BOSCH
Invented for life

Advanced Ceramics

Advancing your life

High performance ceramics are our passion
nature's perfection is our inspiration

About us

Expertise with more than 100 years of know-how in technical ceramic

The Bosch Group is a leading global supplier of technology and services. It employs roughly 401,300 associates worldwide (as of December 31, 2021). According to preliminary figures, the company generated sales of 78.8 billion EUR in 2021. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in some 60 countries.

Ceramic production has a long tradition with Bosch. At the beginning of the 20th century, series production of the groundbreaking Bosch spark plugs began, and in 1939 Bosch filed its first patent for ceramic injection molding (CIM). Advanced Ceramics is part of the Bosch Group, which drives business innovation and supports new business ideas as a 100% subsidiary of Robert Bosch GmbH.

Manufacture and technology

Bosch Advanced Ceramics has a wide range of technologies for innovative ceramic solutions


3D Printing


Ceramic injection molding


Green and hard machining


Laser processing


Pressing


Functional coatings


Cofiring ceramic processing


Quality assurance

Certifications

High Bosch quality standard and high process robustness

- ISO 9001 for comprehensive quality management
- ISO 13585 Medical devices quality management *
- OHSAS 1800 for occupational health and safety management *
- IATF 16949 Automotive quality management *
- ISO 14001 for environmental management *
- ISO 50001 for energy management *

* Bosch plants are certified according to various standards

Materials

Bosch Advanced Ceramics chooses the right composition for various applications

For ceramic components, the composition of the material is crucial. By choosing and adjusting the suitable material composition, the material can be perfectly adapted to the ambient conditions. The properties are to be regarded as indicative values, which are transferable to real components only to a certain extent. We are glad to provide our expertise to assess the suitability of a material for your practical application.

Advanced ceramics datasheet of our oxide ceramics

Material	Alumina				Zirconia		Composites	
Specification	Al_2O_3 96,0%	Al_2O_3 > 99,7%	Al_2O_3 > 99,8% coarse grain	Al_2O_3 > 99,8% fine grain	ZrO_2 3,7mol% Y_2O_3-PSZ	ZrO_2 3 Y_2O_3 TZP	ATZ	ZTA
Density [g/cm³]	3,8	3,92	3,92	3,96	6,05	6,05	5,5	4,1
Hardness HV [GPa]	14	17	14	14	13	15	14	17
Compressive Strength [MPa]	2800	2800	2600	2600	2400	2300	2300	2600
Flexural Strength 4-point [MPa]	400	440	395 (3-Point)	430	1100	930	1000	600
Fracture Toughness K_{Ic} [MPa*m$^{1/2}$]	4.2	4.3	5	5	10.5	10	6.5	5
Modulus of elasity [GPa]	340	380	300	300	210	205	220	360
Surface Roughness[µm]	Rz 5,1*	Rz 3,6*	Ra 0.9	Ra 0,4	Rz 3.6*	Ra 0.6	Rz 3.6*	Rz 3.6*
Thermal Expansion Coefficient [10^{-6}/K]	8	8	8	8	10	10	9	9
Thermal Conductivity [W/mK]	24	30	37	37	3	3	6	25
Electr. Resistance at 20°C [Ωm]	10^{14}	10^{14}	10^{14}	10^{14}	10^{9}	10^{10}	10^{6}	10^{14}
Electr. Resistance at 600°C [Ωm]	10^{6}	10^{6}	10^{6}	10^{6}	10^{4}	10^{4}	10^{4}	10^{6}

* depending on the technology and process

Properties of technical ceramics

High temperature resistance
The heat resistance reaches far beyond 1000°C - technical ceramics are thus often the only alternative for high temperature applications.

Hardness
The extreme hardness of technical ceramics makes them suitable for handling high pressure and adverse conditions.

Good insulation properties
Technical ceramics display both electrical and thermal insulation properties.

High wear resistance
The excellent mechanical properties of technical ceramics ensure minimal abrasion and long service life, even under harsh conditions.

