



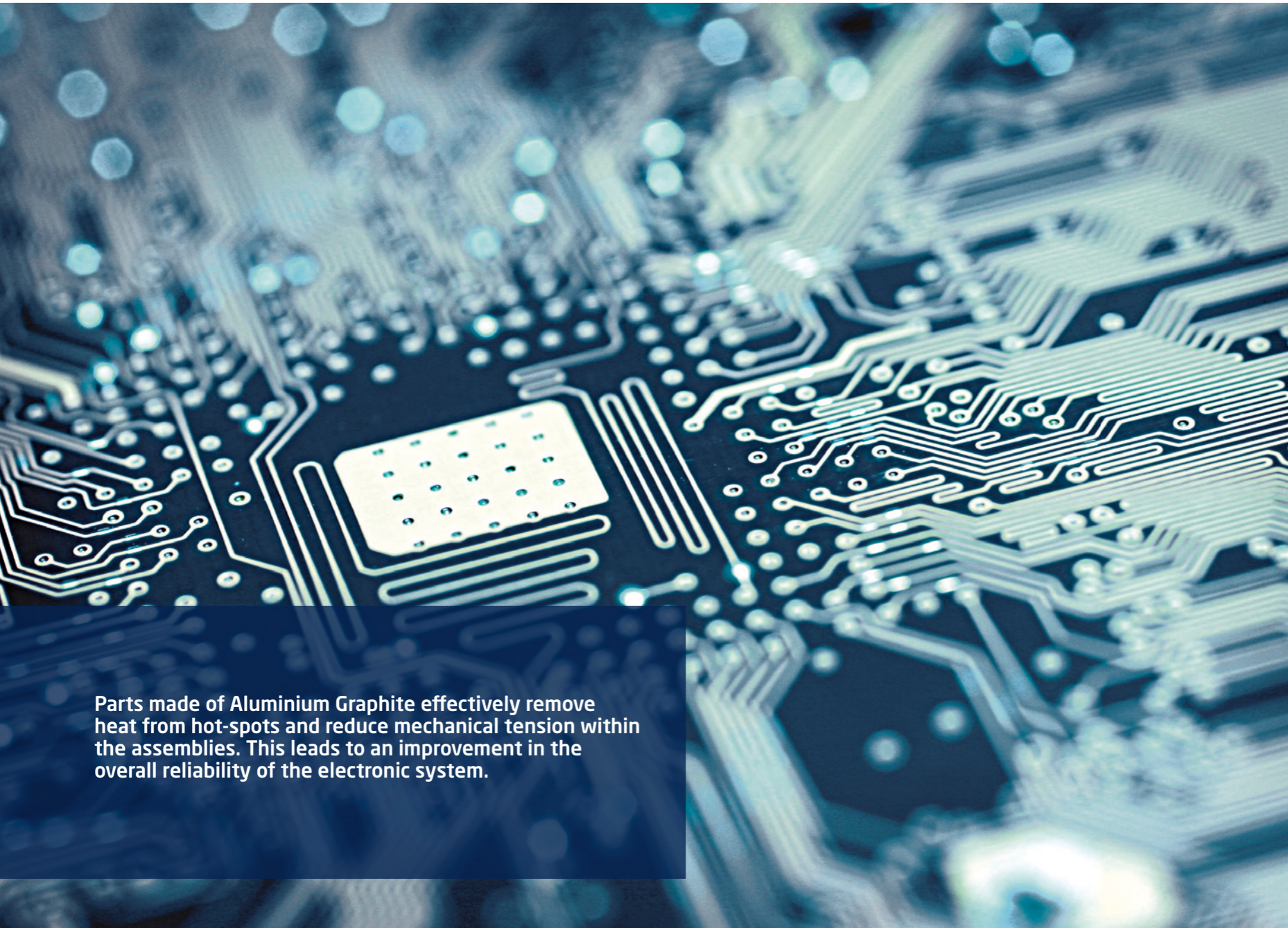
Aluminium Graphite Composites

Thermal Management Materials for High Reliability Applications
in Power Electronics

