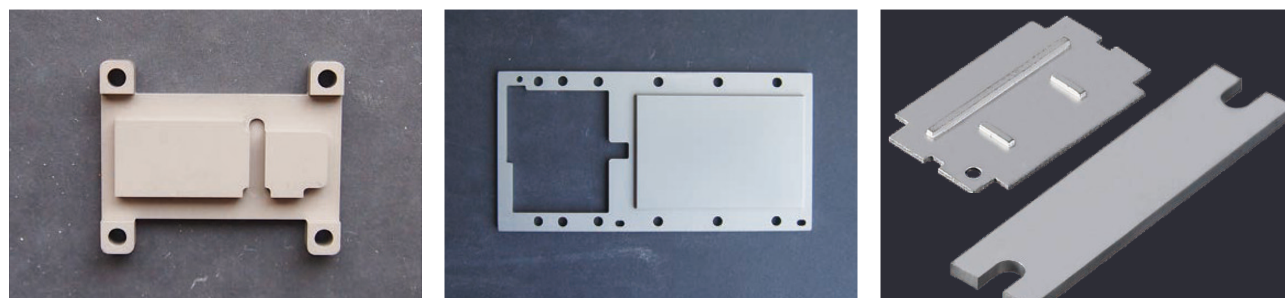
相较于钨铜合金，钼铜合金密度较低，并且可以冲压加工，适合超大批量生产。

MoCu alloy is a kind of pseudo-alloy that is composed of Molybdenum and copper. It consists of both the characteristics of molybdenum and copper, having high thermal conductivity, low adjusted thermal expansion coefficient, being non-magnetic, low content of gas, good vacuum resistance, good machinability and special high-temperature performance, etc.
Compared with WCu alloy, MoCu alloy has lower density and is easier to stamp. It makes MoCu suitable for volume produce.

典型的钼铜合金性能 Typical MoCu Alloy Properties

牌 号 Materials	成分 （wt%） Composite		密度 Density	热膨胀系数 CTE	热导率 Thermal Conductivity
	Cu	W	g/cm³	10^{-6}/K	W/M·K
Mo90Cu10	10±1	Balance	10.0	5.6	150-160
Mo85Cu15	15±1	Balance	9.93	6.8	160-180
Mo80Cu20	20±1	Balance	9.90	7.7	170-190
Mo70Cu30	30±1	Balance	9.80	8.1	180-200
Mo60Cu40	40±1	Balance	9.66	10.3	210-250
Mo50Cu50	50±1	Balance	9.54	11.5	230-270
Mo40Cu60	40 ±0.2	Balance	9.42	11.8	280 - 290

产品规格：表面电镀Ni、NiAu、NiAg、NiCu或裸片。
Surface: plating Ni, NiAu, NiAg, NiCu or non-plating.