Chemical resistance
Technical ceramics are resistant to many chemicals such as acids and brines, and are therefore corrosion resistant.

Biocompatibility
Technical ceramics are suitable both for the medical and food sectors: the materials are 100% biocompatible.

Automotive

Technical ceramics meet high requirements

Sensor contact holder

- Alumina ensures high heat & corrosion resistance
- Complex designs realize tiny channels for connector pins

High temperature cofired ceramic

- Multilayer ceramics of alumina & zirconia
- Well controled signal conductor lines width

Low temperature cofire ceramic

- Glass-Al_2O_3-ceramic, Sintered at 850-900°C, coated with Ag, AgPd
- Well controled signal conductor lines width resistors with high power load and excellent accuracy

Sparkplug ceramic

- Alumina ensures high dielectric and mechanical strength
- High quality ceramic for long service life

Sealing plate, valve and anti-wear components

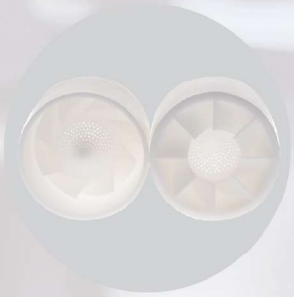
- Alumina and zirconia ensure high wear resistance and electrical insulation
- Precise dimension, high hardness and polished surface quality

Industrial engineering

Long service life with technical ceramics

Jets or nozzles for dispensing

- Complex shape in series production made of alumina
- High dispensing behavior due to optimized flow design and smooth inner surface

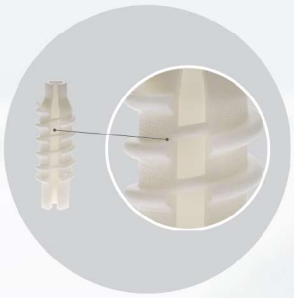


Ceramic mixer components

- Alumina made by 3D printing realizes fine and precise flow channels
- Smooth surface enables less contaminations and less flow losses

Turbocompressor of heat pumps

- Alumina with good thermal and wear resistance
- High design complexity and tolerance accuracy



Ceramic heat exchanger

- Alumina made by 3D printing used in energy industry
- Complex and functional design ensure high heat exchange

Microreactor for chemical industry

- Heat and corrosion resistance, low thermal expansion
- Electrical insulation capability
- Internal complex structures and high dimensional stability

Anti-wear ceramic components

- Alumina and zirconia ensure high wear resistance
- Advanced manufacturing for accurate running fit

Medical technology

Safety with technical ceramics

Scissor blades

- Tailor-made material ensures high wear resistance and enhanced lifetime
- High tolerance accuracy for surgical instruments

Ceramic carriers for medical instrument

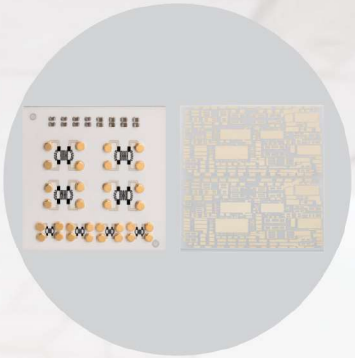
- Good heat dissipation
- Creative design with laser treatment

Ceramic sealing disk, valves

- Biocompatible materials and smooth surface
- Chemical resistance realizes precise medical analysis

Electronics & consumer goods

A huge variety of application possibilities



Functional coatings on ceramic

- Ceramics, machining, cleaning, different coating technologies
- Applied in Lambda–Sensors, pressure sensors, particle sensors, etc

Optical lens carrier

- Alumina for laser distance measuring device
- Tailor-made material shows enhanced lifetime
- High wear resistance, tolerance accuracy and thermal stability

Coffee grinder

- Stable grinding efficiency beyond metal materials
- Endurable, wear resistant to keep coffee flavor
- Biocompatible materials and stable use in corrosive condition

Water tap and valve for coffee and washing machine

- Alumina ensures high wear and good thermal stability
- Enhanced lifetime and complex structure can be achieved