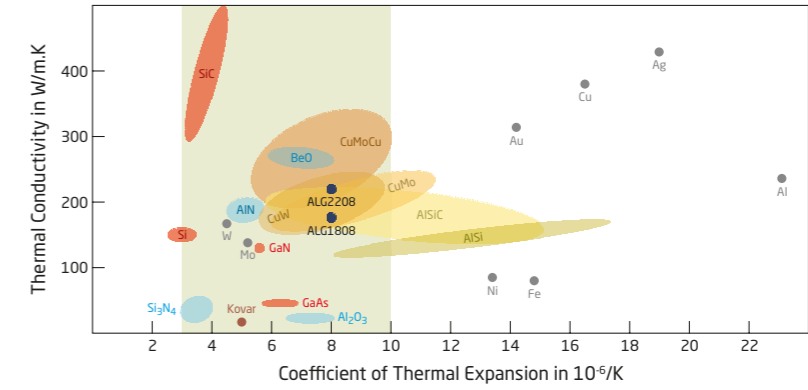


Aluminium Graphites are Metal Matrix Composites (MMC) for high reliability applications in power electronics.

Aluminium Graphite is a new composite material for Schunk Carbon Technology that exhibits a unique set of thermal properties. These closely mirror the sharp rise in interest in the design of thermal management materials exhibiting specific properties that have to accommodate the ever increasing requirements regarding reliability.



Parts made of Aluminium Graphite effectively remove heat from hot-spots and reduce mechanical tension within the assemblies. This leads to an improvement in the overall reliability of the electronic system.



Thermal Management with Aluminium Graphite

Increased power densities, high reliability in extreme operating environments, as well as high levels of integrations, are challenges faced by current power electronic systems. These are made up of a variety of materials, such as metals, semiconductors, and insulators, with a range of different characteristics. In order to work optimally, the thermal conductivity and the coefficient of thermal expansion (CTE) must be well-attuned within the various materials as they are determining factors in the reliability and performance of the current assemblies. Aluminium Graphite (ALG) possesses a desirable combination of aforementioned thermal properties to make it an ideal solution to thermal management problems in power electronics.

Aluminium Graphite - Production & Properties

Based on our extensive knowledge of graphite materials, Schunk Carbon Technology has developed different Aluminium Graphite materials, namely ALG1808 and ALG2208. Both ALG materials are produced by pressure infiltration of porous graphite with liquid aluminium. The merger of these two materials creates a new composite that incorporates the advantageous properties of both.

ALG materials stand out due to their combination of

- high thermal conductivity,
- adapted coefficient of thermal expansion, and
- very low density (lower than both copper and aluminium).

These properties, in particular the CTE, produce ALG parts for power electronics applications that lead to a low-stress assembly, high thermal and power cycling capabilities, improved reliability, and consequently an extended lifetime for the device.

	ALG1808		ALG2208	
Properties	isotropic		anisotropic	
Orientation	x/y/z		x/y	z
Thermal Conductivity (25°C) in W/m.K	180		220	140
Coefficient of Thermal Expansion (25°C) in 10 ⁻⁶ /K	8		8	12
Density in g/cm ³	2.2		2.3	2.3

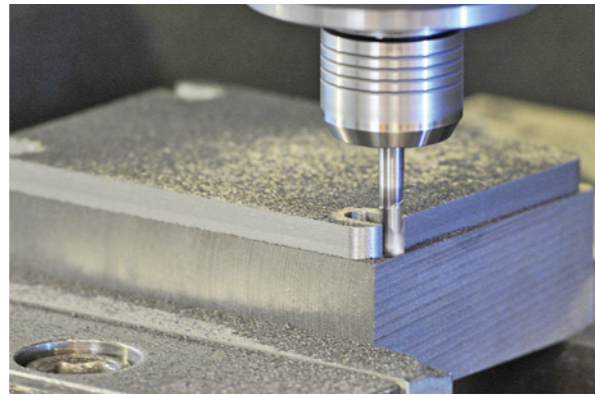
Customer-Specific Designs

The versatile machinability of Aluminium Graphite means that diverse shapes (from simple surfaces to complex geometries) can be attained. These can be further metallized to provide a solderable surface.

