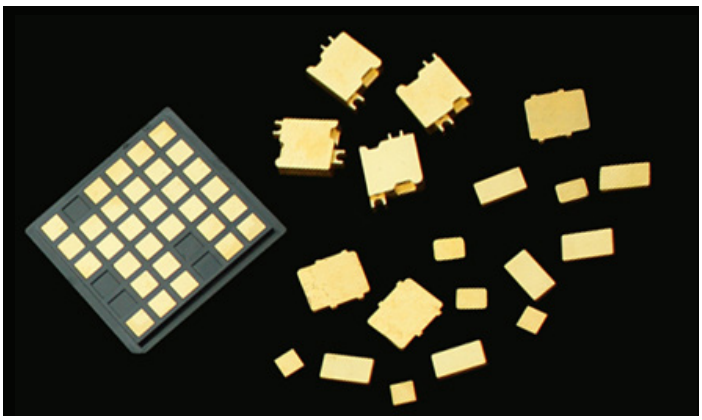
COPPER DIAMOND CD650

Advanced Metal Matrix Composite for High Power Density Semiconductor Thermal Management



Superior Thermal Conductivity with CTE Matching

Advanced thermal packaging materials for GaN and SiC wide bandgap semiconductors is a key technology driver for optimal device performance and reliability. High thermal conductivity low thermal expansion copper diamond metal matrix composites (MMCs) enable passive heat transfer in commercial and defense systems. Thermally isotropic components (650 W/m°K) up to 6" long x 4" wide ranging from ≥ 0.010" to 2" thick are currently offered by Parker Hannifin's CSS Division in North Haven, CT for client evaluation and qualification.

Features

- Isotropic thermal conductivity 650 W/m°K
- CTE matching for managing thermal stress
- Low density, 40% lighter weight than copper
- Near net shape features: raised pedestals, recesses, holes, counterbores, cavities
- Ni, Au, Cu, Ag metallization

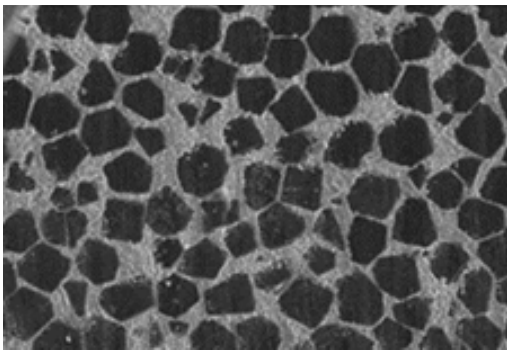
Products

- Heat spreaders
- Die tabs
- Baseplates
- Pedestals
- Shims
- Thermal inserts
- Material blanks
- PCB coins
- Lids
- Housings
- Carriers
- Cold plates
- Integrated constructions

Power Densities Increasing

Innovative material and design solutions play a crucial role in advancing semiconductor thermal management. As devices become smaller, more powerful, and functionality more densely packed together, efficiently dissipating heat becomes increasingly challenging.

Wide-bandgap semiconductors like silicon carbide (SiC) and gallium nitride (GaN) offer superior performance by operating at higher voltages, frequencies, and temperatures, paving the way for further miniaturization and functionality for next generation electronics.



Scanning electron microscope (SEM) image: Diamond particle distribution in Cu

Features / Advantages / Benefits

Feature	Advantage	Benefit
Isotropic Thermal Conductivity and Low CTE	Excellent heat spreading and sinking Direct die attach	Smaller, more powerful devices with greater functionality and reliability
Low Density	66% weight reduction vs. CuW 40% weight reduction vs. Cu	Weight sensitive applications
Near Net Shape Manufacturing	Not limited to simple planar shapes	Design freedom, irregular geometries possible
Hybrid Preform Integration	Hot spot remediation only where needed	Smart Engineering

Applications

- Phased array radar
- Satellites
- 5G, IoT, Data Centers
- Defense and Aerospace
- Automotive electric vehicles (EVs)
- Medical

Thermo-Physical Properties

Copper Diamond CD650	
Thermal Conductivity (W/m°K)	
@ 25°C	650
@ 125°C	620
@ 175°C	600
@ 225°C	580
@ 325°C	550
Cp (J/g-K)	0.54
Avg CTE (ppm/°C)	
30° to 150°C	6.8
30° to 200°C	6.9
30° to 300°C	7.3
Density (g/cc)	5.4
Electrical Resistivity (ohm * m)	$9.5x10^{-8}$
Plating Metallization	Electrolytic Copper QQ-N-290 Class 1 Nickel ASTM B488 Type III Gold

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CSS-5167 Print Reorder Number 03/24

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