3D-Printing advanced ceramics

The market leader in industrial 3D printing for technical ceramics

Applications

Flexible designs without tool investments for

1. Prototypes **2.** Small parts **3.** Complex geometries **4.** Small quantities

Properties of 3D-printing parts

Surface roughness

Directly after sintering without post processing

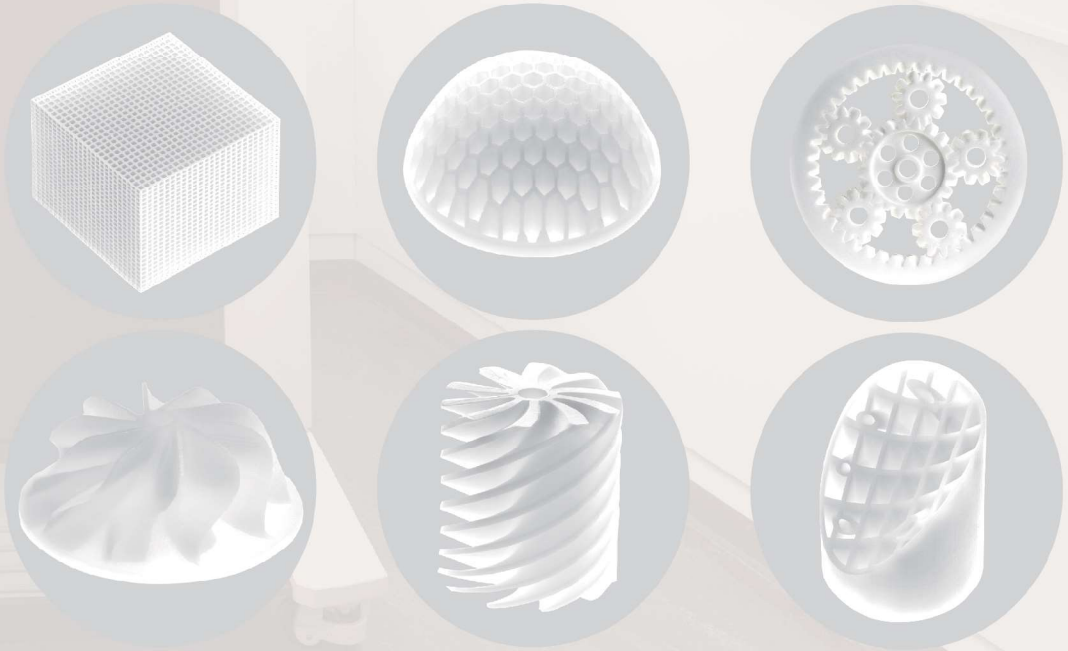
- Alumina up to Ra = 0,6 Rz = 3,9
- Zirconia up to Ra = 1,42 Rz = 6,9

Dense components

- Dense microstructure
- >99,4% of theoretical density
- One of few 3D-methods for production of dense parts

Highly complex geometries

- Alumine: 51mm x 93mm x 247mm (XYZ)
- Wall thickness 0,12 ... 4 mm
- After heat treatment ±0,5% of nominal size



Research & service

A team with experience and competence, your full-service partner for your product