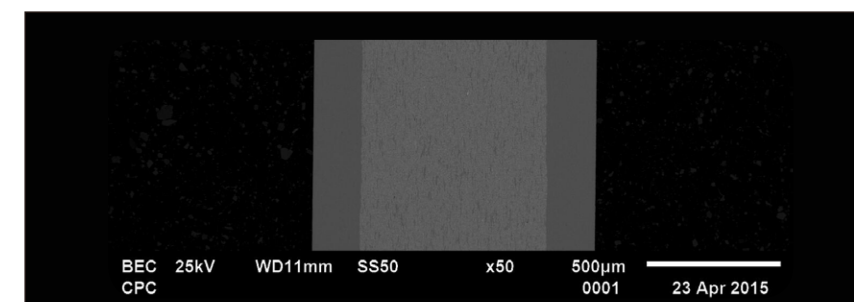


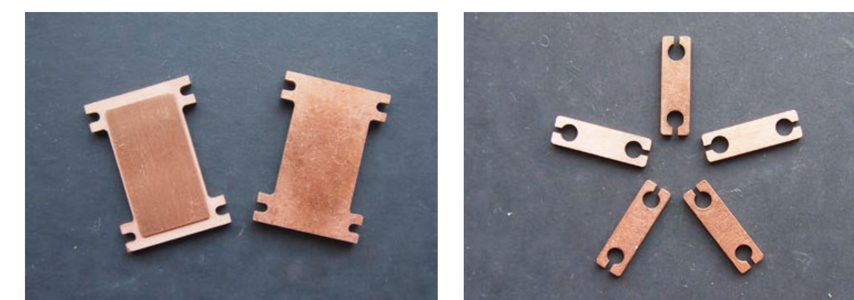
铜-钼-铜 Cu/Mo/Cu（CMC）

此材料是具有类似三明治结构的复合材料，芯材为钼，双面覆铜。其膨胀系数和热导率具有可设计性，用于热沉、引线框、多层印刷电路板（PCB）的低膨胀层和导热通道。

此材料可以冲压加工。

CMC(Cu/Mo/Cu) is a sandwich composite including a molybdenum core layer and two copper clad layers. It has adjustable CTE and high thermal conductivity which make it suitable for heatsink, lead frame and microchannel for PCB. All types of CMC sheets can be stamped into components.





典型的CMC合金性能 Typical CMC properties

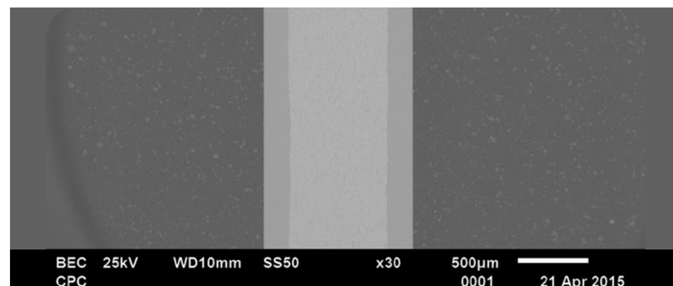
牌 号 Materials	成分 （wt%） Composite	密度 Density	热膨胀系数 CTE	热导率 Thermal Conductivity
	Cu:Mo:Cu	g/cm³	10^{-6}/K	W/M·K
CMC13:74:13	13:74:13	9.88	5.6	200
CMC 141	1:4:1	9.75	6.0	220
CMC 131	1:3:1	9.66	6.8	244
CMC 121	1:2:1	9.54	7.8	260
CMC 111	1:1:1	9.3	8.8	305

产品规格：表面电镀NiAu、NiAg或裸片。
Surface: plating NiAu, NiAg or non-plating.

铜-钼铜-铜 CMCC

此材料性能和用途类似于铜钼铜，芯材通常是Mo70Cu30，也也可以选用Mo50Cu50等。铜-钼铜-铜的热膨胀系数和热导率是可调的。铜-钼铜-铜在X和Y方向的热膨胀系数通常有差异，但是可以调整，这与轧制工艺有关。铜-钼铜-铜比钨铜、钼铜和CMC的热导率更高。铜-钼铜-铜同样可以冲压加工。

CMCC(Cu/MoCu30/Cu) is a sandwich composite similar to Cu/Mo/Cu including a MoCu alloy core layer and two copper clad layers. The normal proportion of MoCu is Mo70Cu30 alloy, sometimes Mo50Cu50 and so on. The ratio of the CTE of CMCC is adjustable. It has different CTE in X and Y direction, but it is also adjustable. It has higher thermal conductivity than that of WCu, MoCu & CMC. All types of CMCC sheets can be stamped into components.



典型的CMCC合金性能 Typical CMCC properties

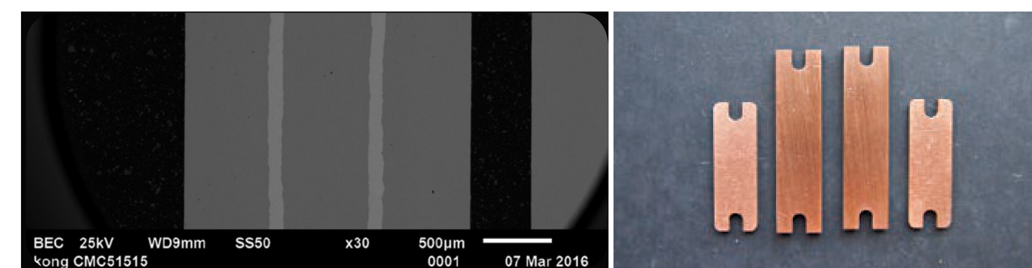
牌 号 Materials	成分 （wt%） Composite	密度 Density	热膨胀系数 CTE	热导率 Thermal Conductivity
	Cu:Mo:Cu	g/cm³	10^{-6}/K	W/M·K
CMCC 141	1:4:1	9.5	8.5	220
CMCC 232	2:3:2	9.3	9.0	255
CMCC 111	1:1:1	9.2	9.5	260
CMCC 212	2:1:2	9.1	11.5	300

