



D E F E N C E

High performance ceramics in  
defence applications

**Protecting lives  
every day**



## Advanced ceramics for worldwide efficient protection: on land, at sea and in the air

At CeramTec we design, develop and manufacture advanced ceramics and assemblies that are used worldwide in a wide range of different applications, from mechanical engineering to the automotive industry and medical technology – and as well for armour, sensor and measurement applications for defence uses. Our

technology and materials open up the possibility of greater precision, reliability and efficiency. As an established engineering partner, CeramTec offers individual solutions and assemblies that are precisely tailored to customer requirements in the applications. From detection and measurement with sensors of specific

properties to the protection of people and vehicles with appropriate protective ceramics. The world is changing every day. Military and Security forces worldwide are continuously faced with new threats. CeramTec's defence mission is to protect life on land, at sea and in the air with advanced ceramics.

With production sites and subsidiaries in Europe, America, and Asia, CeramTec is present around the globe as a manufacturer and supplier. The company is headquartered in Plochingen, near Stuttgart.

## Advanced ceramics makes the difference in protection of people and vehicles



In a modern composite armour system, the ceramic is placed on the strike face to stop the penetrator of a projectile.

Solutions for the specific requirements can be tailored to the customer needs with parts made of ALOTEC® or SICADUR®.

CeramTecs expertise is in the manufacture of advanced ceramics as components for armour systems, cut, drilled and machined to customer specifications, and ready to assemble into protective modules.

The significant lower weight of ceramics allows weight savings of more than 50 per cent over conventional metallic solutions.

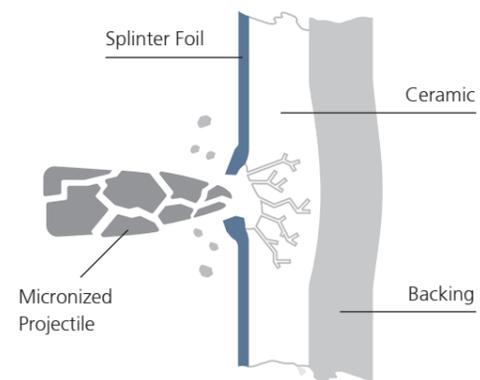


The most important ceramic materials today for ballistic protection are:

- Alumina ( $Al_2O_3$ )
- Silicon carbide (SiC)

Owing to its excellent price efficiency ratio, alumina is still the pre dominant ceramic armour material for vehicle applications. Only when an extremely low weight is required (e.g. for personal protection, helicopters or weight sensitive vehicle parts) silicon carbide materials are used.

CeramTecs ceramics are characterized by good processability and economic volume production and possesses very high mechanical properties.



CeramTec provides ceramics for ballistic applications in various geometries, designs and thicknesses customized to the specific application.

**CeramTecs advanced ceramics are used in a wide range of land applications:**

- Anti-Cut-Solution,
- Body Armour,
- Shields,
- Vehicle Armour.

Rifle protection of body armour under all conditions can only be ensured by ceramic based hard ballistic inserts. Multitile-assemblies show the highest multi-hit performance.

CeramTec is not only producing single ceramic parts. A special competence in service is the construction and manufacturing of customized preassembled panels for armoured vehicles.





## Recognise, communicate and protect over and under the sea

### Piezo and transducer ceramics

With three production sites – two in the UK and one in Germany – for piezo ceramic parts and -transducers, CeramTec is well equipped to provide excellent products for defence applications on land, in the air, over and under the sea.

With a selection of more than 20 different piezo material formulations, we are able to offer customer specific solutions for every application.

We offer high – volume – highly automated production with integrated 100 % in-line inspection as well as craftsmanship production of special components with complex shapes in low volumes.

Dimensional capabilities reach from sub 1 mm to in excess of 250 mm diameter. Our metallisation solutions include thick film silver processes, evaporation and plating using Ni, Ni/Au, Ni/Cr/Sn.

### Armouring for watercrafts

For armouring of watercrafts CeramTec offers different types of tiles from standard format up to customized tiles and in varied ceramic armour materials for to achieve best possible safety.