Design development
Appropriate to ceramics and manufacturing requirements

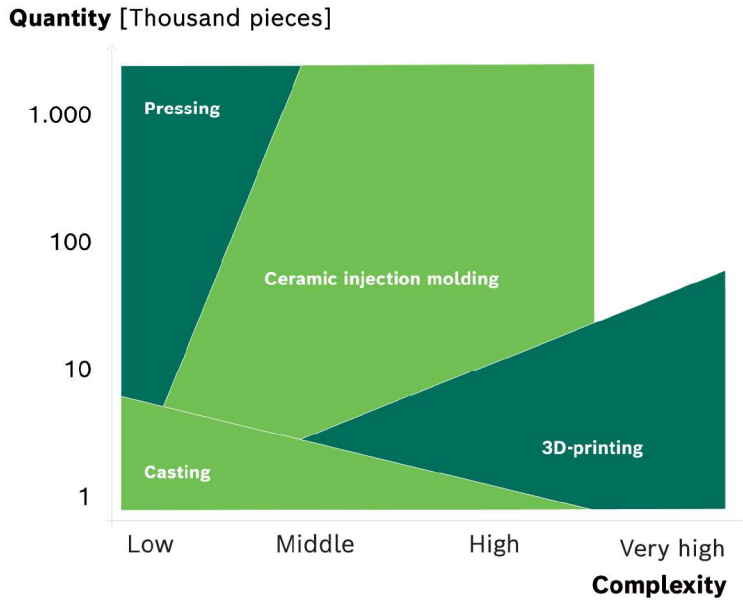
Agile prototyping
Rapid prototyping by 3D printing of functional ceramic parts

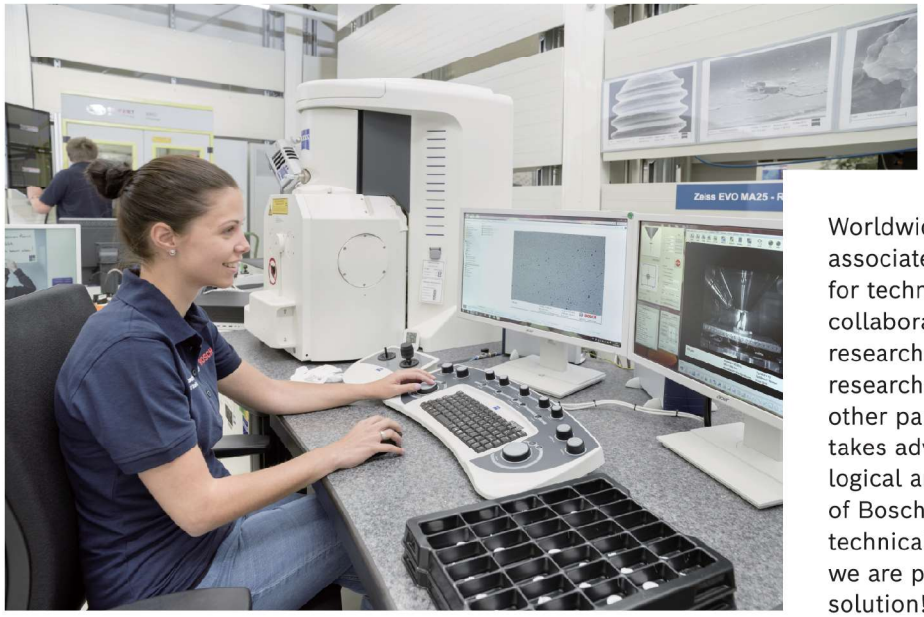
Inhouse engineering know-how
Flexible, self-developed, standardized, Efficient

Quality assurance
According to the high-quality standards of Bosch and your customer requirements

Outstanding technology portfolio for maximum flexibility

We offer more than just manufacturing: our commitment to quality and the intensive support for our customers and their products during the engineering process complete Advanced Ceramics' range of services into a full-service package





Worldwide, 1,800 highly specialized associates work for Bosch to search for technological breakthroughs, collaborating in an international research network with more than 700 research institutions, universities and other partners. Advanced Ceramics takes advantage of the wide technological and industry-specific expertise of Bosch in research for enhancing the technical ceramics. Just contact us, we are pleased to send you our solution!

Global footprint

Bosch Advanced Ceramics is always in touch with customer worldwide

We bring our customers the combined competencies from various Bosch business areas and plant. In this regard we work closely with the production plants and the Bosch Research Center in Renningen. Advanced Ceramics coordinates with the various parties, always remaining in touch with the customer.