产品规格：表面电镀NiAu、NiAg或裸片。
Surface: plating NiAu, NiAg or non-plating.

多层式铜-钼-铜 S-CMC

多层式铜-钼-铜（S-CMC）是一种五层或七层结构的三明治材料，比CMC材料具有更好的热导率和抗变形性能。S-CMC材料同样可以冲压加工。

S-CMC is a sandwich composite with 5 or 7 layers, which has better thermal conductivity and anti-distortion ability than CMC. S-CMC is also suitable for stamping.



典型的S-CMC性能 Typical S-CMC properties

牌 号 Materials	成分 （wt%） Composite	密度 Density	热膨胀系数 CTE	热导率 Thermal Conductivity
	Cu:Mo:Cu:Mo:Cu	g/cm³	10^{-6}/K	W/M·K
S- CMC 51515	5:1:5:1:5	9.2	12.8	350
S- CMC 31313	3:1:3:1:3	9.66		
S- CMC 61216	6:1:2:1:6	9.54		

产品规格：表面电镀NiAu、NiAg或裸片。
Surface: plating NiAu, NiAg or non-plating.

Pure Tungsten and molybdenum

纯钨和纯钼材料

纯钨与纯钼材料热膨胀系数小，高温下不易于变形。

Pure tungsten & Molybdenum are not easily deformed at high temperature because of low CTE.

纯钨、纯钼材料性能 Pure W & Mo properties

牌 号 Materials	密度 Density	热膨胀系数 CTE	热导率 Thermal Conductivity
	g/cm³	10^{-6}/K	W/M·K
纯钨 Tungsten	19.3	4.67	167
纯钼 Molybdenum	10.2	4.90	138

铝碳化硅 AlSiC

产品优势：（AlSiC）铝碳化硅IGBT基板是高铁上必不可少的零件。铝碳化硅复合材料是将碳化硅陶瓷与金属铝复合而成的新材料，将陶瓷与金属的优秀品质齐集一身，热导率高、热膨胀系数低、比刚度好、质量轻，是理想的功率电子基板材料和衬底材料，与电子芯片焊接后可实现良好工作匹配。铝碳化硅基板封装的IGBT产品广泛应用于高铁驱动、地铁驱动、新能源汽车、风力发电、焊接机器人等行业。

Advantage: (AlSiC) aluminum silicon carbide IGBT substrate is indispensable parts on high-speed rail. The composite material of Aluminum silicon carbide is the aluminum silicon carbide ceramic and metal compound and then into new materials, with all the excellent quality of ceramic and metal. It has thermal conductivity, low thermal expansion coefficient and good stiffness, light quality, so it is the ideal power electronic substrate material and substrate material. With the electronic chip, it can realize good match after welding. IGBT products by Aluminum silicon carbide substrate encapsulation are widely used in high-speed rail, subway, and new energy cars, wind power, welding robot, etc.