### Various kind of geometries are possible like:

- Discs
- Rings
- Tubes
- Plates
- Blocks
- Hemispheres
- Bimorphs
- Complete transducers



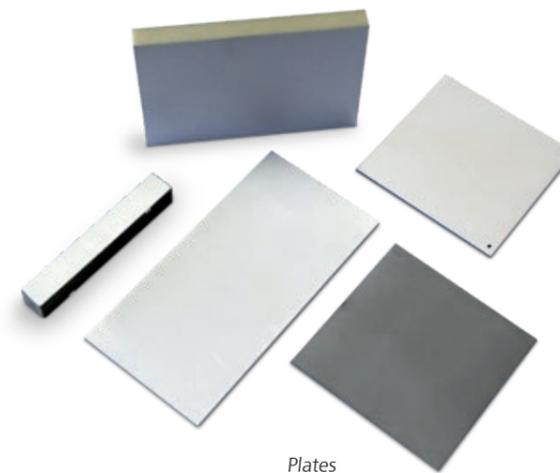
Hex-tiles for armouring of critical ship infrastructure



Tubes



Hemispheres



Plates

### Typical applications for the components we offer, are:

- Submarine Sonar Systems
    - Active Systems
    - Passive long range sonar
    - Flank Arrays
  - Variable depth systems for surface ships
  - Torpedo Guidance & Decoys
  - Towed Arrays
  - Diver Detection
  - Underwater communication systems
  - Sonobuoys and dipping sonar system (Aircraft deployed)
  - PZT Blocks for composite manufacture for multiple systems mentioned above
- 
- Naval Armouring

## Sensor and protective ceramics for aerospace



### Sensor ceramics

CeramTec piezoceramic solutions for defence applications such as Ring Laser Gyroscopes (RLG's) are used in many systems that are dependent on inertial navigation and guidance and are used in Aerospace, Maritime and Space environments, where critical frequency stabilisation is obtained using a piezoelectric transducer to precisely move one or more of the mirrors located on the perimeter of the cavity.

Many of our proprietary PZT materials have qualities that are desirable in RLGs or other precision actuators & sensors. For example, PZT406 and PZT401 offer a close compromise between high permittivity, low dielectric losses, high density, high piezoelectric activity and a high mechanical factor - This combination enables production of an actuator that is extremely efficient under high driving modes, and in an RLG for example maximises the accuracy of the mirror positioning in situ during the compensation sequence. Another ceramic, PZT503, is excellent as a feedback sensor, because it offers high permittivity and excellent sensitivity levels, which means a stronger signal to noise ratio back to the amplifier unit. The actuator and feedback sensor are vital factors in the performance of many defence systems.

### Advanced Ceramic Components for wide range of applications including:

- Ring Laser Gyroscopes used in Aerospace
- Aircraft deployed sonar systems
- Fuel Level Sensors for aircraft
- Vibration sensors for condition monitoring

Helicopter Ballistic Armour Applications both for fuselage and seat protection

### Protective ceramics

Silicon carbide has a weight advantage of 20% compared to alumina. Therefore it is highly applicable to helicopter armouring applications from a single tile to a customized pre-assembled pad.

CeramTecs SiC-solutions ensure highest safety with lowest weight for air vehicle armouring.

### CeramTecs advanced ceramics are used in a wide range of aerospace applications

- Piezo sensors,
- Probe collector for satellites,
- Helicopter protection (incl. crew seats).





## Production Power

### Get in touch with our defence team for armour- and piezo applications:

Phone +49 (0) 22 05.9200 - 0  
Email [myceramtec@ceramtec.de](mailto:myceramtec@ceramtec.de)

Only for ballistic inquiries:  
Email [info@etec-ceramics.de](mailto:info@etec-ceramics.de)

CeramTec serves customers with high grade of specialization: In **Lohmar** (Germany) is the CeramTec-Competence Center for Ballistic Protection.

The UK facilities in **Ruabon** and **Southampton** (United Kingdom) are focused on piezo products in custom sizes and geometries as well as standard shapes and transducer or sensor assemblies.

The plant in **Lauf** (Germany) is equipped for the production of piezo products in high volumes in high quality.

For defence applications CeramTec mainly work with customers that are part of the NATO and EU and adheres to the strict export controls that are in place in this sector.

**Special requirements? Our global defence team will find the ideal solution for your application.**



**CeramTec**  
THE CERAMIC EXPERTS

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