1
R&D center

Germany
Campus Renningen

1
Manufacturing plants

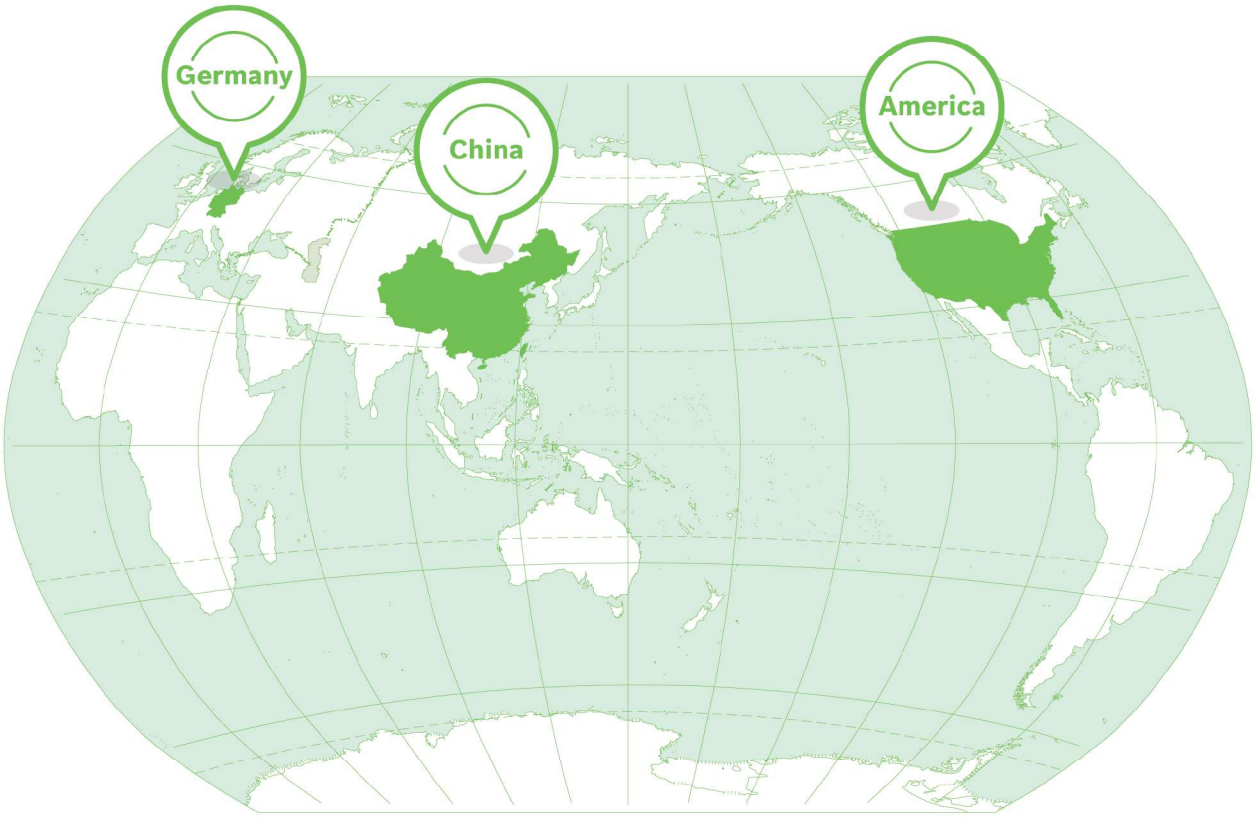
Germany
Blaichach

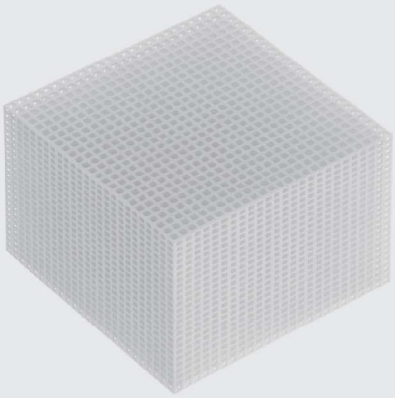
3
Sales offices

Germany Immenstadt
(Head Office)

China
Shanghai

America
Farmington Hills





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