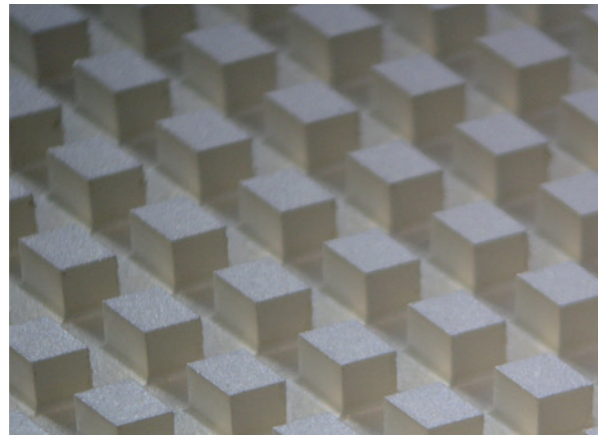
Machining

Blocks of Aluminium Graphite are processed using common machining techniques, such as cutting or milling, to produce user-defined parts.

Complex features such as holes, pedestals or pin fins are easily produced. The surface quality depends on the finishing method, the processing parameters, and the application requirements.



▲ *The excellent machinability of ALG allows for the incorporation of complex features whilst adhering to tight tolerances.*



▲ *Various platings are possible for ALG, ranging from a single layer system to multiple layer systems to provide, amongst other things, solderable surfaces.*

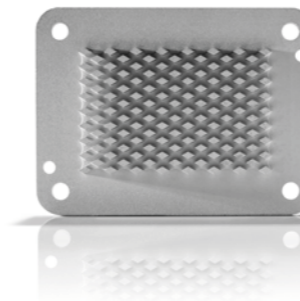
Plating options

Aluminium Graphite parts can be plated to provide suitable surfaces for the further processing by customers. Therefore, coating technologies, such as electro plating or electro-less plating can be used to apply nickel or other metallizations, for example silver and gold.

Once the ALG has been plated, the CTEs of Aluminium Graphite and the substrate or device can interact optimally.

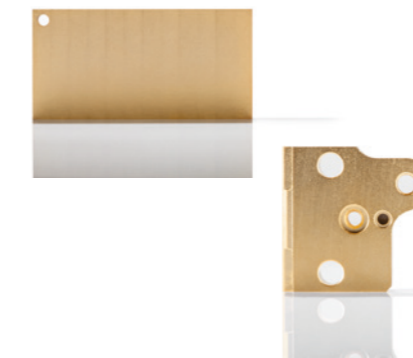
Applications

With its wide range of properties and combinations thereof, Aluminium Graphite finds applications in many different areas of thermal management. Parts may be used as active or passive cooling solutions in power electronics.



Base Plates and Coolers

The CTE of ALG base plates or coolers makes them compatible with commonly used ceramic substrates, such as DBCs (Direct Bonded Copper), for high reliability applications. The parts stand out due to their high thermal conductivity and low density, which is particularly important for weight-sensitive applications in traction and transportation.



Heat Sinks and Heat Spreaders

The thermal properties and the possibility of making miscellaneous parts with different geometrical shapes makes ALG a suitable heat sink material with the additional advantages of a low CTE and low density. ALG2208 parts are predestined for heat spreading applications as their high lateral thermal conductivity efficiently removes heat from hot-spots.



Discs and Rings

Thin round discs and rings made of ALG can be used as contact materials in press-pack diodes or thyristor modules. The parts act as strain buffers between the copper electrodes and the silicon device to improve the overall reliability of the system. They are a viable alternative to conventional molybdenum discs and rings.

Schunk Carbon Technology:
Always by your side.

Schunk Carbon Technology focuses on the development, manufacture and application of carbon and ceramic solutions. It combines an innovative spirit and technological expertise with exceptional customer service to provide a range of products and services unparalleled in the market.

With Schunk Carbon Technology, you have a partner who can offer all the technological possibilities of an international company and implement ideas tailor-made for your needs, both for high-volume industrial markets and highly specialized niche markets.

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