典型的AlSiC性能 Typical AlSiC properties

牌 号 Materials	密度 Density	热膨胀系数 CTE	热导率 Thermal Conductivity	抗弯强度 Bending Strength
	g/cm³	10^{-6}/K	W/M·K	MPa
Al-55%SiC	2.95	9.0	200	>420
Al-60%SiC	2.97	8.3	209	>380
Al-65%SiC	2.99	8.1	210	>320

硅铝 SiAl

产品优势：主要用于电子封装，在微波功率器件，集成功率模块，T/R模块等电子功率器件中，利用硅铝合金作为电子封装材料的基座，外壳，盒体，盖板，匹配性好，可提供更好的散热，能极大的延长封装大功率模块的使用寿命，可靠性增加。该材料具有重量轻（密度2.4—2.7g/cm³），热导率高，热膨胀系数低，刚度高，易于机加工，表面镀覆性能以及焊接性能好，材料致密性好，耐高温，耐腐蚀等特点。

Advantage: In microwave power device, it is mainly used for electronic packaging, integrated power module, the power electronic devices such as T/R module. Using silicon aluminum alloy as base of electronic packaging materials, shell, the box body, cover plate are a good match. It can provide a better heat dissipation, can greatly prolong the service life of encapsulated power module, increase the reliability. Density of the material has light weight (2.4~2.7 g/cm³), high thermal conductivity, low thermal expansion coefficient, high stiffness, easy for machining, surface plating performance and good welding performance, good material density, high temperature resistance, corrosion resistance, etc.

典型的SiAl性能 Typical AiAL properties

牌 号 Materials	密度 Density	热膨胀系数 CTE	热导率 Thermal Conductivity	抗弯强度 Bending Strength
	g/cm³	10^{-6}/K	W/M·K	MPa
36%SiAl	2.54	13.6	150	>460
50%SiAl	2.50	11.0	128	>190

Glidcop

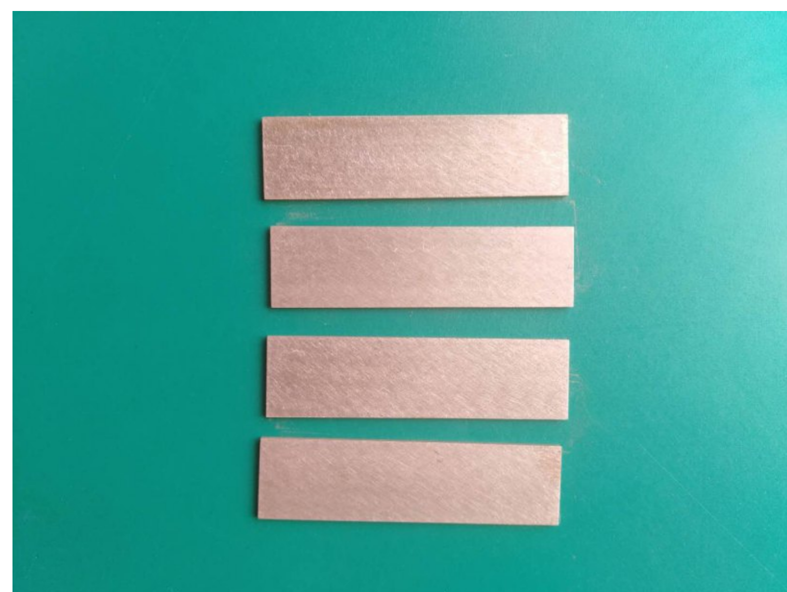
弥散铜材料

氧化铝弥散铜具有接近铜的热导率和热膨胀系数，但是其高温强度性能良好。

Alumina dispersion copper has thermal conductivity and thermal expansion coefficient close to copper, but its high temperature strength performance is good.

典型弥散铜材料性能 Typical Glidcop properties

性能 Properties / 牌号 Grade	导电率 Electric Conductivity IACS%	抗拉强度 Tensile Strength δb，MPa		延伸率 Percentage Elongation	硬度 Hardness HRB	
		室温 Room Temperature	650℃	δ%	室温 Room Temperature	900℃*1h退火 900℃*1h annealing
GM-1	90~95	350~450	270~360	10~15	55~70	55~65
GM-2	85~92	450~550	380~480	7~12	65~80	58~72
GM-3	80~88	460~580	420~530	5~10	78~85	65~75



OFC Heat SinK

无氧铜热沉

典型无氧铜材料性能 Typicl OFC Materials Properties

熔点 Melting point	软化温度 Softening Temperature	密度 Density	热膨胀系数 CTE	热导率 Thermal conductivity
℃	℃	g/cm³	10^{-6}/K	W/M·K
1083℃	150℃	8.93	17.7	391