AEROSPACE

Materials and solutions for high temperatures and space optics

Electrical solutions for motors and generators

Power electronics cooling systems
A leading manufacturer of aerospace products

- As a worldwide supplier in the forefront of electric systems and high-performance materials, Mersen helps to improve a number of aerospace systems. We deliver solutions to the leading aircraft manufacturers, such as Airbus, Boeing and Embraer, and to the main subcontractors in the aerospace sector.

Expertise, Know-how and Experience

- These are the reasons why our customers come to us. They know that we deliver solutions that are controlled throughout the product’s life cycle (development, manufacture of the materials, product design, quality control, distribution and technical expertise). We propose reliable solutions that have been tried and tested in the civil and military aerospace sector for many years.

Research and development policy

- We work hand-in-hand with our suppliers to develop innovative solutions in order to improve the performance of our customers’ applications. Our research teams use sophisticated test benches to work on a number of development priorities in the aerospace sector in order to meet the demands of the market of the future.

- On all five continents, our technical staff proposes a global offer that includes technical support for the design of parts. We have local production capacity in the Mersen workshops all over the world and can guarantee on-site technical assistance.

Quality and the environment

- All our production sites all over the world are ISO-certified for quality and environment. In Europe, we also have EN9100-certified work-shops dedicated to the aerospace sector. This means that our customers are sure to receive products that are built to meet the strictest quality criteria, also in accordance with the applicable environmental standards.

Energy performance

- All our solutions contribute to the improvement of the efficiency of our customers’ applications, by reducing weight, saving energy, cutting consumption and increasing reliability.
Severe safety demands and extreme environments demand components and materials that are both reliable and resistant. Our solutions benefit from 100 years of experience with materials. We can rely on our knowledge to optimize the performance of applications, even under the most extreme conditions.

Resistance to extreme conditions of abrasion and temperature:
- Mersen’s materials (carbon, graphite, composite, silicon carbide) can withstand the conditions in nozzles, rockets, turbojets and aircraft brakes.

Reliable components that meet extreme safety demands:
- Our EN 9100-certified design offices and workshops have acquired a unique know-how in the field of the mechanical components that guide, seal or hydraulically or electro-mechanically actuate aerospace systems.

  Mersen designs carbon brushes, brush-holders and slip ring assemblies that guarantee the optimal performance of aerospace applications, especially at high altitudes. Mersen’s graphite grades are treated by impregnating resins and metal salts, or are enriched with molybdenum disulfide in order to behave optimally in rarefied atmospheres.

Weight savings
- It is essential to cut the weight of aerospace systems in order to save energy. Mersen can propose innovative solutions in the fields of composite materials, power electronics cooling systems and mechanical solutions to reduce friction, to all the major players in the aerospace sector.

Extreme precision for space optics
- In cooperation with EADS Astrium, Mersen is designing the new instruments to observe the Earth and the universe. The Boostec® silicon carbide offers outstanding dimensional stability for optical instruments in the space vacuum, thanks to its high rigidity, isotropic properties and low thermal expansion coefficient.
• Works at high speeds without seizure
• Reduced operation gap / leaks under high temperature conditions
• Possible metal housing for easier integration into the system
• Self-lubricating properties
• No blocking when starting or stopping the system
• No seizing, even after long periods without use
• Possible on-demand design
• Reduced leaks thanks to the optimized design (overlaps, etc.)

**POWER ELECTRONICS COOLING SYSTEMS**

**Air Heatsink**
- Optimized fin assembly technology (Swaging process)
- High cooling performances
- Weight saving benefit

**Liquid-cooled heatsink**
- Tailor-made optimized solution using aluminum vacuum-brazing process
- High thermal performances
- High pressure withstanding
- High reliability and lifetime

**Carbon & Graphite SHAFT SEALS / DYNAMIC SEALS**
- Self-lubricating properties to reduce friction torques
- Reduced wear
- No seizing, even after long periods without use
- Operates at temperatures of up to 650°C
- Compatible with most aerospace fluids
- Can be impregnated for increased service life
- Can be shrunk-fit for easier integration into the system

**Carbon & Graphite GUIDES / BUSHES**
(Pumps, jet engine blades)
- Self-lubricating properties
- No blocking when starting or stopping the system
- Can be impregnated for increased service life
- Dry or lubricated operation at high speeds

**C/C Composite BRAKES / TORQUE LIMITERS**
- Stable friction coefficient
- Reduced wear thanks to the use of composite materials
- High friction coefficient
- Dry or lubricated operation
- Low- and high-energy braking

**CARBON PUMP VANES**
- Self-lubricating properties
- No blocking when starting or stopping the system
- Can be impregnated for increased service life
- Dry or lubricated operation at high speeds

**CARBON BRUSHES**
- Four types of graphite grades
  - Impregnated electro graphite (resins/metal salts)
  - Electrographite with MoS₂ cores
  - Carbon graphite enriched with MoS₂
  - Copper graphite enriched with MoS₂
- Tried and trusted riveting techniques
- Wear detection system

**BRUSH-HOLDER / SLIP RING ASSEMBLIES**
- Customized solutions
- Good mechanical stability
- Optimal guidance of the brush
- Optimized distribution of the electric current
- A selection of quality materials

