

High Performance Metal Solutions

# Refractory Metals

for the Power Semiconductor Industry



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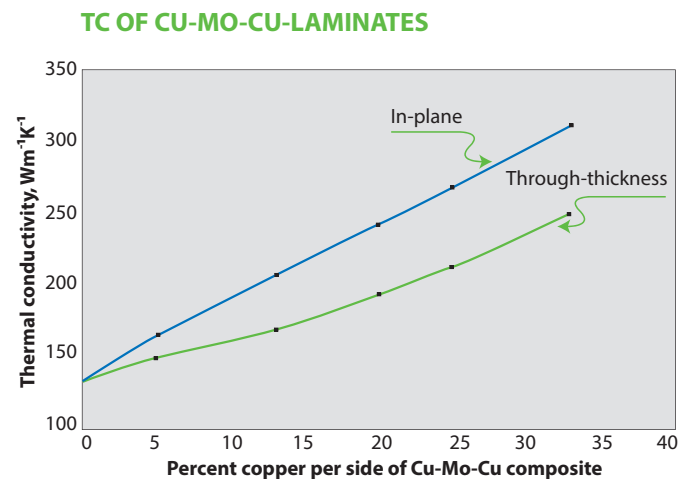
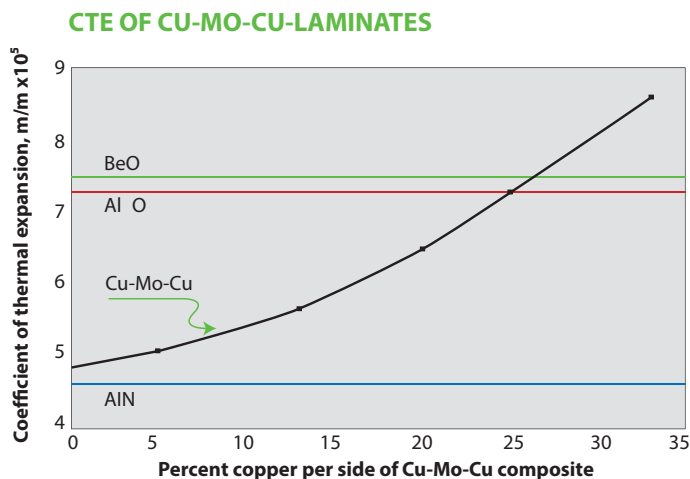
# High Tech Materials for the Power Semiconductor Industry

H.C. Starck Solutions has decades of experience in the production of high performance materials that provide solutions to demanding applications in the electronics industry.

Custom-engineered thermal management materials from the Fabricated Products Group of H.C. Starck Solutions are helping the electronics industry continue its rapid growth, part of which is driven by increasing miniaturization. This trend puts ever greater cooling demands on electronic circuitries. Our molybdenum and tungsten materials, laminates, and engineered composite materials are uniquely suited for these applications.

The thermal properties of our materials include their low and controlled CTE (coefficient of thermal expansion) and high TC (thermal conductivity), which help remove heat rapidly from high power density devices. Equally important is the expertise of our engineering staff in designing highly engineered materials that match the specific requirements of each application.

Our CuMoCu laminates have an adjustable CTE that could be matched to Si while maintaining high thermal conductivity, which makes them an ideal choice for power devices where considerable heat is generated.



## Exceptional Properties:

- > Adjustable CTE and TC values
- > Suitable for Si-based devices
- > Low electrical and thermal resistance
- > Moderate thermal conductivity (Mo = 140-150 W/mk)
- > Suitable for large area power devices with considerable heat generation

# Value-Added Product Solutions for Power Semiconductors

Advancements in electronic controls in high power equipment have resulted in specific demands of the packing materials. Molybdenum and metal-metal matrix composites manufactured by H.C. Starck Solutions minimize stress in the package while allowing the electronics to operate in the manner desired.

**Molybdenum and tungsten flat parts are widely used as contact materials in:**

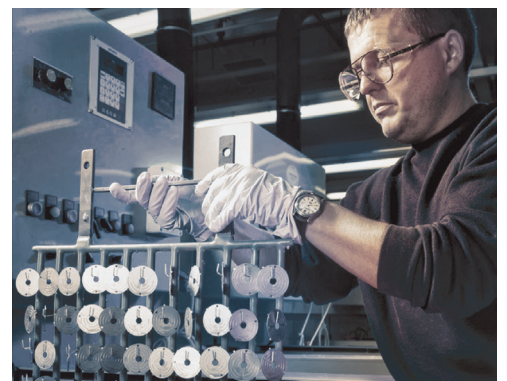
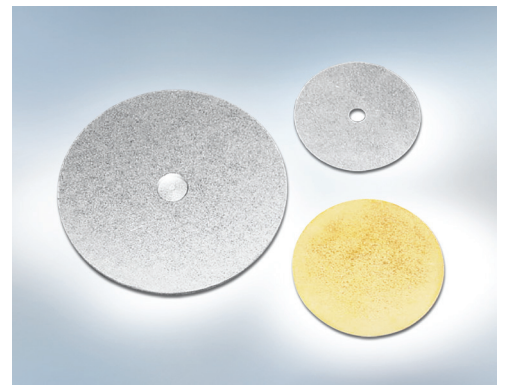
- > **Silicon Controlled Rectifiers Diodes**
- > **Transistors**
- > **Thyristors (GTO 's)**
- > **Heat Sink Bases in IC's, LSI's and Hybrid Circuits**

**Value-Added Product Solutions:**

- > **Discs/Molybdenum**
  - > Thickness: 0.1 mm – 6.0+ mm
  - > Diameter: 1.0 mm – 150.0 mm\*
- > **Discs/Tungsten**
  - > Thickness: 0.1 mm – 3.0 mm
  - > Diameter: 5.0 mm – 60.0 mm\*
- > **Squares/Molybdenum and Tungsten**
  - > Thickness: 0.01 mm – 3.0+ mm
  - > Width/Length: 0.50 mm – 200.0 mm\*

\* depending on thickness

Our photo-chemical etching capabilities allow us to manufacture parts with excellent precision, repeatability, accuracy, and speed. To add value to the machining and fabrication of molybdenum and other refractory metals, we have one of the largest electroplating facilities and electrolytic nickel coatings held to micron thicknesses. Various techniques are available, including PVD for single or double-sided coating, rack or barrel plating enabling complete and comprehensive part size flexibility in addition to volume management capability from a single components to multi-batch.



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