**MERSEN IN THE AEROSPACE INDUSTRY**

**Electrical power generation and distribution**
- Air heatsink
- Liquid-cooled heatsink

**Carbon & Graphite GUIDES / BUSHES**
(Pumps, jet engine blades)
- Self-lubricating properties
- No blocking when starting or stopping the system
- Can be impregnated for increased service life
- Can be shrunk-fit for easier integration into the system

**C/C Composite BRAKES / TORQUE LIMITERS**
- Stable friction coefficient
- Reduced wear thanks to the use of composite materials
- High friction coefficient
- Dry or lubricated operation
- Low- and high-energy braking

**CARBON PUMP VANES**
- Self-lubricating properties
- No blocking when starting or stopping the system
- Can be impregnated for increased service life
- Dry or lubricated operation at high speeds

**CARBON BRUSHES**
- Four types of graphite grades
  - Impregnated electro graphite (resins/metal salts)
  - Electrographite with MoS₂ cores
  - Carbon graphite enriched with MoS₂
  - Copper graphite enriched with MoS₂
- Tried and trusted riveting techniques
- Wear detection system

**BRUSH-HOLDER / SLIP RING ASSEMBLIES**
- Customized solutions
- Good mechanical stability
- Optimal guidance of the brush
- Optimized distribution of the electric current
- A selection of quality materials
The properties of Boostec® material
- Density: 3.15 g/cm³
- Young's modulus: 420 GPa
- Resistance to bending / Weibull modulus: 400 MPa / 11
- Breaking strength: 3.5 MPa.m
- Coefficient of thermal expansion: 2.2 . 10⁻⁶/K
- Thermal conductivity: 180 W.m/K

Satellite actuation:
- Solar panels
- Fuel supply
- Bearing / Guide Shaft seal
- Space optics instrumentation
- Engine components

Space optics instrumentation
- Boostec® silicon carbide is used in the EADS Astrium observation satellite projects to design ultra high-performance optical systems. This material thermal and mechanical stability is exceptional in the space vacuum. The mirrors on the Herschel observation satellite are made entirely of this material. The annular structure (diameter of 3 meters) of the GAIA observation satellite (launching in 2012 to map one billion stars in the Milky Way) is based on a unique assembly technique.

The properties of Boostec® material
- Density: 3.15 g/cm³
- Young's modulus: 420 GPa
- Resistance to bending / Weibull modulus: 400 MPa / 11
- Breaking strength: 3.5 MPa.m
- Coefficient of thermal expansion: 2.2 . 10⁻⁶/K
- Thermal conductivity: 180 W.m/K

Carbon & Graphite SHAFT SEALS / DYNAMIC SEALS
- Work at high speeds without seizure
- Reduced operation gaps and leaks at high temperature
- Possible metal housing for easier integration into the system
- Self-lubricating properties
- No blocking when starting or stopping the system
- No seizing, even after long periods without use
- Possible on-demand design
- Reduced leaks thanks to the optimized design (overlaps, etc.)

REFRACTORY COMPONENTS FOR NOZZLES
- Resistance to abrasion of the carbon/carbon composite
- High density of the isomolded graphite
- Can withstand temperatures up to 3,000°C

C/C Composite BRAKES / TORQUE LIMITERS
- Stable friction coefficient at high temperatures and in cryogenic environments
- Reduced wear thanks to the use of composite materials
- Wide range of friction coefficient
- Dry or lubricated operation

CARBON BRUSH / BRUSH-HOLDER SYSTEMS
- Carbon brushes
  - Specific carbon-silver grades with solid lubricant cores
  - Tried and tested riveting techniques
  - Wear detection system
- Brush-holders
  - Customized solutions
  - Good mechanical stability
  - Optimal guidance of the brush
  - Optimized distribution of the electric current

Carbon & Graphite GUIDES
- Self-lubricating properties
- Stable behaviour at high temperatures and in cryogenic environments
- Possible impregnation to extend the service life and/or reduce wear

Carbon brushes
- Specific carbon-silver grades with solid lubricant cores
- Tried and tested riveting techniques
- Wear detection system

Brush-holders
- Customized solutions
- Good mechanical stability
- Optimal guidance of the brush
- Optimized distribution of the electric current

End carbon brushes
- Self-lubricating properties
- Stable behaviour at high temperatures and in cryogenic environments
- Possible impregnation to extend the service life and/or reduce wear

Carbon & Graphite SHAFT SEALS / DYNAMIC SEALS
- Work at high speeds without seizure
- Reduced operation gaps and leaks at high temperature
- Possible metal housing for easier integration into the system
- Self-lubricating properties
- No blocking when starting or stopping the system
- No seizing, even after long periods without use
- Possible on-demand design
- Reduced leaks thanks to the optimized design (overlaps, etc.)

C/C Composite BRAKES / TORQUE LIMITERS
- Stable friction coefficient at high temperatures and in cryogenic environments
- Reduced wear thanks to the use of composite materials
- Wide range of friction coefficient
- Dry or lubricated operation

CARBON BRUSH / BRUSH-HOLDER SYSTEMS
- Carbon brushes
  - Specific carbon-silver grades with solid lubricant cores
  - Tried and tested riveting techniques
  - Wear detection system
- Brush-holders
  - Customized solutions
  - Good mechanical stability
  - Optimal guidance of the brush
  - Optimized distribution of the electric current

Carbon & Graphite GUIDES
- Self-lubricating properties
- Stable behaviour at high temperatures and in cryogenic environments
- Possible impregnation to extend the service life and/or reduce wear